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Prepared for:
National Grid, USA
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Remedial Design Work Plan

Former Clifton MGP Site
Operable Unit No. 2
Richmond County, New York
Site No.: 2-43-023

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Acronyms and Abbreviations

AOC	Administrative Order on Consent
ASTM	American Society for Testing and Materials
bgs	below ground surface
CAMP	Community Air Monitoring Plan
CPP	Citizen's Participation Plan
DER	Declaration of Environmental Restriction
DNAPL	dense nonaqueous phase liquid
DOT	Department of Transportation (U.S.)
FS	Feasibility Study
GAC	granular activated carbon
HASP	Health and Safety Plan
hsa	hollow stem auger
IC/EC	institutional controls and engineering controls
IDW	investigation derived waste
IRM	interim remedial measure
MGP	manufactured gas plant
msl	mean sea level
NGVD	National Geodetic Vertical Drum
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	operation, maintenance, and monitoring
OSHA	Occupational Safety and Health Administration
OU-1	Operable Unit 1
OU-2	Operable Unit 2
OVDCP	Odor, vapor, and dust control plan
PDI	Pre-Design Investigation
POTW	publicly-owned treatment works
PPE	personal protective equipment
PRAP	Proposed Remedial Action Work Plan
QAPP	Quality Assurance Project Plan
RD	Remedial Design
RIR	Remedial Investigation Report
ROD	Record of Decision
ROW	right of way

SCGs	standards, criteria, and guidance
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SPT	standard penetration testing
SVOCs	semivolatile organic compounds
TCLP	Toxicity Characteristics Leaching Procedure
TOC	total organic carbon
TP	test pit
VOCs	volatile organic compounds

Executive Summary

On behalf of National Grid, USA (National Grid), ENSR Corporation (ENSR) has prepared this Remedial Design (RD) Work Plan for the former Clifton Manufactured Gas Plant (MGP) Site - Operable Unit No. 2 (OU-2) located in Clifton, Richmond County, New York (Site). This Work Plan provides the framework for implementing the New York State Department of Environmental Conservation (NYSDEC) selected remedy in accordance with the Record of Decision (ROD) for the Site [NYSDEC, 2006] and the Administrative Order on Consent [Index No. D2-0001-98-04, (NYSDEC, 1998)] between Brooklyn Union (now National Grid) and the NYSDEC.

This Work Plan presents the approach by which the design will be completed in order to satisfy the remedial objectives. The components of the remedy as defined in the ROD are as follows:

- Demolition of the existing building on the Site to allow for the excavation of the contamination located beneath the building;
- Removal of former MGP-related structures including their foundations which contain coal tar to the extent practicable;
- Excavation of approximately 38,300 cubic yards of grossly contaminated soils, down to an approximate depth of ten (10) feet below ground surface (bgs);
- Backfill of the excavated areas with clean fill from an off-site location. Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas. The top two (2) feet will consist of clean soil capable of supporting vegetation;
- Installation of vertical cutoff walls in the subsurface to prevent off-site migration of dense nonaqueous phase liquids [(DNAPL), coal tar] from the Site;
- Installation of recovery wells to allow for collection, treatment and disposal of DNAPL that remains at depth in the subsurface after the excavation work is complete; and
- A Site Management Plan and environmental easement.

The design basis presented in this Work Plan includes a description and rationale for the proposed design and focuses on site preparation, excavation, waste management, water management, site restoration, and environmental monitoring and control to achieve the remedial goals established in the ROD. In addition, this work plan provides a brief summary of the activities associated with the removal and disposal of impacted soils, site and public safety, structure safety, and air monitoring which will be further detailed in the Transportation Plan, Community Air Monitoring Plan (CAMP), Health & Safety Plan (HASP), Odor, Vapor, and Dust Control Plan (OVDCP) for the Site. These documents will be submitted as addenda following completion of the 60% design phase.

This Work Plan also includes the details of the Pre-Design Investigation (PDI) activities. During PDI activities, the following information will be collected for design of the final remedy:

- Soil analytical data needed to characterize the soils to be excavated for off-site disposal at a National Grid approved facility. This data is required by the off-site facilities where the soils will be taken for final disposal.

- Geotechnical data around the perimeter of the Site, including along Willow Avenue and Bay Street. This data will be used to help design the cutoff wall, temporary excavation bracing; and dewatering system necessary to allow excavation of soils at the Site.
- Testing of soil at the Site for dewatering and soil management parameters. This information is necessary to predict how the soil will need to be handled on site before sending it off-site for disposal.
- Testing of groundwater to define the likely design/effluent permitting requirements for on-site treatment systems.
- Delineation of historical subsurface structures using precharacterization borings and test pits.

These activities are scheduled to be conducted in winter 2008 and spring 2009. During the performance of this work there will be heavy equipment on the Site and on some of the adjoining roads. National Grid will work with the local authorities to control any interruptions to traffic. National Grid will perform community air monitoring around the perimeter of the Site in accordance with New York State Department of Health (NYSDOH) requirements. National Grid will keep NYSDEC, the City, and surrounding property owners apprised of the schedule and activities throughout the investigation. The data from these activities will be made available to the NYSDEC during the design process.

1.0 Introduction

ENSR Corporation (ENSR), on behalf of National Grid, USA (National Grid) has prepared this Remedial Design (RD) Work Plan for remediation of the former Clifton Manufactured Gas Plant (MGP) Site - Operable Unit Number 2 (OU-2) located at 25 Willow Avenue in Clifton, Richmond County, New York (Site). The Site location is shown in Figure 1-1. The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), has selected the remedy for the Site, as established in the Record of Decision (ROD) for the Site (NYSDEC, 2006). The RD detailed within this work plan is being completed as per the ROD and also as a part of the Administrative Order on Consent [Index No. D2-0001-98-04, (AOC), (NYSDEC, 1998)] between Brooklyn Union (now National Grid) and NYSDEC. National Grid is currently undertaking remedial actions at the OU-1 parcel at the Clifton Site. The details of this work have been submitted under separate cover.

This Work Plan presents the approach by which the design will be completed at the Site in order to satisfy the remedial objectives specified in the ROD.

A Remedial Investigation Report [(RIR); GEI 2005] and a Feasibility Study [(FS); PS&S PC, 2005] were completed for the Site and approved by the NYSDEC. The FS identified six remedial alternatives and provided arguments on whether or not each alternative was technically feasible. Subsequently, the NYSDEC issued the ROD for the Site based on NYSDEC Administrative Record and public input to the Proposed Remedial Action Work Plan (PRAP) presented by NYSDEC [NYSDEC, 2006]. The components of the remedy are as follows:

- Demolition of the existing building on the Site to allow for the excavation of the contamination located beneath the building;
- Removal of former MGP-related structures including their foundations which contain coal tar to the extent practicable;
- Excavation of approximately 38,300 cubic yards of grossly contaminated soils, down to an approximate depth of ten (10) feet below ground surface (bgs);
- Backfill of the excavated areas with clean fill from an off-site location. Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas. The top two (2) feet will consist of clean soil capable of supporting vegetation;
- Installation of vertical cutoff walls in the subsurface to prevent off-site migration of dense nonaqueous phase liquids [(DNAPL), coal tar] from the Site;
- Installation of recovery wells to allow for collection, treatment and disposal of DNAPL that remain at depth in the subsurface after the excavation work is complete; and
- A Site Management Plan and environmental easement.

This Work Plan also includes details of Pre-Design Investigation (PDI) activities to collect additional information needed for design of the remedy for the Site. The PDI is scheduled for spring 2009 and will provide design data for excavation shoring and the dewatering system and address potential data gaps along the proposed excavation perimeter. In addition, the PDI will include soil pre-characterization for disposal and an evaluation of the free drainage potential of the soils for dewatering purposes. During PDI activities, groundwater samples will also be collected from select monitoring wells to obtain data for design of construction water treatment system and discharge permitting.

1.1 DER-10 Requirements

A copy of the ROD has been included as Appendix A of this document to satisfy the following requirements of Section 5.2 (b) of the DER-10:

- Summary of the RIR Section 5.1 of the ROD;
- Summary of sampling results collected to date of the publication of the ROD;
- Identification of all applicable Standards, Criteria, and Guidance (SCGs);
- Figures identifying all areas where the remedial action will be conducted;
- Figures showing the vertical and horizontal extent of the area to be remediated.

Additionally, an Operation, Maintenance, and Monitoring (OM&M) Plan will be developed and submitted as an addendum following completion of the 60% design phase.

In accordance with the AOC and the Draft DER-10, technical guidance for site investigation and remediation [(DER-10); NYSDEC, 2002], the Remedial Design program will include the preparation/submittal of the following information:

Remedial Design Work Plan (this document)

- Remedial Design Report (this RD Work Plan is submitted in lieu of the RD Report);
- Schedule to implement the RD;
- Protocols to determine the effectiveness of the RD; and
- PDI activities, note that Health and Safety Plans (HASP) for the investigation portions of the work is included in Appendix C.

60% design submittal

- Biddable quality design documents for the RD, consisting of specifications and drawings;
- Operation, Maintenance and Monitoring (OM&M) Plan;
- Contingency Plan; and
- Citizen's Participation Plan (CPP).

90% design submittal including biddable quality design documents for the RD, consisting of specifications and drawings

The following additional documents are not explicitly required by the AOC but are integral to the remedial design program. They will also be provided as addenda to the 60% design submittal:

- Community Air Monitoring Plan (CAMP);
- Odor, Vapor, and Dust Control Plan (OVDCP);
- Transportation Plan;
- Construction site-specific Health and Safety Plan (HASP);
- Vibration Monitoring Plan; and
- Permitting Plan that includes associated permits and review correspondence.

The remedy will be implemented in the following four phases:

- The first phase of the remedy will involve PDI activities and development of design drawings and specifications to execute the work. These activities will include the design of soil removal plans and systems (sequencing and support) and a subsurface containment system consisting of two vertical barrier walls keyed into the underlying confining layer at approximately 44 feet bgs. This first phase of the remedy is more fully described in this RD Work Plan.
- The second phase will involve the field implementation of the excavation and containment designs. Field activities will consist of surface building demolition, excavation and off-site disposal of soils saturated with NAPL at thermal treatment facilities pre-approved by National Grid, and the installation of two barrier walls to prevent further migration of on-site impacts. Upon completion of this phase, the Site will be restored.
- In the third phase of the remedy, a DNAPL recovery program will be implemented to remove potentially mobile DNAPL from the subsurface.
- Finally, in accordance with the AOC and the ROD, institutional controls will be imposed as the fourth phase of the remedy. These controls will be documented in a Site Management Plan, which will include a schedule for operation, maintenance, and monitoring of components of the remedy and for the submission of the periodic certification of the institutional and engineering controls.

Please note that these phases may be implemented consecutively or concurrently based on the Site conditions as they develop.

1.2 Off-Site Remedial Action

In addition to the remedial work proceeding on OU-1 and OU-2 of the Clifton Site, a Remedial Action (RA) is currently being implemented on the off-site 89 Willow Street property. In addition, a second RA is planned for the off-site Edgewater Plaza property. The design and implementation of the two RA's are being undertaken outside of the remedial design process for OU-2.

A Supplemental Remedial Investigation Report and an RA Work Plan for 89 Willow Avenue off-Site property have already been issued to NYSDEC. A Supplemental Remedial Investigation (SRI) Report for Edgewater Plaza, developed by another consultant, has also been submitted to NYSDEC. Based on the results of the SRI Report, a RA Work Plan for Edgewater Plaza property will be developed and submitted to NYSDEC later this year.

1.3 Report Format

This Work Plan is organized in the following manner: Section 2.0 details the PDI objectives and activities; Section 3.0 presents the Work Plan for the implementation of the remedial design; Section 4.0 provides a summary of all required permits and/or substantive permit requirements; and Section 5.0 provides details of the proposed schedule for the implementation of the Remedial Design program.

The following documents/appendices were developed to support the PDI field efforts detailed in Section 2.0. A Quality Assurance Project Plan (QAPP) specific to the PDI activities is included as Appendix B and specifies procedures for data collection and quality control in the field and in the laboratory. A site specific Health and Safety Plan (HASP) is included as Appendix C and provides a description of the procedures to be followed during the PDI to protect the health and safety of the field-personnel and the public in the vicinity of the Site. In addition, ENSR Field Methods for the PDI are compiled in Appendix D. Appendix E contains Historic Boring Logs and Test Pit Logs for use as a reference for field personnel.

2.0 Pre-Design Investigation

This section details the PDI activities proposed at the Site. The PDI activities will provide design data for the excavation shoring and dewatering systems and address potential data gaps along the proposed excavation perimeter. In addition, the PDI will include pre-characterization activities for soil and groundwater to evaluate the free drainage potential of the soils for dewatering purposes and to facilitate the treatment/disposal of impacted media.

2.1 Site Background

2.1.1 Site Location and Description

The Site is situated at the northwest corner of the intersection of Bay Street and Willow Avenue in the Clifton section of Staten Island, New York. The current Site layout with the locations of the former MGP structures is illustrated on Figure 2-1. OU-2 is the focus of this report and includes the following parcels: 25 Willow Avenue, adjacent parcels located to the northwest on Greenfield Avenue, railroad embankment and active railroad right of way (ROW), and a small triangular shaped parcel located between Bay Street and Edgewater Street. OU-2 also encompasses the ROW of Willow Avenue, Edgewater Street and Bay Street adjacent to the 25 Willow Avenue parcel, as well as the property located at One Edgewater Street.

The Site is currently improved with an unoccupied single-story, multi-bay, commercial building. The building was formerly utilized as an automotive repair and new car preparation facility. Automotive repair operations were conducted within the building and included the storage and handling of petroleum products (*i.e.,* motor oil, gasoline, diesel fuel, *etc.*). With the exception of a small landscaped strip of land that separates the Site building from the adjacent Bay Street, the remainder of the Site is surfaced with bituminous pavements and utilized for automobile parking.

The 25 Willow Avenue parcel is currently zoned for manufacturing. The area surrounding it is characterized by a combination of urban residential and commercial uses. Commercial parcels are located on Greenfield Avenue to the northwest of the 25 Willow Avenue Parcel. A vacant lot, currently utilized for parking, is located to the northeast between Bay and Edgewater Streets.

2.1.2 Site Topography and Drainage

The Site is located in a locally topographic low, bowl shaped area that gently slopes to the northwest towards the railroad embankment and appears to be associated with the historic stream that flowed on the northwest portion of the 25 Willow Avenue Parcel. The surface drainage is consistent with the bowl like topography of the Site, with surface water flowing away from the higher elevations towards lower elevations as presented in the RIR (GEI, 2005). The elevations ranging from approximately 8 feet above mean sea level (msl) in the southwestern part of the Site to approximately 10 feet above msl in the northeastern part of the Site. During heavy rain, storm water accumulates at low points, particularly in the southwestern portion of the Site and along Willow Avenue. Northeast and south of the Site, along Bay Street and Willow Avenue (respectively), storm water catch basins connect to storm sewers that convey flow to the northwest and ultimately discharge to the New York Harbor.

2.1.3 Site Geology and Hydrogeology

Four major stratigraphic units were identified underlying the Site during RI activities (GEI, 2005). These units are, in order of increasing depth:

1) Imported fill material made up of silt, sand and gravel mixed with slag, coal, brick, concrete, metal, ash, and clinkers. This unit ranges in thickness from a few inches to approximately nine feet;

2) Alluvial/marsh deposits beneath the layer of fill. This unit ranges up to 20 feet thick;

3) Glacial deposits beneath the alluvial deposits; and

4) A weathered bedrock layer known as saprolite. The top of the saprolite was encountered at depths of 114 to 123 feet.

No surface water bodies are currently located on or immediately adjacent to the Site. However, a stream formerly traversed the 25 Willow Avenue Parcel. Currently, a storm sewer line follows the approximate trace of the historic stream and extends along the northwestern border of the 25 Willow Avenue Parcel within the site. The storm sewer empties into New York Harbor approximately 500 to 600 feet to the northeast.

Two aquifers have been identified underlying the Site: a shallow, unconfined aquifer (water table) and a deep confined aquifer. In addition, a water-bearing zone was also identified within the semiconfining units and displays artesian conditions. This shallow groundwater aquifer is located in the fill, alluvium/marsh and shallow glacial deposits. The water table elevations (shallow aquifer) ranged from approximately 4.02 to 8.99 feet National Geodetic Vertical Datum (NGVD). The deep aquifer is under confining pressure; wells installed in this aquifer (RW-15 and RW-16) exhibited flowing artesian conditions. These wells were screened in the stratified silty-sand and gravelly-sand layers located with the glacial deposits located above the bedrock. Static head elevations in this aquifer ranged from 9.89 feet to 13.88 feet NGVD. The dense silt ground moraine and harbor till terminal moraine form a semi-confining layer separating the water table aquifer from the deep aquifer. The water-bearing unit located within the semi confined aquifer is under confining pressure and exhibited higher elevations than nearby wells screened in the water table aquifer.

Additional information regarding the site geology and hydrogeology of the site is presented in the RIR and the ROD (NYSDEC, 2006).

2.1.4 Summary of Impacts Requiring Further Delineation and/or Investigation for Design Components

Several environmental investigations have been performed at the Site and indicate that MGP-related compounds are present in soil and groundwater on and adjacent to the Site. The extent of the NAPL/tar containing soil is shown on Figure 2-2 and is largely encompassed by the proposed excavation area. The impacts appear to be well delineated at the Site. The approximate area of horizontal delineation is shown on Figure 2-2. Vertically, impacts are largely isolated at depths of five to ten feet bgs in unsaturated soils.

2.2 Pre-Design Investigation

A PDI will be conducted to gather the remaining information needed to ensure a safe and effective design of the field remedy and facilitate its implementation. The needs of the investigation are summarized below:

Remedial Component	Data Needed	Pre-Design
Excavation	Vertical and horizontal extents of NAPL	Geotechnical boring and Geoprobe sampling during disposal pre-characterization.
Subsurface Structure Removal	Delineation of subsurface structures	Test pits and disposal pre-characterization borings.
Shoring	Geotechnical parameters	Geotechnical data from soil borings.
Dewatering Configuration and Flowrates	Grain size	Sampling during pre-design investigation
NAPL Cutoff	Vertical and horizontal extent of NAPL	Geoprobe sampling during disposal pre-characterization.
DNAPL Collection	Flowability and recoverability	NAPL viscosity, interfacial sampling during pre-design investigation and NAPL recovery testing.

The objectives of the PDI are listed below:

- delineate the vertical extent of the contaminated soils ,
- confirm the horizontal extent of the contaminated soils to be removed,
- delineate the vertical and horizontal extent of subsurface structures to be removed,
- provide design data for the excavation shoring containment systems,
- pre-characterize soil for disposal options,
- aquifer testing to evaluate dewatering rates and free drainage potential of soils,
- evaluate potential impacts in groundwater to facilitate the design of on-site treatment systems, and review of effluent disposal options, and
- determine the extent and recoverability of DNAPL along the cutoff wall alignments

The following tasks will be performed to provide data to meet the PDI objectives:

- Property access agreement and road/sidewalk closing permit procurement
- Utility clearance
- Mobilization
- Soil boring advancement
- Test pit excavation
- Dewatering evaluation
- Water treatment evaluation
- DNAPL recovery evaluation sampling

- Investigation derived waste management
- Community air monitoring
- Site survey

These tasks are detailed in the scope of work presented in the subsequent subsections.

2.2.1 Property Access Agreements and Road/Sidewalk Closing Permits

ENSR will work with KeySpan to obtain access agreements to the adjacent properties where additional borings are required to delineate the extent of impacts to be remediated and to provide design data as necessary. In addition, ENSR will work with County officials to acquire a street opening permit and determine proper procedures and protocols such as signage for drilling within the streets and/or sidewalks to the east and south of the Site. Copies of access agreements and permits will be kept onsite during the performance of the field investigations to ensure compliance with requirements.

2.2.2 Utility Clearance

A code 753 mark-out will be completed to identify subsurface utilities on and adjacent to the Site prior to intrusive activities. Following mark-out, proposed boring locations will be hand-cleared to five feet bgs to ensure the locations are free of underground utilities. Once clear, drilling and excavation activities will proceed slowly and carefully for the top ten feet of each investigation location. Proposed sampling locations may be shifted to avoid subsurface and overhead utilities as appropriate.

2.2.3 Mobilization

Following procurement of appropriate agreements and permits, ENSR will mobilize to the Site and set up a decontamination area, drum storage area, and heavy equipment laydown area for the PDI activities. This area will be placed within KeySpan property in a centrally located area. ENSR will coordinate field activities with the appropriate agencies and the County to avoid or minimize disruptions, to the extent practicable.

2.2.4 Soil Boring Advancement

During the PDI, soil borings will be advanced by direct push methods to collect soils for pre-characterization efforts and hollow stem auger (HSA) methods to provide geotechnical data for design parameters (excavation, shoring, and dewatering). These borings will also be used to delineate the horizontal and vertical impacts and subsurface structures. Drilling and decontamination procedures provided in Appendix D (ENSR Field Procedures) will be followed during the drilling efforts. Upon completion, the borings will be tremie-grouted to land surface. .

Figure 2-3 illustrates the areas in which geotechnical borings will be advanced. Table 2-1 summarizes the boring location rationale. Approximately six borings will be advanced to approximately 50 ft bgs along the proposed barrier wall alignment and four borings to approximately 30 ft bgs spaced along the remaining areas of the perimeter, as illustrated on Figure 2-3 and summarized on Table 2-1. The final boring locations and depths may be adjusted based on the observations of MGP impacts at the proposed locations. Aside from soil logging and standard penetration testing, samples will be collected for geotechnical testing parameters from each boring (Table 2-1). A minimum of one sample per boring will be submitted for particle size analysis using the American Society for Testing and Materials (ASTM) Method D422. In addition, all borings will be continuously sampled for standard penetration testing (SPT) using ASTM Method D1586.

Additional soil borings will be placed in a grid pattern within the proposed excavation area at a spacing sufficient to collect one sample per 500 cubic yards of soil (the minimum sampling frequency of the soil disposal facilities). In order to expedite the transportation and off-site disposal of excavated soil during implementation of the site remedy, pre-characterization of the soil for disposal facilities will be performed. The characterization of the soil for disposal is dictated by the permit of the disposal facility receiving the waste. A list of the potential disposal facilities and their analytical requirements for soil characterization are presented in Tables 2-2 and 2-3.

2.2.5 Test Pit Excavation

Test pits will be conducted at locations presented in Figure 2-3 to locate structures not detailed during previous investigations and to evaluate the presence of obstructions along the barrier wall alignments. As detailed in the field procedures provided in Appendix D, a small rubber tired excavator will be used to advance test pits, the depth of the test pit will be based on the stability of the excavation and the degree of impact encountered. Materials removed from the test pit may be used to evaluate free draining capacity of the soil or other geotechnical parameters that may assist in the design and implementation of the selected remedy.

Three test pits (TP-1, TP-2 and TP-4) will be advanced in order to confirm or verify the location and depth of select on-site structures that appear to not have been located during the previous investigations. This includes, but is not limited to fuel oil tanks, storage tanks, used oil tank, and a gas holder. Another test pit (TP-3) will be constructed at a location along the western site boundary, parallel to the railroad embankment in an effort to determine the subsurface features of the embankment. This test pit will be installed in a manner so that the structural stability of the railroad embankment is not compromised.

The test pits will be advanced in areas and to a depth known to contain minimal impacts. If necessary, odor control foam and plastic sheeting will be used to minimize odors generated during test pitting. In the event that the CAMP or worker protection air monitoring criteria is exceeded, soil handling and excavation activities will be temporarily suspended and additional odor control measures will be evaluated.

2.2.6 Dewatering Evaluation

A preliminary evaluation of the existing data indicates that excavation dewatering may generate significant volumes of water. Additional aquifer testing, including pumping tests, may facilitate design of more efficient dewatering and water treatment systems and reduce the overall remediation costs for the project. The need for this testing will be further assessed during the initial design stages. This will include an estimate of the possible range of dewatering rates given the available data, expected contaminant loadings, and options and possible flow rate limitation for treated water discharge. This evaluation will establish the need for any additional aquifer testing.

2.2.7 Water Treatment Evaluation

Samples of water collected during free draining evaluation of impacted soil (Section 2.2.6) will be analyzed for MGP constituents as well as acceptance parameters for the local Publicly Owned Treatment Works (POTW), these will include total and suspended solids, oil and grease, and total cyanide. The results will be used to determine the preliminary treatment requirements and facilitate the evaluation of the cost-effectiveness of an on-site treatment system.

2.2.8 DNAPL Recovery

An evaluation of the DNAPL recovery parameters will be made during the PDI. If necessary, two new DNAPL monitoring wells may be installed at locations shown in Figure 2-3. The exact number, location and depth of these monitoring wells will be determined during the implementation of PDI. Select monitoring wells installed during previous investigations will be gauged and monitored for DNAPL. If DNAPL is present in the well, it will be pumped out for volume measurement and recovery rates. The samples will be submitted to PTS Laboratories in Santa Fe Springs, California for physical characteristic testing including viscosity, density,

interfacial, and surface tension analysis using the ASTM Methods D445 and D1481. NAPL samples will also be submitted to NYS approved analytical laboratory for chemical characteristic testing including volatile organic compounds (VOCs) using Environmental Protection Agency (EPA) Method 8260, semivolatile organic compounds (SVOCs) using EPA Method 8270, and total organic carbon (TOC) using EPA Method 9060. The samples collected will follow the laboratory sampling guide provided in Appendix B. Geotechnical and pre-characterization borings will be used to further refine the limits of DNAPL.

2.2.9 Investigation Derived Waste Management

All Investigation Derived Waste (IDW) generated during the PDI will be collected in properly labeled 55-gallon drums and grouped by environmental matrix. Subsequently, the drums will be characterized with laboratory analyses and properly disposed in accordance with management of IDW procedures outlined in Appendix D.

The majority of the soil removed during the excavation of test pits will be returned to the test pit. All additional residuals generated during the test pits (chemical treated soils and/or water) will be containerized and shipped to a pre-approved off-site disposal facility.

2.2.10 Community Air Monitoring

Community air monitoring requires real-time monitoring for VOCs, particulates (*i.e.*, dust), and MGP-related odors at the downwind perimeter of each designated work area when certain activities are in progress at the site. The community air monitoring is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (*i.e.*, off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigation work activities. The CAMP provided as part of the HASP included in Appendix C specifies action levels which require increased monitoring corrective actions to abate emissions and/or work shutdown for the PDI.

2.2.11 Site Survey

Following completion of the PDI, all sampling and investigation locations will be surveyed for elevation and location using a licensed New York surveyor. In addition, the survey will include other site elements such as site boundaries, topography, storm drain and/or sanitary sewer system invert elevations, and possibly other subsurface utilities (water lines, *etc.*). This information will be merged with existing base map information to allow preparation of a revised base map for the Site.

3.0 Design Basis

This section describes the remedial goals and provides details of the remedial action and the methods and procedures by which the anticipated activities will be completed in order to satisfy the remedial objectives.

3.1 Remedial Goals

The remedial goals for the Site have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. As stated in the ROD, "The selected remedy is protective of human health and the environment, complies with state and federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. The remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element." (NYSDEC, 2006).

In accordance with the ROD, the remediation goals for this Site are to eliminate or reduce to the extent practicable:

- direct contact with contaminated surface and subsurface soil at concentrations exceeding SCGs;
- ingestion of contaminated surface and subsurface soil at concentrations exceeding SCGs;
- migration of NAPL in the subsurface soil; and
- the source of contamination to the groundwater with a goal of reduction in the groundwater contamination over time.

3.1.1 Site Remedy

To achieve the remedial goals, NYSDEC, in consultation with NYSDOH, has selected the following remedial approach for the Site:

- A RD program will be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program.
- Demolition of the existing building and associated features located in the northeastern portion of the 25 Willow Avenue parcel to allow for the excavation of the impacted materials located beneath the building.
- Installation of two vertical barrier cutoff walls to prevent the migration of NAPL from the site source areas to off-site locations.
- Excavation of source materials to an approximate depth of ten (10) feet bgs to remove approximately 38,300 cubic yards of contaminated soils. Material to be removed will include soil containing visible coal tar or separate phase materials.
- Former MGP-related structures including foundations and associated grossly contaminated soil determined to contain coal tar with potential for future mobility will be removed to their full depth, to the extent practicable.

- Excavated areas will be backfilled with clean soil from an off-site location or if applicable, with clean debris from surface demolition activities. The top two (2) feet of the entire on-site parcel will be filled with clean top soil.

- DNAPL recovery wells will be installed to allow for the collection, treatment and disposal of mobile DNAPL that may be present in the subsurface after shallow soils and MGP-related structures have been removed.

- Institutional control in the form of an environmental easement will be required for the remedy. The environmental easement will:

  (a) restrict the use of the Site to "commercial use";

  (b) restrict the use of groundwater at the Site;

  (c) require the management of the Site in accordance with the provisions of the site management plan, to be approved by the Department; and

  (d) require a periodic certification to be completed and submit to the NYSDEC.

- A Site Management Plan (SMP) will be developed and implemented. The SMP will identify the institutional controls and engineering controls (IC/ECs) required for the remedy and detail their implementation. The SMP for this remedy will include:

  (a) an IC/EC control plan to establish the controls and procedures necessary to; (i) manage remaining contaminated soils that may be excavated from the Site during future activities, including procedures for soil characterization, handling, health and safety of workers and the community as well as, disposal/reuse in accordance with applicable NYSDEC regulations and procedures; (ii) evaluate the potential for vapor intrusion for any buildings developed on the Site, including mitigation of any impacts identified; (iii) maintain use restrictions regarding site development or groundwater use identified in the environmental easement; and (iv) require the property owner to provide an IC/EC certification on a periodic basis.

  (b) a monitoring plan to monitor the vertical barrier walls and NAPL recovery wells. The effectiveness of the cut-off walls will be determined from sampling results obtained from a periodic groundwater monitoring program; and

  (c) an OM&M Plan to provide the detailed procedures necessary to operate and maintain the remedy, including the NAPL recovery system. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

Figure 3-1 shows the proposed limits of excavation and vertical barrier cut off walls as described above.

The proposed remedial program will include the following components:

- mobilization and site preparation including demolition;
- installation of a shoring wall around the perimeter of the excavation area;
- erection of a temporary fabric structure for vapor containment and control over areas with significant impacts and potential for odor generation;
- air monitoring to evaluate potential fugitive emissions;

- excavation of impacted soils and MGP structures, including piping;
- transportation and management of impacted material at an off-site permitted facility;
- installation of subsurface containment consisting of two vertical barrier walls;
- installation of recovery wells for passive collection of any DNAPL; and
- surveying, backfilling, site restoration, and demobilization.

The remainder of this report describes these activities and provides the information used as the basis for the design.

3.2 Design Submissions

The design will consist of the following documents to be submitted for NYSDEC review:

- Remedy Design Work Plan (this document)
- 60% Remedial Design submittal (Drawings and Specifications) and corresponding plans
- 90% Remedial Design submittal (Drawings and Specifications).

The anticipated list of specifications for the 90% design is:

Division 1 Specifications – General requirements

- Summary of Work
- Work Restrictions
- Contract Modification Procedures
- Measurement and Payment
- Payment Procedures
- Project Management and Coordination
- Construction Progress Documentation
- Submittal Procedures
- Regulatory Requirements
- Health and Safety Requirements
- Mobilization and Temporary Facilities
- Erosion and Sediment Controls
- Surveying
- Closeout Procedures

Division 2 Specifications – Site work

- Off-Site Transportation and Disposal
- Decontamination
- Odor and Vapor Control (temporary fabric structure and controls)
- Building and Subsurface Demolition
- Clearing
- Dewatering
- Construction Water Treatment and Discharge
- Excavation
- Excavation Support
- Barrier Wall
- Backfilling and Grading
- Existing Site Infrastructure
- Roadway Pavement
- Parking Lot Pavement
- Concrete Curb and Sidewalk
- Collection Wells
- Planting and Seeding
- Treated Water Discharge Pipeline Construction (Optional)

The anticipated list of drawings for the 90% design is:

- Title Sheet and Index
- Legend and General Notes
- Existing Conditions and Extents of Excavation
- Site Preparation and Erosion and Sediment Control (site layout and infrastructure)
- Erosion and Sediment Control Details (silt fence, construction entrance, stockpiling, and decontamination pad construction)
- Structure Demolition Plan (surface and subsurface)

- Excavation Support
- Excavation Support Cross Sections
- Temporary Fabric Structure
- Excavation Limits (on- and off-site locations)
- Excavation Cross Sections
- Barrier Wall
- Barrier Wall Cross Sections
- Excavation Details
- Restoration
- Restoration Cross Sections

A 100% design document will be prepared based on contractual negotiations with the selected remedial contractor. The 100% design will be submitted to NYSDEC, but will not require review.

This list is preliminary and subject to change as the design process proceeds.

3.3 Site Preparation

The Site will be prepared for the required remedial action and restoration work. The site preparation activities include: mobilization; relocation of existing security fencing as needed for the proper implementation of the remedy; installation of erosion and sedimentation controls; installation of temporary site facilities; surveying to establish baseline conditions and grades; utility location, protection, and relocation, if necessary; demolition of existing surface and subsurface structures; and installation of traffic controls at the Site. Any monitoring wells that will be damaged during the remedy implementation will be removed in their entirety or abandoned per NYSDEC regulations during the site preparation activities. Documentation required for the abandonment and removal of these wells will be included in the remedy completion report.

All necessary engineering controls to control odors will be installed prior to the start of excavation activities.

3.4 Excavation

Excavation will achieve the specific performance and design requirements presented in the ROD (NYSDEC, 2006) and summarized in Section 3.1. The current estimate of the limit of excavation, as determined in the ROD, is shown in Figure 3-1 and is approximately 103,410 square feet. The estimate assumes that the excavation will extend down to a depth of 10 feet bgs representing a total in-place volume of approximately 38,300 cubic yards.

The proposed extents of excavation will be finalized as part of the PDI and will be presented to NSDEC prior to the start of field remediation activities. During the PDI, ENSR will utilize the geotechnical soil borings along the excavation perimeter to establish the vertical extent of impacts and provide an initial estimate of the depth of excavation. These results will be used to define the extent of excavation at the 60% design level. The depth of the excavation will be further refined during the subsequent pre-characterization boring program (grid of geoprobe points). Given the required time sensitivity of the data used for disposal pre-characterization and

facility acceptance, the pre-characterization program will be undertaken as late in the design process as practical. The refined limits of excavation will be reflected in the 90% design.

Excavation will begin following demolition of surface structures, site clearing and grading, construction of a shoring wall, installation of site-wide and/or localized dewatering systems, and erection of a temporary vapor containment structure. Additionally, some portion of the areas shown in Figure 3-1 for removal may not be sufficiently contaminated to warrant removal. The actual extent of removal in these locations will be based on visual observations as the excavation proceeds, with the concurrence of the NYSDEC on-site representative.

3.4.1 Shoring Wall/Vertical Barrier Wall and Dewatering/DNAPL Collection System Construction

Based on the proximity of the soil excavation area to surrounding buildings and streets and the presence of a shallow water table, engineering controls including benching and/ or structural shoring and a dewatering system will be required. In locations where the shoring wall coincides with the vertical barrier wall described in the ROD, the vertical barrier will be constructed to provide structural support for the excavation. Additionally, dewatering of the excavation will be required for effective operations. Details on the shoring wall and dewatering activities are provided in the following discussion.

The structural shoring wall will be constructed at the perimeter of the excavation area to provide excavation wall stability as well as reduce the amount of lateral groundwater infiltration into the excavations. Geotechnical soil samples will be collected from various locations on the perimeter of the excavation area during the PDI to characterize the soils for construction of a shoring wall. The vertical barrier walls will be installed in two areas of the Site to cut off migration of contamination off the Site. The barrier walls will be designed so as to prevent water from simply flowing around the wall (*e.g.*, wing walls, *etc.*). The type and configuration of the walls to be installed will be determined during the design of the selected remedy. The evaluation will take into account the constructability and compatibility of the wall with subsurface site contamination. The barrier wall will also serve to support excavation.

Temporary shoring or benching will be used to support excavation at significant depth in the central portions of the Site. PDI activities will indicate those areas of the Site where these controls are likely to be required.

Site-wide and/or localized dewatering systems will be installed to lower the water table across the excavation area to prevent groundwater infiltrations into the excavations. Along with the Site wide and/or localized dewatering systems, recovery/monitoring wells will be placed immediately upgradient and down gradient of the walls to ensure recovery of DNAPL collecting behind the vertical barrier walls, as well as any significant DNAPL that may be present immediately outside of the walls. The actual number and locations of wells, the screen intervals and method of recovery will be determined during the design of the remedy. Groundwater samples will be collected from select wells during PDI to obtain data for construction water treatment design, disposal and permitting.

Detailed plans and specifications for the shoring wall and dewatering activities will be prepared as part of the design activities and will be presented to NYSDEC during the design submittals.

3.5 Waste Management

3.5.1 On-Site Waste Management

To the extent possible, excavated soil will be loaded directly into trucks for off-site transportation. However, because of construction sequencing and off-site disposal facility scheduling issues, and in order to consolidate large amounts of waste material for bulk truck shipments, it will likely be necessary to store waste material on-site prior to loading and shipment. In these instances, excavated soil will be transported by loader or on-site

haul truck from the excavation areas to the stockpile area within the temporary fabric structure. To the extent practicable stockpile areas will be located over areas to be excavated, negating the need for liners and berms. If stockpile areas are placed in unimpacted or restored areas, berms and liners will be used to protect underlying materials from becoming impacted.

Surface debris generated during demolition may require decontamination or crushing to meet facility acceptance requirements. Decontamination will take place using brushes, steam cleaners, and/or pressure washers. Residues from decontamination operations will be collected and managed with impacted soils. Excavation debris may potentially be decontaminated and sent to an off-site facility for disposal. Decontamination water, as well as residuals from dewatering activities will be temporarily stored in appropriate tanks prior to treatment and management in the temporary water treatment system or transported to an appropriate off-site disposal facility as required.

It is assumed that the composition of the excavated soils will meet the requirements of NYDEC guidance, Management Of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment [(DER - 4), NYSDEC 2002], and can be managed as solid wastes at permitted off-site disposal facilities. The soils within the site will be pre-characterized during the PDI. Pre-characterization will facilitate the profiling and pre-acceptance of the materials to the disposal facilities. Soils excavated from below the water table, may require temporary staging at the edge of the excavation to allow free water to drain back into the excavation. These soils may require amendment prior to shipment, if required the soils will be amended with a facility accepted drying agent (fly ash or equivalent) to facilitate transport to the off-site disposal facility.

3.5.2 Waste Characterization

All wastes at the Site that have been impacted by MGP residues will be classified as non-hazardous industrial waste unless they are determined to exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity characteristics leaching procedure (TCLP) benzene, as determined by laboratory testing. If they do exhibit one or more of these characteristics, they will be classified as hazardous wastes.

The soils within the Site will be pre-characterized during the PDI. Pre-characterization will facilitate the profiling and pre-acceptance of the materials to the disposal facilities. Once the soils are pre-characterized and accepted they can be direct loaded from the excavation into transport trucks or stockpiled on the Site so not to impede the progress of the excavation.

3.5.3 Off-Site Transportation

Excavated materials will be transported off-site in dump or tanker trucks to the receiving facilities. Transportation of impacted materials from the Site will be performed in accordance with all regulatory requirements and in accordance with a Transportation Plan.

All haul trucks will have poly bed liners that fully line the bed of the truck and can be overlapped to cover the top of the load to manage odors during transportation. The vehicles will be loaded in such a way as to avoid contamination of their exteriors, including tires. All trucks will be checked before leaving the Site and all loose soil or other materials will be brushed off to prevent spreading to streets or other areas off-site.

Waste shipments will be documented using the required waste manifests. Other materials that have no specific documentation requirements will be documented using waste tracking forms, bills of lading, and receipts. All shipments of waste from the Site will be documented, describing the type and amount of material and the receiving facility.

3.5.4 Off-Site Disposal or Treatment

The following facilities have been preliminarily identified for the thermal desorption and disposal of impacted soil from the Site:

- Environmental Soil Management of New Jersey, LLC, located at 75 Crows Mill Road, Keasbey, NJ 08832.
- Clean Earth of Southeast Pennsylvania, Inc., located at 7 Steel Road East, Morrisville, Pennsylvania 19067.
- Mid-Atlantic Recycling Technologies, located at 3209 North Mill Road, Vineland, NJ 08360.

These treatment facilities are suitable for the disposal of non-hazardous industrial waste and contaminated debris that has been crushed to appropriate size. Final selection of facilities will be based on facility acceptance, facility scheduling, and availability. Additional information regarding the above mentioned facilities is provided in Table 2-2.

Debris which cannot be reduced to the appropriate size will be transported to an approved and licensed landfill disposal facility. Additional disposal facilities may be required for the treatment or recycling of NAPL if sufficient quantities are encountered in the excavations. These materials will be characterized and managed in accordance with the applicable requirements of 6 NYCRR Parts 370 through 374 and 376 (NYSDEC, 2006).

3.6 Water Management

Construction water will be generated during the dewatering activities conducted to support excavation and water containing MGP constituents will be generated during decontamination of debris and equipment. Storm water run-off from impacted areas will also be collected. The work, performed under the AOC (NYSDEC, 1998) will meet the substantive requirements for discharge to the local sanitary sewer system. Permitting requirements for this proposed discharge will be further assessed during the design process and a permitting plan will be submitted.

3.6.1 Excavation Dewatering

The lower portions of the excavation are expected to be carried out in the saturated zone. As previously discussed in Section 3.3.1, a dewatering plan will be prepared as part of design activities and will be included in a later submission.

3.6.2 Water Treatment

A temporary water collection and treatment system will be constructed at the Site to manage construction water generated during the soil removal activities. The treatment system will run continuously until the remediation project is complete. The treatment system will be designed to meet the limits stated by the NYSDEC and/or the local sewerage authority. A typical collection and treatment system for treating MGP impacted construction water is comprised of the following major subsystems:

- Construction dewatering pumps;
- Influent surge tanks;
- Oil water separators;
- Clarifiers;

- Sand filters;
- Granular activated carbon adsorption; and
- Effluent surge tanks.

Typically, construction dewatering pumps transfer construction water generated as a result of the excavation activities into a surge tank. Water from the surge tanks flow through oil water separators and clarifier(s) to remove NAPL and large particulates, respectively. If necessary, flocculants and coagulants are added in the clarifiers to enhance settling. Following sediment and grit removal, water is pumped through a series of sand filters. Granular activated carbon (GAC) vessels, located downstream of the sand filters, remove any organics from the water followed by storage in effluent surge tanks. Typical GAC units consist of two trains operating in parallel with each train having two carbon vessels in lead lag arrangement. Effluent surge tanks allow temporary storage of treated GAC effluent. As mentioned earlier, treated water for this project will likely be discharged to the local POTW through the sanitary sewer. Details of any necessary water treatment system and the required permitting will be based on the results of PDI data and will be provided in the 60% design submittal.

3.7 Site Restoration

Following excavation activities, the excavation will be backfilled with certified clean fill or virgin quarry process material in 12-inch lifts and properly compacted, to restore the Site to the original grade. Specifications for clean fill will be presented in the 90% design submittal. All remnants of the remediation activities will be removed from the Site after completion of remediation activities. Disturbed areas shall be re-graded to match the surrounding areas. Pursuant to the ROD, the top two feet of the entire on-site parcel area will consist of clean soil able to support vegetation. The fence surrounding the Site and within the excavation area will be restored to its original location prior to Site work.

3.8 Environmental Monitoring and Controls

Environmental controls will ensure that the work activities do not spread impacted soil and MGP wastes outside the impacted areas and maintain the protection of human health and the environment throughout the remedial activity.

3.8.1 Odor, Vapor, and Dust Control

Odor, vapor, and dust control will be required for this project due to the immediate proximity of residential and commercial buildings.

A temporary fabric structure will be erected during site preparation to contain odors and vapors that are generated during the work. All excavation, staging, backfilling, loading, or any other handling of impacted soil or MGP residuals will be conducted under the temporary fabric structure to the extent practicable. If needed, a temporary fabric structure might also be erected over the temporary water treatment staging area. Engineering controls, as described below, will be applied during the excavation and handling of soils that cannot be practicably conducted under the temporary fabric structure. The structure will consist of a rigid frame covered with an impermeable fabric cover. Sprung Instant Structures, Universal Fabric Structures, or a similar vendor will manufacture the structure.

The structure will be equipped with an air handling and treatment system. The air handling system will consist of blowers, air filters, and an air treatment system to remove vapors from inside the structure. The air handling system will be a complete unit equipped with a motor starter, changeable filters to capture particulate matter, start/stop controls, and will be sized to provide a minimum of four air changes per hour. The air treatment system will be a vapor-phase carbon system that can remove carbon monoxide from heavy equipment and

truck operation, and volatile organic compounds that will be generated while handling impacted soil and MGP residuals.

An odor and vapor suppressing foam will also be available during the remedial activity to contain air emission sources. The foam will be a direct-contact, spray-on foam, applicable to soil and MGP residuals, that provides an impermeable barrier and has a minimum effective duration of 7 days in all weather conditions. Odor suppressing foam and plastic sheeting (or other approved methods, including BioSolveTM and similar products) will be available onsite at all times, for all soil excavations. The necessary application equipment and plastic sheeting will be brought onsite during mobilization, along with odor neutralization concentrate.

3.8.2 Air Monitoring

Site perimeter and work zone air monitoring will be performed per NYSDOH and Occupational Safety and Health Administration (OSHA) requirements, and according to the site-specific HASP and CAMP (to be provided as an addendum following completion of the 60% design). The contaminants of concern are VOCs and particulates.

Monitoring will be continuous during the excavation and handling of impacted soils. Monitoring will be periodic during non-intrusive activities such as mobilization and equipment decontamination.

Summaries of all air monitoring data will be provided to the appropriate parties' regulatory agencies on a weekly basis to facilitate the transfer of information related to potential health risks.

3.8.3 Noise and Vibration Evaluation

The planned remediation activities, including building demolition, shoring installation, excavation, and backfilling, have the potential to generate noise and vibration. Once the pre-design activities are completed, and a design for the remedy developed, the potential noise and vibration impacts associated with implementing the remedy will be evaluated.

3.8.4 Erosion and Sediment Control

The remediation activities will disturb an area greater than one acre in size. Therefore, the work will meet the substantive requirements of a SPDES General Permit for Stormwater Discharges from Construction Activity (GP-02-01). Erosion will be prevented and sediment will be controlled during all on-site earthwork activities in accordance with the applicable New York State guidance. Stormwater run-off will be controlled to prevent contact with impacted soils. Any stormwater that does contact impacted soils will be diverted to the temporary water treatment system. Hay bales, silt fence, and rip rap will be used as necessary to prevent erosion of exposed soils.

On-site decontamination pads will be used to remove mud from truck tires and prevent tracking of mud and impacted soil onto the streets. Detailed plans and specifications for erosion and sediment control will be provided with the 90% design submittal.

3.8.5 Decontamination

During and upon completion of the investigation and excavation phases of the project, decontamination of equipment will be performed in order to prevent contaminated material from being spread off-site during waste hauling activities and to prevent the spreading of impacted material to un-impacted areas of the site. Trucks used for transport of excavated material will be decontaminated using dry decontamination methods (*i.e.*, removal of loose material with a broom or brush) to limit the volume of decontamination water, which will require treatment and disposal. These methods, along with parking of trucks on plastic sheeting during loading, will effectively prevent the spread of contaminated materials onto roadways during transport to

disposal facilities. Decontamination of the earth-moving equipment will occur at the completion of the excavation phase and prior to the handling of clean backfill or mobilization off-site. The method of equipment decontamination will consist of pressure washing to remove any impacted soil. Decontamination water generated during cleaning of tools and equipment will be discharged to the dewatering system treatment and disposal stream. Water generated from decontaminating personnel will be minimal due to the availability of disposable personal protective equipment (PPE) such as tyvek coveralls, booties, and nitrile gloves. The volume of decontamination water is assumed to be negligible compared to flow rates for dewatering and stormwater removal in the disturbed areas of the Site.

4.0 Permitting and Regulatory Requirements

4.1 Permitting

In addition to performance requirements established to ensure that the design of the remedial action meets the remedial action objectives set in the ROD (NYSDEC, 2006), the design will also be prepared to meet permitting and other regulatory requirements of local, state, and federal laws and regulations. Table 4-1 presents a listing of potentially applicable federal, state, and local permit requirements. As specified in Appendix 7B of the Draft DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, December 2002), NYSDEC may grant exemption from most state permits required for completion of this remedial action, provided the substantive requirements of the permit programs are followed. For federal and local permits that will be required, a plan will be developed to identify the application requirements, a summary of information required, and application forms. Government contacts will be identified for each permit and a potential schedule for meetings with regulators and application submittals will be developed.

4.2 Regulatory Requirements

Compliance with regulatory requirements applicable to this work was discussed in Section 3, including the following work activities:

- Wastewater treatment and discharge requirements;
- Hazardous and non-hazardous waste management; and
- Air quality maintenance and monitoring.

A contingency plan will be developed and submitted as an addendum following completion of the 60% design. The contingency plan will be implemented if any element of the RD Work Plan fails to achieve any of its objectives or otherwise fails to protect human health. Additionally, a CPP will also be developed to incorporate appropriate activities outlined in 6 NYCRR Part 375 (NYSDEC, 2006), and any subsequent revisions thereto.

4.2.1 Occupational Safety and Health Regulations

Regulations promulgated by OSHA specify safety and health requirements for work procedures at all work places and specifically at construction sites and hazardous waste sites.

Industry standards for work at hazardous waste sites presented in 29 CFR 1910.120 describe specific requirements, including the following:

- Preparation of a site-specific HASP;
- Training and medical monitoring of personnel who may be exposed to hazardous substances; and
- Air monitoring, respiratory protection and PPE.

A site-specific HASP will be produced prior to any remedial activity. Procedures outlined in the site-specific HASP will provide requirements for daily health and safety review meetings, proper use of safety equipment, proper mechanical equipment use, and other policies. At a minimum, the PPE to be worn on site will include safety glasses, hard hat, and steel-toed shoes or boots. The subjects covered in the HASP will include:

- Health & safety risk analysis;

- PPE;
- OSHA air monitoring & action levels;
- Site control;
- Decontamination;
- Emergency response plan;
- Lockout/tagout;
- Heavy equipment operations;
- Excavation and trenching;
- Material safety data sheets; and
- Health and safety records and reports.

4.3 Transportation Requirements

The federal Department of Transportation (DOT) has developed requirements that regulate the transportation of hazardous materials by road and rail. Among the hazardous materials identified in these regulations are coal tar distillates. In addition, as discussed above, hazardous waste regulations specify that shipments of hazardous wastes must meet certain requirements presented in the DOT regulations. Specific requirements for hazardous material shipments include the following:

- Shipping papers must include a description of hazardous materials included in the shipment along with the DOT designated identification number and hazard class. Hazardous wastes may not be shipped without a manifest (49 CFR 172.200).
- Each container, package, or vehicle containing a hazardous material must be marked or labeled with the DOT shipping name, technical name, identification number, and hazard class (49 CFR 172.300 and .400).
- Each vehicle or container containing a hazardous material must be appropriately placarded (49 CFR 172.500).
- When hazardous materials are transported, emergency response information must be available at the point of loading, unloading, and during transport.

Truck routes to and from the site will comply with the Transportation Plan.

5.0 Schedule

The schedule for submission of various documents as stated in the Consent Order is detailed in Figure 3-2. The schedule key activities and submissions include the following:

- The PDI is planned to begin in spring 2009 and completed in summer 2009;
- Remedial Design bid documents will be generated subsequent to PDI activities;
- The 60% Remedy Design is anticipated to be submitted to the NYSDEC in July 2009;
- The pre-characterization program is anticipated to start in April 2009
- The 90% Remedy Design is anticipated to be submitted in September 2009.

Remedial activities are planned to begin as soon as NYSDEC approves the Remedial Design submittal and contractors have been procured to perform the remediation.

6.0 References

GEI Consultants, Inc., 2005. Final Remedial Investigation Report, Clifton Former MGP Site, Operable Unit 2 (OU-2), February 2005

New York State Department of Environmental Conservation (NYSDEC). 1998. Administrative Order on Consent – In the matter of the Development and Implementation of a Former Manufactured Gas Plant (MGP) Site Investigation and Remediation Program by Brooklyn Union for the former Richmond County Gas Light site located at 25 and 40 Willow Avenue, Staten Island, New York.

NYSDEC, 2002. Draft DER-10, Technical Guidance for Site Investigation and Remediation.

NYSDEC, 2002. DER-4, Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from former MGPs (TAGM – 4061), January 2002.

NYSDEC. 2006. Record of Decision – Former Clifton MGP Site Operable Unit No. 2 Richmond County, New York. Site No. 2-42-023.

NYSDEC, 2006. NYCRR PART 370 – 374 and PART 376 Environmental Remediation Programs. 2006.

NYSDEC, 2006. 6 NYCRR PART 375 Environmental Remediation Programs Subparts 375-1 to 375- 4 & 375-6, December 2006.

Paulus, Sokolowski and Sartor Engineering, PC, 2005. Feasibility Study Report for the Former Clifton Manufactured Gas Plant (MGP) Site, 25 Willow Avenue Parcel, Operable Unit No. 2 (OU-2), March 2005.

Tables

Table 2-3
Summary of pre-characterization disposal facility analytical sampling requirements
Former MGP site
Clifton, Richmond County, New York

Contaminant	EPA Method	Frequency	ESMI NJ[1]	CESP	MART	Samples Required
Total VOCs	8260B	500 CY	X			76
Total PAHs	8270C	500 CY	X			76
Total PCBs	8082	500 CY	X	X	X	76
Total Metals	3050/6010B	500CY	X[2]	X[3]	X[4]	76
TPH	8015M DRO to C-44	250 CY	X	X[5]	X	152
TOX	9020B (9023)	250 CY		X[5]		152
Ignitability	1010 (7.1.2)	1000 CY		X	X	38
Corrosivity	9040/9045	1000 CY		X	X	38
Reactivity (Cyanides & Sulfides)	7.3.3.2 & 7.3.4.1	1000 CY		X	X	38
Sulfur	ASTM D3176/4239D	1000 CY	X			38
TCLP Metals	1311/6010B	1000 CY		X[6]	X	38
TCLP Hg	1311/7471	1000 CY		X[6]	X	38
TCLP Herbicides	1311/8151A	1000 CY		X	X	38
TCLP Pesticides	1311/8081A	1000 CY		X	X	38
TCLP VOA	1311/8260	1000 CY		X	X	38
TCLP SVOC	1311/8270	1000 CY		X	X	38

Notes:

Assumption that 38,300 CY will have to be removed from the Site.

X signifies that the analysis is required

All TCLP levels are represented in mg/L

All totals are in mg/kg

(1) Composite of five samples (100 CY ea). Samples must be repeated for every 500 CY or fraction thereof.

(2) Includes As, Be, Cd, Cr, Ni, Pb, Hg)

(3) Includes As, Ba, Cd, Cr+6, Cu, Hg, Ni, Pb, Se, Ag, Zn

(4) Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn

(5) One sample for initial 60 CY and second 60 CY, then every 250 CY thereafter.

(6) TCLP analysis required when total concentrations are 20x the RCRA limit [40 CRF 281 Subpart C].

Table 2-2
Summary of pre-characterization disposal facilities
Former MGP site
Clifton, Richmond County, New York

Waste Type	Facility Name and Address	Facility Type	Distance from the Site (Miles)	Max Weight per Truck	Frequency of Analytical
Solid Waste	Environmental Soil Management, Inc. 75 Crows Mill Rd. Keasbey, NJ 08832	Thermal	25	24 Tons	1 per 500 CY (Composite of 5 100 CY samples)
	Clean Earth of Southeast Pennsylvania 7 Steel Road East Morrisville, PA 19067	Themal	64	Unknown	Grab sample first and second 90 tons for TPH & TOX and then every 375 tons thereafter Representative composite sample every 1000 CY
	Mid-Atlantic Recycling Technologies / Casie Protank 3209 North Mill Road Vineland, NJ 08360	Thermal	115	24 Tons	1 per 1000 CY
Hazardous Waste	Environmental Soil Management, Inc. 304 Tow Path Road Fort Edward, NY 12828	Thermal	115	35 Tons	3 for initial 750 CY Every 750 CY After
	GSI Environment 855 Pepin Street Sherbrooke, Quebec - CANADA j112p8	Landfill	418	22 Tons	500 tons 1000 tons
Contaminated Debris	GROWS / TRRF 1121 Bordentown Rd Morrisville, PA 19067	Landfill	65	24 Tons	1 per 500 CY

Table 2-1
Summary of PDI soil boring locations and sample rationale
Former MGP site
Clifton, Richmond County, New York

Sample Location	Number of Borings^	Sample Rationale	Depth Interval (feet bgs)	Proposed Laboratory Analysis*
Vertical Delineation Borings				
Site-wide	132	Evaluate the vertical impacts and the depth of foundations of structures associated with the Former MGP. Evaluate whether excavation depth requires modification to remove targeted impacts.	0-10	Visual and field screening. Potential submittal of laboratory samples* if determined necessary to fill data gap.
Geotechnical Borings				
West Wall	3	Establish soil strength and settlement characteristics for design of earth retaining structures and dewatering system. Evaluate horizontal extent of impacts.	0-30	Continuous standard penetration testing (SPT) - ASTM D1586 and partial site analysis (min. one sample boring) (ASTM D422)
West Wall	1	Establish soil strength and settlement characteristics for design of earth retaining structures and dewatering system. Evaluate horizontal extent of impacts.	0-50	Continuous standard penetration testing (SPT) - ASTM D1586 and partial site analysis (min. one sample boring) (ASTM D422)
East Wall	1	Establish soil strength and settlement characteristics for design of earth retaining structures and dewatering system. Evaluate horizontal extent of impacts.	0-30	Continuous standard penetration testing (SPT) - ASTM D1586 and partial site analysis (min. one sample boring) (ASTM D422)
East Wall	1	Establish soil strength and settlement characteristics for design of earth retaining structures and dewatering system. Evaluate horizontal extent of impacts.	0-50	Continuous standard penetration testing (SPT) - ASTM D1586 and partial site analysis (min. one sample boring) (ASTM D422)
Southeast Wall	4	Establish soil strength and settlement characteristics for design of earth retaining structures and dewatering system. Evaluate horizontal extent of impacts.	0-50	Continuous standard penetration testing (SPT) - ASTM D1586 and partial site analysis (min. one sample boring) (ASTM D422)

Notes:

bgs - below ground surface

^ = At locations where delineation borings and geotech borings are co-located, geotech borings will be used for delineation. Total number of delineation borings does not reflect shared locations.

* = Select delineation borings may be submitted for laboratory analysis as needed to fill potential data gaps. Sample location will be determined in the field. If selected, samples will be tested for:

- VOCs - TCL volatile organic compounds using EPA Method 8260B
- SVOCs - TCL semivolatile organic compounds using EPA Method 8270C
- CN - Total Cyanide using EPA Methods 9012 A
- TAL Metals - Target Analyte List Metals using EPA Methods 6010 and 7471
- TCL - Target Compound List

All sample depths are approximate and may be increased if needed.

Table 4-1
List of environmental permits, ordinances, and citations
Former MGP site
Clifton, Richmond County, New York

Permit, Ordinance, or Citation	Statute, Regulation, or Authority	Agency	Applicable to Project?	State Exempted? [1]	Description of Applicability
Federal					
Nationwide Permit 38 - Cleanup of Hazardous and Toxic Waste	Nationwide: 33 CFR 330	US Army Corps	Yes	No	**Potentially applicable** - Regulates work in or discharges into navigable waters or wetlands of the United States. Nationwide Permits apply to general categories of activities expected to have minimal impacts; otherwise a project may be required to apply for an individual permit. Special permit conditions for navigation, historic properties and endangered species may apply.
Spill Prevention, Control, and Countermeasure Plan 40 CFR 112.3	40 CFR 112.3	USEPA	Potentially	No	**Potentially applicable** - Requires development of a Spill Prevention, Control, and Countermeasure Plan if the site has the capacity to store more than 1,320 gallons of oil onsite. **Onsite storage of this quantity of oil is unlikely. If there is storage, the subcontractor will be responsible for developing and implementing this plan.**
State					
Protection of Waters Regulatory Program	6NYCRR, Part 608	NYS DEC	see below	see below	Protection of Waters Permits are required for the various activities listed below. NYS DEC forwards them to US Army Corps as
Disturbance of the Bed of Banks of a Protected Stream or Other Watercourse			No	Yes	**Not applicable** - Project does not involve disturbing the bed or banks of a stream or watercourse with a classification and standard of C(T) or higher (Sag Harbor class / standard = SA, Sag Harbor Cove class / standard = SC).
Construction, Reconstruction or Repair of Dams and Other Impoundment Structures			No	Yes	**Not applicable** - Project does not involve construction or alteration of dams or impoundments.
Construction, Reconstruction or Expansion of Docking and Mooring Facilities	6NYCRR, Part 608	NYS DEC	No	Yes	**Not applicable** - Project does not involve construction of docks, platforms, or moorings.
Water Quality Certification for Placing Fill or Undertaking Activities Resulting in a Discharge to Waters of the United States.			Yes	Yes	**Potentially applicable, but exempt** - Certification is required to demonstrate that the project will not violate water quality standards if the project results in discharge to the waters of the United States and is required to obtain a Federal permit (i.e. US Army Corps Section 404 permit). Exemption: if a project is authorized under certain US Army Corps Nationwide Permits then application for an individual Water Quality Certification is not required. However, a project authorized under Nationwide Permit 38 (Cleanup of Hazardous and Toxic Waste) requires application for an individual Water Quality Certification from NYS DEC.
Coastal Erosion Control Permit	6NYCRR Part 505	NYS DEC	No	Yes	**Not applicable** - Regulates activities that may be detrimental to designated Coastal Erosion Hazard Areas. Activities include: filling, dredging, excavating, construction of buildings, docks, and other structures, drainage.
Tidal Wetlands Permit	6NYCRR Part 661	NYS DEC	Yes	Yes	**Potentially applicable** - No tidal wetlands ientified in project area. Regulates activities that may be detrimental to tidal wetlands (e.g. marshes, shoals, mudflats). Activities include: filling, dredging, excavating, construction of construction of buildings, docks, and other structures, drainage. Tidal wetlands are defined on the State Tidal Wetlands Inventory maps.
Freshwater Wetlands Permit	6NYCRR Parts 663, 664, and 665	NYS DEC	No	Yes	**Not applicable** - No potential freshwater wetlands identified in project area. Regulates activities that may be detrimental to freshwater wetlands (e.g. marshes, shoals, mudflats). Activities include: filling, dredging, excavating, construction of construction of buildings, docks, and other structures, drainage. Generally, a wetland must be >12.4 acres to be protected.
Applications For Diversion Or Use Of Water For Purposes Other Than Hydro-Electric Power Projects	6NYCRR Part 605	NYS DEC	Yes	Yes	**Potentially applicable** - These rules shall apply to all applications for a license or a permit to take, divert, appropriate or otherwise use the waters of the State, pursuant to article XIV of the Conservation Law, except applications for hydro-electric power projects.

Table 4-1
List of environmental permits, ordinances, and citations
Former MGP site
Clifton, Richmond County, New York

Permit, Ordinance, or Citation	Statute, Regulation, or Authority	Agency	Applicable to Project?	State Exempted? [1]	Description of Applicability
State Pollutant Discharge Elimination System (SPDES) Permit - Industrial Discharges	6NYCRR Parts 750-757 and several Parts of 40CFR	NYS DEC	Yes	Yes	**Applicable but exempt from full SPDES permit, instead applying for a SPDES Permit Equivalent** - Regulates water discharges to waters of the state from industrial sources to protect human health, recreation, and fish and wildlife. There are general permits that apply to specific categories of discharges and individual permits for site-specific discharges that do not fall in the general categories. Many aspects related to the discharge are regulated including: construction or use of outlet structures, construction and operation of water treatment systems, Best Management Practices, effluent monitoring schedules and procedures, and physical and chemical criteria for effluent.
State Pollutant Discharge Elimination System (SPDES) Permit - Construction Stormwater	6NYCRR Parts 750-757 and several Parts of 40CFR	NYS DEC	Yes	Yes	**Applicable but exempt** - Regulates stormwater discharges from construction activities to waters of the state to protect human health, recreation, and fish and wildlife. Projects that disturb < 1 acre are exempt. Many aspects related to the discharge are regulated including: construction or use of outlet structures, construction and operation of water treatment systems, Best Management Practices, effluent monitoring schedules and procedures, and physical and chemical criteria for effluent. **The subcontractor will be responsible for developing and implementing the SWPPP.**
Air - Title 5, State permits, Registrations	6NYCRR Parts 200-201 Title V: Part 201-6 State: Part 201-5 Registration: Part 201-4	NYS DEC	No	Yes	**Not applicable and exempt** - Permits are issued for construction and operation of air pollution sources. Title 5 is not applicable as project is not likely to generate emissions that exceed major stationary source thresholds (25 tons per year volatile organic compound [VOCs] - Suffolk County is a Severe Non-Attainment Area for VOCs). State permit or registration are not applicable - if an operation is exempted from or does not qualify for a Title 5 permit, then NYS DEC will issue a State air permit, except for certain activities which qualify for Air Registration. Certain types of petroleum storage tanks are exempt from permitting and registration requirements (6NYCRR 201-3.2(c)(21)-(27)).
State Environmental Quality Review (SEQR)	6NYCRR Part 617	NYS DEC	Yes	Yes	**Applicable but exempt** - State Environmental Quality Review is not required for Type II actions, which include actions required to be taken pursuant to a judgment or an administrative or judicial order.

Table 4-1
List of environmental permits, ordinances, and citations
Former MGP site
Clifton, Richmond County, New York

Permit, Ordinance, or Citation	Statute, Regulation, or Authority	Agency	Applicable to Project?	State Exempted? [1]	Description of Applicability
Local					
Coastal Consistency Review	Village Code Chapter 52A	Village of Edgewater	Yes	Yes	**Applicable but exempt** - Required so the municipality can determine if the project is consistent with the Local Waterfront Revitalization Program. This requirement does not apply to Type II actions as defined under SEQRA, including actions required to be taken pursuant to a judgment or an administrative or judicial order (Code of the Village of Edgewater, New York, Chapter 52A, Section 3.B(22)).
Wetlands Permit	Village Code Chapter 53A	Village of Edgewater	Yes	No	**Applicable to onsite phase of work** - Regulates activities that involve drainage, dredging, or excavation of soil/sediment from or discharge of pollution to any freshwater or tidal wetlands or land underwater within the boundaries of the Village.
Environmental Quality Review	Village Code Chapter 15 6NYCRR Part 617	Village of Edgewater NYS DEC	Yes	Yes	**Applicable but exempt** - Environmental Quality Review is not required for Type II actions as defined under SEQRA, which include actions required to be taken pursuant to a judgment or an administrative or judicial order.
Demolition Permit	Village Code Chapter 10	Village of Edgewater	Yes	No	**Applicable** - A demolition permit is required to show that the demolition will be covered by sufficient liability insurance to indemnify the Village of Edgewater from liability for any injuries which may be sustained during the demolition. **The demolition subcontractor will be responsible for obtaining this permit.**
Building Permit	Village Code Chapter 7	Village of Edgewater	Yes	No	**Applicable to the onsite phase of work** - A building permit is required before erecting any building structures, including a sprung structure tent.
Street excavation permit Sidewalk encumbrance permit Street encumbrance permit	Village Code Chapter 45	Village of Edgewater	Yes	No	**Applicable** - Permits are required to excavate in Village streets or sidewalks, and to obstruct streets and sidewalks. Separate permits may be needed for different stages of work depending on their location (such as during horizontal drilling for freeze-wall activities and excavation of Bridge Street).
Sewer Connection Permit		Local PTWF			
Toxic and Hazardous Materials Storage and Use	Village Code Chapter 18 Richmond County Articles 7 and 12	Village of Edgewater Richmond County Dept. of Health Services	Potentially	No	**Potentially applicable** - Village permits are issued by the fire marshal for use or storage of certain hazardous or dangerous materials. A permit may also be required from the County to construct and operate a hazardous materials storage facility. **This could apply to materials to be stored for in situ solidification or freeze-wall activities. The subcontractor will be responsible for obtaining this permit(s).**

Notes:

NYS - New York State
DEC - Department of Environmental Conservation
DOS - Department of State
OGS - Office of General Services
OPRHP - Office of Parks, Recreation and Historic Preservation
USEPA - United States Environmental Protection Agency
US Army Corps - United States Army Corps of Engineers
Village Code - Code of the Village of Edgewater, New York
SEQRA - State Environmental Quality Review Act
Coast Guard - United States Coast Guard

[1] - Remedial actions being conducted under an order are exempt from applying for certain permit from NYS DEC (Draft DER-10 Technical Guidance for Site Investigation and Remediation, December 2002, Subsection 7.3 and Appendix 7B)

Figures

UNITED STATES GEOLOGIC SURVEY
THE NARROWS QUADRANGLE
NEW YORK - NEW JERSEY
7.5 MINUTE SERIES (TOPOGRAPHY)

THE NARROWS, NY. - NJ.
1966
PHOTOREVISED 1981

SCALE 1:24000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

N

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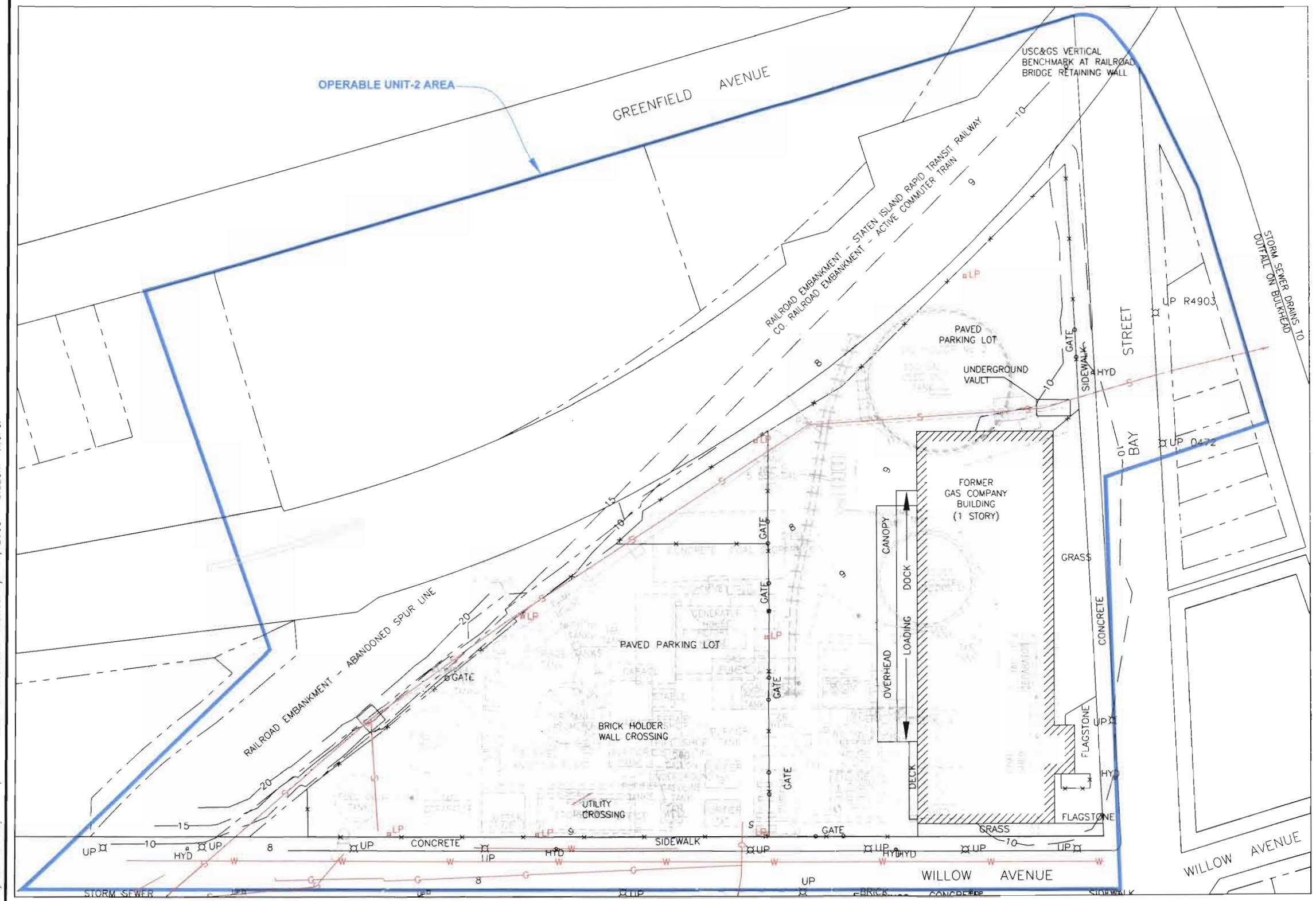
KEYSPAN CORPORATION CLIFTON FORMER MGP SITE CLIFTON, NEW YORK 01765-070				**SITE LOCATION MAP**
DATE: 4/08/08	DRWN: MAW/BIL			**FIGURE 1-1**

File: J:\01765070\SITE_LOC.dwg Layout: ANSI_A(1)-LJ User: mawilliamson Plotted: Apr 08, 2008 - 12:00pm Xref's:



LEGEND

- CHAIN LINK FENCE
- EXISTING BUILDING/STRUCTURE
- HISTORICAL STRUCTURE/FEATURE
- G — GAS LINE
- S — SEWER LINE
- W — WATER LINE
- FP FLAG POLE
- LP LIGHT POLE
- HYD FIRE HYDRANT
- CB CATCH BASIN
- UP UTILITY POLE
- MANHOLE

SOURCES:

1. "FOLLOW-UP SOIL AND GROUNDWATER INVESTIGATION AT THE BROOKLYN UNION GAS COMPANY CLIFTON STATION FACILITY, 40 WILLOW AVENUE, STATEN ISLAND, NY" BY FANNING, PHILLIPS & MOLNAR, AUGUST 29, 1994.
2. "MAP OF PROPERTY, EXIST. BLDG & YARD CONNECTIONS, NEW YORK AND RICHMOND GAS COMPANY - 1921" BY FANNING, PHILLIPS & MOLNAR ENGINEERS, RONKONKOMA, NEW YORK. SCALE 1"=30'. DATED 2/8/94 - REVISED TO 2/13/98.
3. "TOPOGRAPHY AND SAMPLE LOCATIONS, #49 - #67 LYNHURST AVENUE" BY GEI CONSULTANTS, INC., COLCHESTER, CONNECTICUT FOR KEYSPAN ENERGY. SCALE 1"=10'. DATED 7/8/02.
4. "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)", PREPARED BY GEI CONSULTANTS, INC. AND DATED SEPTEMBER 2002.

40 0 80

1"=80'

ENSR | AECOM

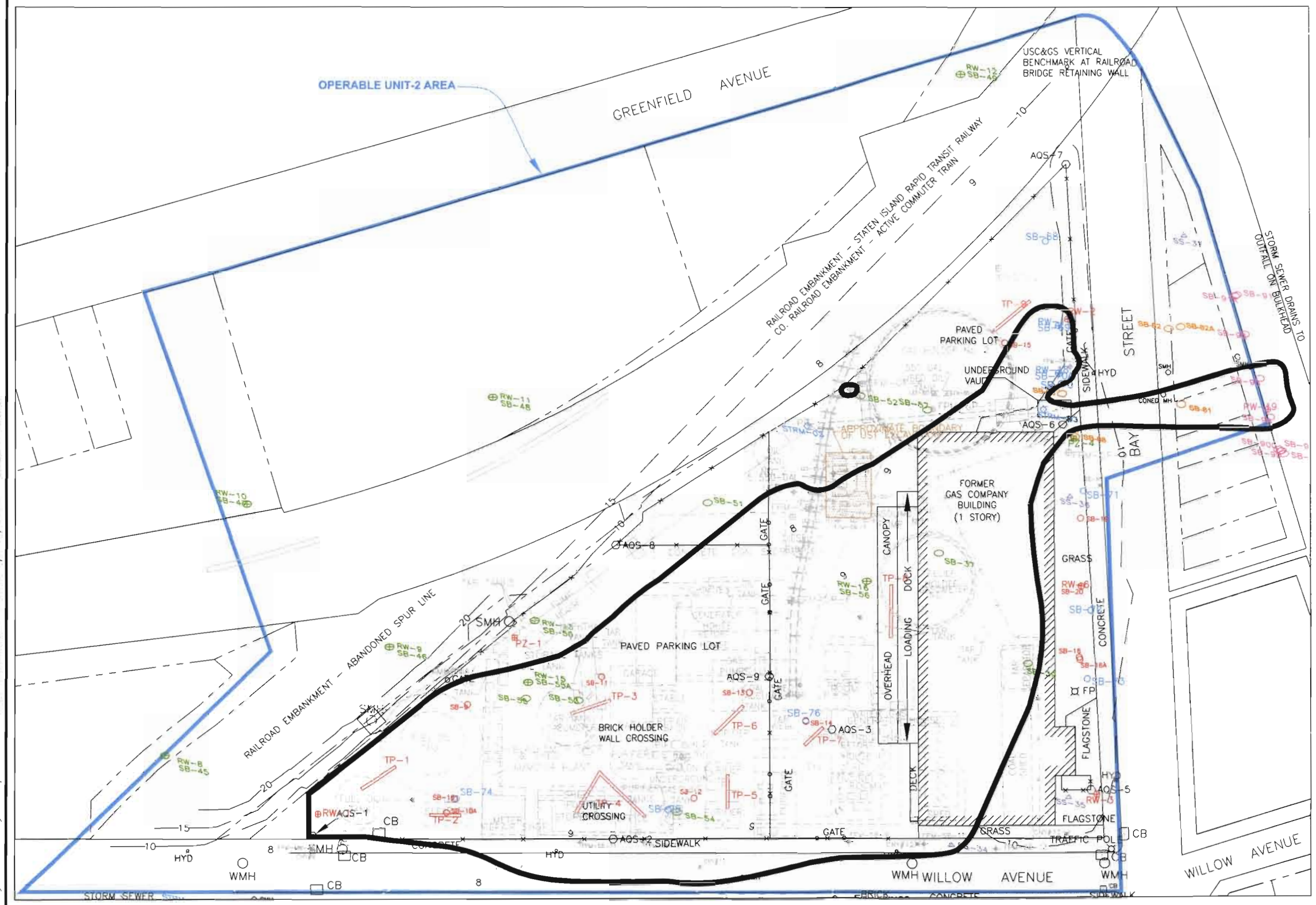
KEYSPAN CORPORATION
CLIFTON FORMER MGP SITE
CLIFTON, NEW YORK 01765-070

DATE: 4/14/08 | DRWN: MAW/BIL

SITE LAYOUT MAP

FIGURE 2-1

File: J:\01765070\REVISED_FIGS.dwg Layout: Site Layout Map 2-1 User: mawilliamson Plotted: Apr 14, 2008 - 8:02am Xref's:



LEGEND

- CHAIN LINK FENCE
- EXISTING BUILDING/STRUCTURE
- HISTORICAL STRUCTURE/FEATURE
- AQS-1 RI AIR QUALITY SAMPLE LOCATION
- SS-1 RI SOIL SAMPLE LOCATION
- RW-1 RI MONITORING WELL LOCATION
- TP-7 RI TEST PIT LOCATION
- SB-14 RI SOIL BORING LOCATION
- PZ-3 RI PIEZOMETER LOCATION
- STRM-03 RI STORM SEWER SAMPLE LOCATION
- GP-1 FEASIBILITY STUDY (FS) SUPPORT GEOPROBE LOCATION
- ROUND 1 SAMPLING OF REMEDIAL INVESTIGATION
- ROUND 2 SAMPLING OF REMEDIAL INVESTIGATION
- ROUND 3 SAMPLING OF REMEDIAL INVESTIGATION
- ROUND 4 SAMPLING OF REMEDIAL INVESTIGATION
- ROUND 5 SAMPLING OF REMEDIAL INVESTIGATION
- ROUND 6 SAMPLING OF REMEDIAL INVESTIGATION
- PREVIOUS LEXICON SIDEWALL SOIL SAMPLE LOCATION
- PREVIOUS LEXICON MONITORING WELL LOCATION
- PREVIOUS FANNING, PHILLIPS & MOLNAR MONITORING WELL LOCATION
- PREVIOUS FANNING, PHILLIPS & MOLNAR GEOPROBE/PIEZOMETER LOCATION
- PREVIOUS SOIL BORING LOCATION
- PREVIOUS FANNING, PHILLIPS & MOLNAR SOIL BORING LOCATION
- PREVIOUS CITY OF NEW YORK SOIL BORING LOCATION
- FP FLAG POLE
- LP LIGHT POLE
- HYD FIRE HYDRANT
- CB CATCH BASIN
- UP UTILITY POLE
- MANHOLE
- COMPLETED EXCAVATION BOUNDARY
- ESTIMATED LIMITS OF NAPL PLUME

SOURCES:

1. "FOLLOW-UP SOIL AND GROUNDWATER INVESTIGATION AT THE BROOKLYN UNION GAS COMPANY CLIFTON STATION FACILITY, 40 WILLOW AVENUE, STATEN ISLAND, NY" BY FANNING, PHILLIPS & MOLNAR, AUGUST 29, 1994.
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40 0 80

1"=80'

ENSR | AECOM

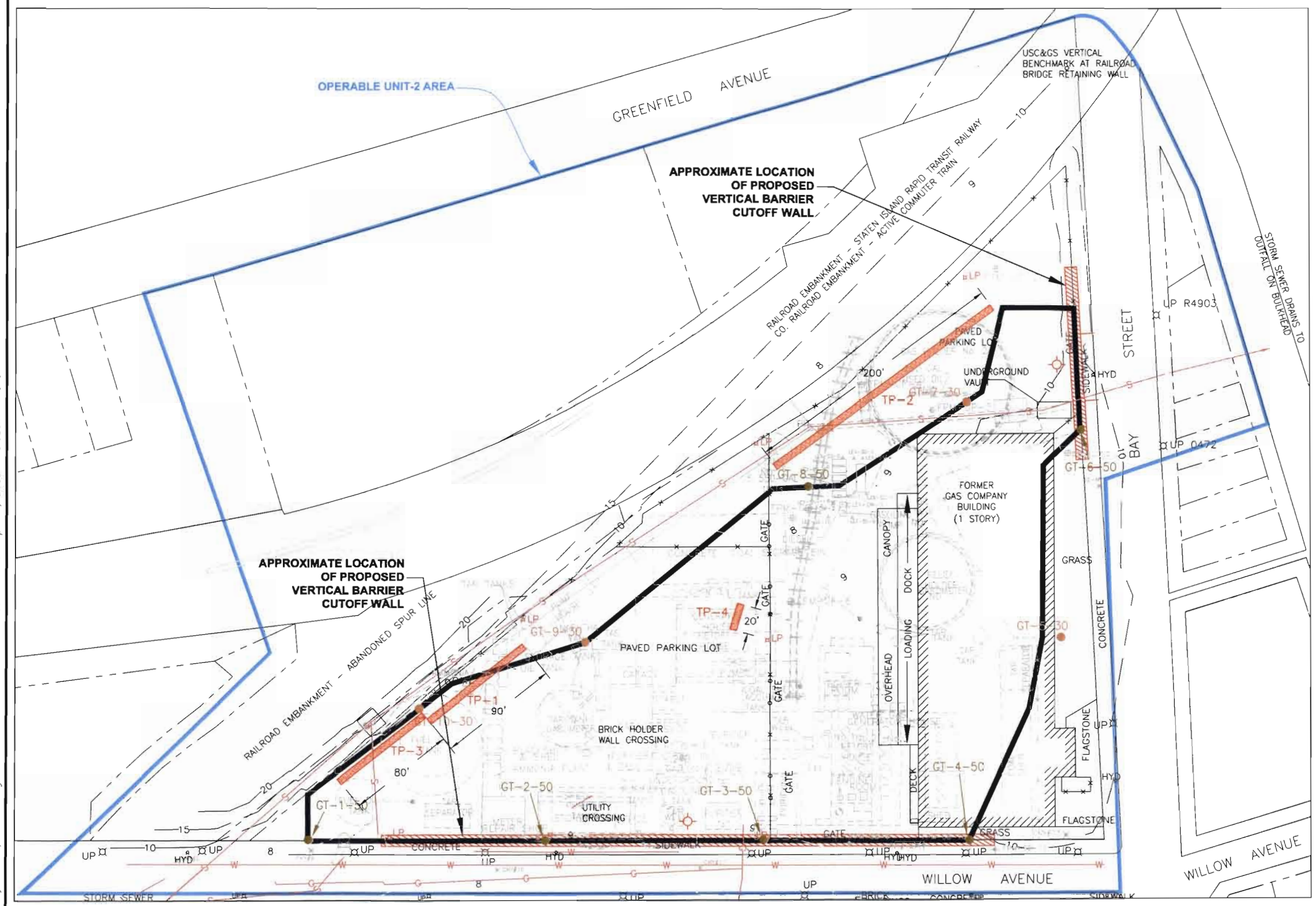
KEYSPAN CORPORATION
CLIFTON FORMER MGP SITE
CLIFTON, NEW YORK 01765-070

DATE: 4/14/08 | DRWN: MAW/BIL

ESTIMATED EXTENT OF NAPL

FIGURE 2-2

File: J:\01765070\REVISED_FIGS.dwg Layout: Summary of Impacts 2-2 User: mawilliamson Plotted: Apr 14, 2008 - 8:02am Xref's:



LEGEND

- CHAIN LINK FENCE
- EXISTING BUILDING/STRUCTURE
- HISTORICAL STRUCTURE/FEATURE
- GT-2-30 GEOTECHNICAL BORING @30' DEPTH
- GT-1-50 GEOTECHNICAL BORING @50' DEPTH
- G GAS LINE
- S SEWER LINE
- W WATER LINE
- FP FLAG POLE
- LP LIGHT POLE
- HYD FIRE HYDRANT
- CB CATCH BASIN
- UP UTILITY POLE
- MANHOLE
- ESTIMATED LIMITS OF EXCAVATION
- PROPOSED PILOT TEST RECOVERY WELL/ PUMP TEST WELL
- PROPOSED TEST PIT
- APPROXIMATE LOCATION OF PROPOSED VERTICAL BARRIER CUTOFF WALL

SOURCES:

1. "FOLLOW-UP SOIL AND GROUNDWATER INVESTIGATION AT THE BROOKLYN UNION GAS COMPANY CLIFTON STATION FACILITY, 40 WILLOW AVENUE, STATEN ISLAND, NY" BY FANNING, PHILLIPS & MOLNAR, AUGUST 29, 1994.
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40 0 80

1"=80'

ENSR | AECOM

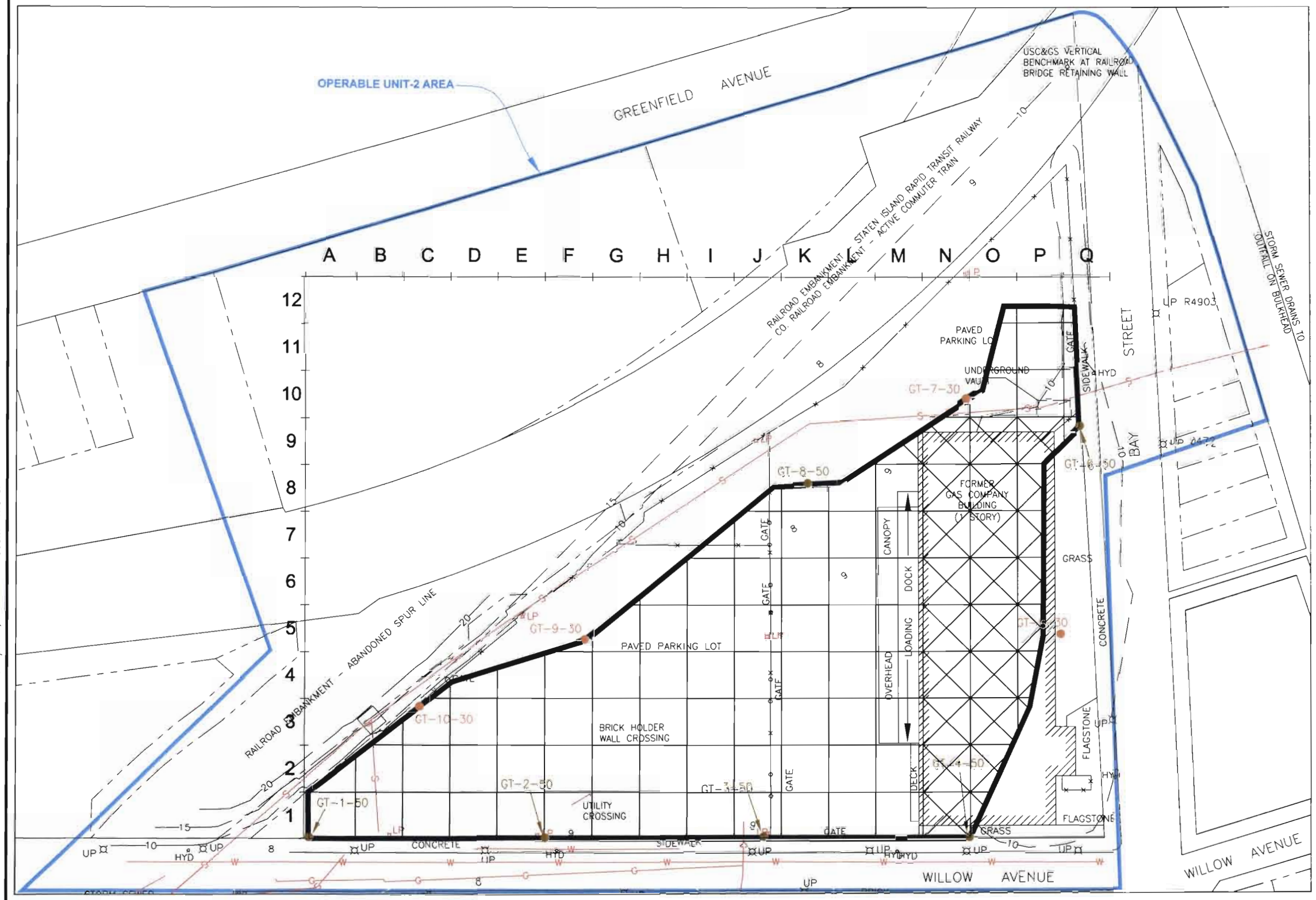
KEYSPAN CORPORATION
CLIFTON FORMER MGP SITE
CLIFTON, NEW YORK 01765-070

DATE: 4/14/08 | DRWN: MAW/BIL

PROPOSED PRE-DESIGN INVESTIGATION LOCATIONS

FIGURE 2-3

File: J:\01765070\REVISED_FIGS.dwg Layout: Proposed Boring Locations 2-3 User: mawilliamson Plotted: Apr 14, 2008 - 8:02am Xref's:



LEGEND

- CHAIN LINK FENCE
- EXISTING BUILDING/STRUCTURE
- GT-2-30 GEOTECHNICAL BORING @30' DEPTH
- GT-1-50 GEOTECHNICAL BORING @50' DEPTH
- G GAS LINE
- S SEWER LINE
- W WATER LINE
- FP FLAG POLE
- LP LIGHT POLE
- HYD FIRE HYDRANT
- CB CATCH BASIN
- UP UTILITY POLE
- MANHOLE
- ESTIMATED LIMITS OF EXCAVATION
- PRE-CHARACTERIZATION SAMPLING GRID 35'x35'
- TO BE SAMPLED FOLLOWING DEMOLITION

SOURCES:

1. "FOLLOW-UP SOIL AND GROUNDWATER INVESTIGATION AT THE BROOKLYN UNION GAS COMPANY CLIFTON STATION FACILITY, 40 WILLOW AVENUE, STATEN ISLAND, NY" BY FANNING, PHILLIPS & MOLNAR, AUGUST 29, 1994.
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40 0 80

1"=80'

ENSR | AECOM

KEYSPAN CORPORATION CLIFTON FORMER MGP SITE CLIFTON, NEW YORK 01765-070		**PDI GRID LAYOUT**
DATE: 4/08/08	DRWN: MAW/BIL	**FIGURE 2-4**

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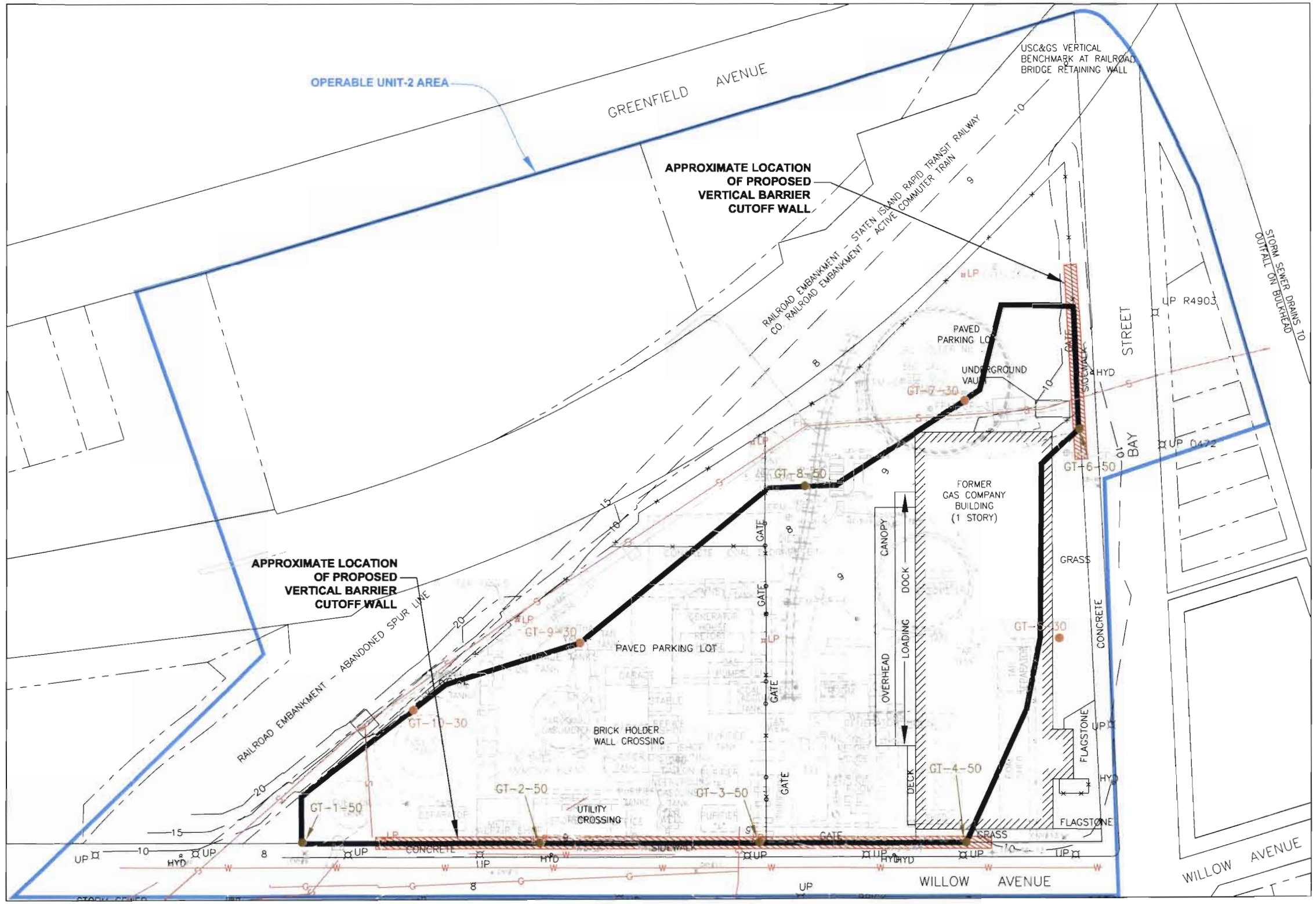

LEGEND

- CHAIN LINK FENCE
- EXISTING BUILDING/STRUCTURE
- HISTORICAL STRUCTURE/FEATURE
- GT-2-30 GEOTECHNICAL BORING @30' DEPTH
- GT-1-50 GEOTECHNICAL BORING @50' DEPTH
- PREVIOUS LEXICON SIDEWALL SOIL SAMPLE LOCATION
- PREVIOUS LEXICON MONITORING WELL LOCATION
- PREVIOUS FANNING, PHILLIPS & MOLNAR MONITORING WELL LOCATION
- PREVIOUS FANNING, PHILLIPS & MOLNAR GEOPROBE/PIEZOMETER LOCATION
- PREVIOUS SOIL BORING LOCATION
- PREVIOUS FANNING, PHILLIPS & MOLNAR SOIL BORING LOCATION
- PREVIOUS CITY OF NEW YORK SOIL BORING LOCATION
- G GAS LINE
- S SEWER LINE
- W WATER LINE
- FP FLAG POLE
- LP LIGHT POLE
- HYD FIRE HYDRANT
- CB CATCH BASIN
- UP UTILITY POLE
- MANHOLE
- ESTIMATED LIMITS OF EXCAVATION
- APPROXIMATE LOCATION OF VERTICAL BARRIER CUTOFF WALL

SOURCES:

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40 0 80

1"=80'

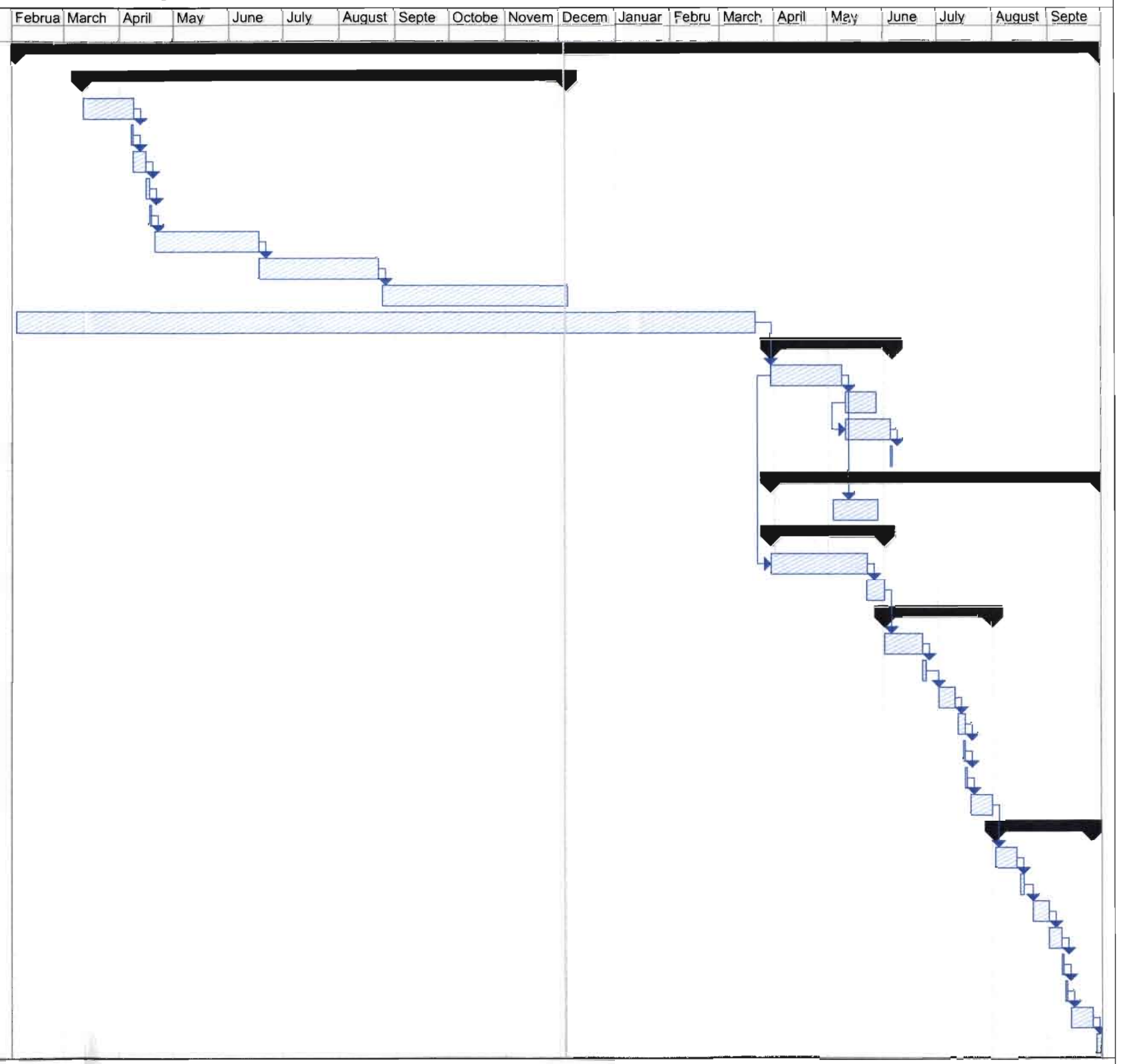
ENSR | AECOM

KEYSPAN CORPORATION CLIFTON FORMER MGP SITE CLIFTON, NEW YORK 01765-070		**LIMITS OF EXCAVATION**
DATE: 4/14/08	DRWN: MAW/BIL	**FIGURE 3-1**

File: J:\01765070\REVISED_FIGS.dwg Layout: Limits of Excavation J-1 User: mawilliamson Plotted: Apr 14, 2008 - 8:02am Xref's:

Figure 3-2 Draft 0% Remedy Design Schedule
Former MGP Site
Clifton, Richmond County, New York

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Remedial Design**	**429 days**	**Mon 2/4/08**	**Wed 9/30/09**	
2	**Remedial Design Workplan**	**191 days**	**Wed 3/12/08**	**Fri 12/5/08**	
3	Draft Remedial Design Workplan	20 days	Wed 3/12/08	Tue 4/8/08	
4	Submit Draft RDWP for National Grid Review	1 day	Tue 4/8/08	Tue 4/8/08	3FS-1 day
5	National Grid Review	5 days	Wed 4/9/08	Tue 4/15/08	4
6	Draft RDWP Revisons	2 days	Wed 4/16/08	Thu 4/17/08	5
7	Submit Draft RDWP for NYSDEC Review	1 day	Fri 4/18/08	Fri 4/18/08	6
8	NYSDEC Review	42 days	Mon 4/21/08	Tue 6/17/08	7
9	Response to NYSDEC Comments	48 days	Wed 6/18/08	Fri 8/22/08	8
10	Submit Final RDWP to NYSDEC	73 days	Mon 8/25/08	Fri 12/5/08	9
11	Operable Unit 1 Remediation (By Others)	290 days	Mon 2/4/08	Fri 3/20/09	
12	**Pre-Design Investigation**	**51 days**	**Mon 3/30/09**	**Fri 6/5/09**	
13	Pre-Design Investigation	30 days	Mon 3/30/09	Fri 5/8/09	11FS+5 days
14	Laboratory Geotechnical Analysis	14 days	Mon 5/11/09	Wed 5/27/09	13
15	Pre-Design Investigation Report	20 days	Mon 5/11/09	Thu 6/4/09	14SS
16	Submit PDI Report to NYSDEC	1 day	Fri 6/5/09	Fri 6/5/09	15
17	**Remedial Design Bid Documents**	**134 days**	**Mon 3/30/09**	**Wed 9/30/09**	
18	Basis of Design Memo	20 days	Mon 5/4/09	Thu 5/28/09	13FS-5 days
19	**30% Remedy Design**	**47 days**	**Mon 3/30/09**	**Mon 6/1/09**	
20	Draft 30% Remedial Design	40 days	Mon 3/30/09	Fri 5/22/09	13SS
21	National Grid Review Draft 30%	7 days	Sat 5/23/09	Mon 6/1/09	20
22	**60% Remedy Design**	**44 days**	**Tue 6/2/09**	**Fri 7/31/09**	
23	Draft 60% Remedial Design	15 days	Tue 6/2/09	Mon 6/22/09	21
24	Constructability Review Draft 60%	2 days	Tue 6/23/09	Wed 6/24/09	23
25	National Grid Review Draft 60%	7 days	Thu 7/2/09	Fri 7/10/09	24FS+5 days
26	Remedial Design 60%	4 days	Mon 7/13/09	Thu 7/16/09	25
27	Submit 60% Remedy Design to NYSDEC	1 day	Thu 7/16/09	Thu 7/16/09	26FS-1 day
28	60% Remedy Design Meeting with NYSDE	1 day	Fri 7/17/09	Fri 7/17/09	27
29	NYSDEC Review 60% RD	10 days	Mon 7/20/09	Fri 7/31/09	28
30	**90% Remedy Design**	**40 days**	**Mon 8/3/09**	**Fri 9/25/09**	
31	Draft 90% Remedial Design	10 days	Mon 8/3/09	Fri 8/14/09	29
32	Constructability Review Draft 90%	2 days	Mon 8/17/09	Tue 8/18/09	31
33	National Grid Review Draft 90%	7 days	Mon 8/24/09	Tue 9/1/09	32FS+3 days
34	Remedy Design 90%	5 days	Wed 9/2/09	Tue 9/8/09	33
35	Submit 90% Remedy Design to NYSDEC	1 day	Wed 9/9/09	Wed 9/9/09	34
36	90% Remedy Design Meeting with NYSDE	1 day	Fri 9/11/09	Fri 9/11/09	35FS+1 day
37	NYSDEC Review 90% RD	10 days	Mon 9/14/09	Fri 9/25/09	36
38	Final Remedial Design Bid Package	3 days	Mon 9/28/09	Wed 9/30/09	37



Task — Progress — Summary — External Tasks — Deadline

Split — Milestone — Project Summary — External Milestone

Appendix A

NYSDEC Record of Decision (ROD)

Alternative #5 12-15-06

Department of Environmental Conservation

Division of Environmental Remediation

Record of Decision

Former Clifton MGP Site
Operable Unit No. 2
Richmond County, New York
Site No. 2-43-023

December 2006

New York State Department of Environmental Conservation
GEORGE E. PATAKI, *Governor* DENISE M. SHEEHAN, *Commissioner*

DECLARATION STATEMENT - RECORD OF DECISION

Former Clifton MGP Inactive Waste Disposal Site
Operable Unit No. 2 - 25 Willow Avenue Parcel
Richmond County, New York
Site No. 2-43-023

Statement of Purpose and Basis

The Record of Decision (ROD) presents the selected remedy for Operable Unit 2 of the Former Clifton MGP site, an inactive hazardous waste disposal site. The selected remedial program was chosen in accordance with the New York State Environmental Conservation Law and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (NYSDEC) for Operable Unit 2 of the Former Clifton MGP inactive hazardous waste disposal site, and the public's input to the Proposed Remedial Action Plan (PRAP) presented by the NYSDEC. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Assessment of the Site

Actual or threatened releases of hazardous waste constituents from this site, if not addressed by implementing the response action selected in this ROD, presents a current or potential significant threat to public health and/or the environment.

Description of Selected Remedy

Based on the results of the Remedial Investigation and Feasibility Study (RI/FS) for the Former Clifton MGP site and the criteria identified for evaluation of alternatives, the NYSDEC has selected demolition of existing building, removal of former structures, excavation of contaminated soil, installation of vertical barrier walls and tar recovery wells. The components of the remedy are as follows:

- Demolition of the existing building on the site to allow for the excavation of the contamination located beneath the building.
- Removal of former MGP-related structures including their foundations which contain coal tar.

- Excavation of approximately 38,300 cubic yards of grossly contaminated soils, down to an approximate depth of ten (10) feet below ground surface (bgs).

- Backfill of the excavated areas with clean fill from an off-site location. Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas. The top two (2) feet will consist of clean soil capable of supporting vegetation.

- Installation of vertical cutoff walls in the subsurface to prevent off-site migration of DNAPL (coal tar) from the site.

- Installation of recovery wells to allow for collection, treatment and disposal of dense non-aqueous phase liquids (DNAPL) that remain at depth in the subsurface after the excavation work is complete.

- A site management plan and environmental easement.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy selected for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

_____ _____

Date

Dale A. Desnoyers, Director
Division of Environmental Remediation

TABLE OF CONTENTS

RECORD OF DECISION

Former Clifton MGP Inactive Waste Disposal Site
Operable Unit No. 2 - 25 Willow Avenue Parcel
Richmond County, New York
Site No. 2-43-023
March 2006

SECTION 1: SUMMARY OF THE RECORD OF DECISION

The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), has selected this remedy for Operable Unit No. 2 of the Former Clifton MGP Site.

The site is currently separated into two parcels of land, 40 Willow Avenue and 25 Willow Avenue which are identified as Operable Units (OU)1 and 2, respectively, as shown on Figure 1. The property at 40 Willow Avenue is known as Operable Unit 1, where a remedy was selected in March, 2004. This document deals with the property at 25 Willow Avenue, which is identified as Operable Unit 2.

The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, the operation of a manufactured gas plant (MGP) at the Former Clifton MGP Site has resulted in the disposal of hazardous wastes, including coal tar containing benzene, toluene, ethylbenzene, xylene and polycyclic aromatic hydrocarbons. These wastes have contaminated the soils and groundwater at the site, and have resulted in:

- a significant threat to human health associated with potential exposure to contaminated soil and groundwater.
- a significant environmental threat associated with the impacts of MGP contaminants to groundwater.

To eliminate or mitigate these threats, the NYSDEC has selected the following remedy:

- Demolition of the existing building to allow for the excavation of the impacted materials located beneath the building.

- Installation of vertical cutoff walls in the subsurface to prevent off-site migration of NAPL from the site.
- Excavation, offsite treatment and disposal of approximately 38,300 cubic yards of contaminated soils, down to an approximate depth of ten (10) feet below ground surface (bgs).

- Removal of former MGP-related structures including foundations determined to contain coal tar to the extent practicable.

- Backfill of the excavated areas with clean soil materials from an off-site location. Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas. The top two (2) feet will consist of clean top soil.

- Installation of recovery wells to allow for collection, treatment and disposal of dense non-aqueous phase liquids (DNAPL) that may remain at depth in the subsurface after the excavation work is complete.

- A site management plan and environmental easement.

The selected remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Former Clifton MGP site occupies two parcels at the intersection of Bay Street and Willow Avenue in the Clifton section of Staten Island, Richmond County, New York (see Figures 1 and 2).

Operable Unit (OU) No. 2, which is the subject of this document, consists of the 25 Willow Avenue parcel of the Former Clifton MGP Site. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. The remaining operable unit, (OU-1) for this site is the 40 Willow Avenue parcel of the Former Clifton MGP Site. A Record of Decision was completed for this unit in March of 2004.

The OU-2 parcel is a 3.5-acre parcel bounded to the northeast by Bay Street; to the south by Willow Avenue, and to the northwest by a wooded embankment and an associated active railroad right-of-way (ROW). The OU-2 parcel is currently owned by Keyspan Corporation and is zoned for manufacturing. The surrounding area is characterized by a combination of urban residential, industrial and commercial uses.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The Former Clifton MGP was operated by the Richmond County Gas Light Co. from 1856 to 1901. The plant was then operated by the New York and Richmond Gas Company from 1901 until 1957. Brooklyn Union (now KeySpan) acquired the latter company in 1957, at which point MGP operations ceased.

Manufactured gas plants produced combustible gas by heating coal and petroleum products. The gas was cooled, purified, and then piped to homes and businesses in the surrounding area, where it was used for heating and cooking in much the same way that natural gas is used today. In addition, prior to the widespread availability and use of electricity, the manufactured gas was also used for lighting.

The 25 Willow Avenue parcel was the location of the main operational facility of the former MGP. The MGP consisted of a brick retort and water gas house where gas was manufactured, a purifying house, and other structures including a 75-foot-diameter relief holder. Tar and fuel oil storage tanks were also located on the site.

Over the years, by-products, such as coal tar generated from the MGP operations, have leaked or been released from the former relief holder and other structures resulting in the contamination of soil and groundwater.

3.2: Remedial History

Remedial activities at the site are being performed in accordance with a 1998 Administrative Order on Consent (Index No. D2-0001-98-04) (AOC).

In 1993, Brooklyn Union removed seven underground storage tanks from the 25 Willow Avenue parcel. These tanks had formerly contained gasoline, diesel fuel or waste oil.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers. KeySpan Corporation, the present owner of the parcel has been identified as the PRP for this site.

The NYSDEC and KeySpan entered into a Consent Order on April 14, 1998. The Order obligates Keyspan to implement a full remedial program.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) was conducted to determine the nature and extent of contamination and to evaluate the alternatives for addressing threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The RI was conducted in several rounds of field work between February 1999 and December 2004. The field activities and findings of the investigation are described in the RI report. The following activities were conducted during the RI:

- Research of historical information

- Installation of over 100 borings and nine test pits to identify the location of former MGP structures, characterize the contamination surrounding these structures, and to define the extent to which this contamination has spread.

- Collection of 12 soil gas samples to evaluate the potential for contaminated soil vapors to enter the building at 25 Willow Avenue. This building is currently vacant and will be demolished as part of the proposed remedy.

- Collection of 67 discrete groundwater samples from 18 new and existing monitoring wells, collection of 114 subsurface soil samples and 10 surface soil samples; and

- A survey of public and private water supply wells in the area around the site;

To determine whether the soil and groundwater contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on the NYSDEC "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.

- Soil SCGs are based on the NYSDEC "Technical and Administrative Guidance Memorandum (TAGM) 4046; Determination of Soil Cleanup Objectives and Cleanup Levels".

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized below. More complete information can be found in the RI report.

5.1.1: Site Geology and Hydrogeology

The remedial investigation identified four distinct stratigraphic units. These units are, in order of increasing depth:

1) Imported fill material made up of silt, sand and gravel mixed with slag, coal, brick, concrete, metal, ash, and clinkers. This unit ranges in thickness from a few inches to approximately nine feet;

2) Alluvial/marsh deposits beneath the layer of fill. This unit ranges up to 20 feet thick;

3) Glacial deposits beneath the alluvial deposits; and

4) A weathered bedrock layer known as saprolite. The top of the saprolite was encountered at depths of 114 to 123 feet.

Two aquifers are present beneath the site: a shallow, unconfined water table aquifer and a deep semi-confined aquifer. The water table elevations for the shallow unconfined aquifer range from about 4 feet to approximately 9 feet bgs. Groundwater flow in the shallow aquifer is controlled by the presence of a filled, former stream channel and a storm sewer that traverse the site.

The deep aquifer is located within the glacial deposits above the saprolite. The water in the deeper aquifer is under confining (artesian) pressure. Groundwater in this aquifer generally flows to the northeast and discharges to New York Harbor, located approximately 600 feet from the site.

5.1.2: Nature of Contamination

The principal waste product produced at MGPs was coal tar, which is an oily, dark colored liquid with a strong, objectionable odor. Coal tar is also referred to as a dense non-aqueous phase liquid or DNAPL since it is heavier than water and will sink through the groundwater until it reaches some material which it cannot penetrate. Unlike most materials labeled as "tar", this is not a viscous material. Rather, it has a physical consistency similar to motor oil, which enables it to move through the subsurface. The tar contains high levels of volatile and semi-volatile organic compounds (VOCs and SVOCs).

The principal coal tar VOCs are benzene, toluene, ethylbenzene, and xylenes. These compounds, collectively known as BTEX, are slightly soluble in water. Groundwater which comes into contact with tar or tar-contaminated soils will become contaminated with BTEX compounds. This contaminated groundwater can then move through the subsurface along with the ordinary groundwater flow.

The principal coal tar SVOCs are a group of compounds known as polycyclic aromatic hydrocarbons, commonly abbreviated as PAHs. PAH compounds are generally less soluble than BTEX, and are consequently less likely to dissolve in groundwater. This makes PAH compounds less mobile in the subsurface, so the highest levels of PAHs are normally found in close proximity to the tar from which they are derived.

Specific PAHs of concern in coal tar are the following:

acenaphthene
acenaphthylene
anthracene
benzo(a)anthracene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(g,h,i)perylene
benzo(k)fluoranthene
dibenzo(a,h)anthracene
chrysene
fluoranthene
fluorene
indeno(1,2,3-cd) pyrene
2-methylnaphthalene
naphthalene
phenanthrene
pyrene

In this document, PAH concentrations are referred to as either total PAHs (TPAHs) or carcinogenic PAHs (cPAHs). The TPAH concentration is the sum of the concentrations of each (italicized and non-italicized) PAH listed above. The cPAH concentration is the sum of the concentrations of each italicized PAH listed above.

The contaminated materials were found primarily in the immediate area surrounding historic structures that handled tar. Some of the tar has moved away from these source areas through individual soil layers. Discrete intervals of tar impacted materials were observed at depth beneath Willow Avenue and Bay Street/Edgewater Street as depicted in Figures 8 and 9.

5.1.3: Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

Chemical concentrations are reported in parts per billion (ppb) for water, and parts per million (ppm) for soil. For comparison purposes, where applicable, SCGs are provided for each medium.

Table 1 summarizes the degree of contamination for the contaminants of concern in soil and groundwater and compares the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Surface Soil

Surface soil is defined as the soil located from zero to two inches in depth. Very little surface soil is exposed in the OU2 area, since most of the site is paved or covered by a building. However, one small grassy area does exist, and surface soil samples were collected from this area. For comparison purposes, soil samples were also collected in the surrounding neighborhood to determine background surficial soil concentrations in areas not impacted by the MGP site

On site surface soils show TPAH concentrations ranging from 11 ppm to 92 ppm and cPAH concentrations from 5.9 to 54 ppm. BTEX concentrations range from non-detect to 0.8 ppm. Cyanide was not detected in any of the surface soil samples.

Contaminant concentrations were generally lower in the background areas. On site soils contained trace levels of BTEX and concentrations of TPAH ranging from 5.3 to 56 ppm. cPAH levels ranged from 3.1 to 30 ppm.

Isolated blobs of thick, weathered tar were found seeping through cracks in the parking lot pavement on the 25 Willow Avenue parcel. Although this tar was almost solidified on the surface of the pavement, the seeps provided a complete route of exposure to site contaminants. Keyspan covered the tar seeps with heavy steel plates in 2004 as an interim measure to prevent exposure.

Subsurface Soil

High levels of subsurface soil contamination are generally found in the immediate vicinity of former MGP structures that handled tar (see Figure 2). Tar-saturated soils are present within the walls of former Relief Holder No.1, and in the soils outside this structure, down to a depth of approximately 44 feet bgs. Soils within and around other former MGP structures including the tar separator, tar tanks, and tar wells were also found to be grossly contaminated by MGP tar. Isolated deposits of tar and tar stained soils were noted at off-site locations beneath the Edgewater Street right of way to a depth of approximately 24 feet bgs and beneath Willow Avenue to a depth of 25 feet bgs.

TPAH concentrations in subsurface soils range from non detect to a maximum of 96,090 ppm. BTEX concentrations range from non-detect to 6,100 ppm.

Based on the results of the remedial investigation, it does not appear that tar is currently moving into uncontaminated areas, either on site or off site. However, if the site is left in its current state, some fraction of the tar could move in the future in response to changes in land use such as construction activity or groundwater pumping.

Groundwater

Groundwater contamination was detected primarily in areas near grossly impacted soils and former tar handling structures. BTEX and TPAH levels in groundwater decrease rapidly with distance away from the former tar handling structures.

Shallow groundwater at the southwestern corner of the 25 Willow Avenue Parcel contains traces of BTEX and low levels of PAHs (4.6 ppb). BTEX with a concentration of 111 ppb and TPAH at 219 ppb was noted along the route of the former stream/storm sewer. No measurable amount of NAPL was observed in any of the shallow monitoring wells at the OU-2 parcel.

Measurable tar was observed in only one well (RW-18) on the OU-2 parcel. However, the groundwater sample from this well contained only 0.7 ppb BTEX and no detectable PAH. PAHs and total cyanide were not detected in either of the deep groundwater samples collected during the RI. Deep groundwater at the OU-2 parcel does not appear to be significantly contaminated by MGP by-products.

Off-site migration of groundwater contamination at this site is not considered significant. However, source materials in site soils impacting the site groundwater will be addressed during the remedial phase of the project to allow and enhance natural attenuation of the site groundwater over time.

Soil Vapor

Twelve (12) soil vapor samples were collected beneath the concrete floor slab of the existing building. The samples primarily contained concentrations of chlorinated VOC compounds including 1,1,1-trichloroethane ranging from non-detect to 25,000 micrograms per cubic meter

(mcg/m^3). Other compounds detected were 1,1-dichloroethane, 1,1-dichloroethene and tetrachloroethene at maximum concentrations of 5,400 mcg/m^3, 2,800 mcg/m^3 and 960 mcg/m^3 respectively. These compounds are typically not associated with the operation of the MGP and are likely associated with post-MGP operations. .

The building is currently unoccupied and will be demolished to allow implementation of the selected remedy. Consequently, no further investigation of soil vapor intrusion in this building is warranted.

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

KeySpan conducted an Interim Remedial Measure (IRM) as a temporary measure in May of 2004 to eliminate potential exposures to tar which was found seeping through cracks in the pavement. As described in Section 5.1.3, the IRM included placement of steel plates over the tar seep in accordance with an NYSDEC-approved work plan.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 7 of the RI report.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

There are no known completed exposure pathways at the site. However, potential exposure pathways are:

- Dermal contact with contaminated surface soil, subsurface soil or groundwater
- Incidental ingestion of contaminated soils or groundwater

- Inhalation of contaminated soil vapors

Surface and subsurface soils contain elevated levels of site-related contaminants. Most of the site is paved and enclosed by a locked chain-link fence, thus restricting access to contaminated surface and subsurface soils. Exposure to surface soil is not expected in the grass strip along Bay Street because of limited area of exposed surface soils. If contaminated soil is brought to the surface through excavation or other site activities, exposures could occur via inhalation of fugitive particulates, dermal contact or incidental ingestion.

No one is currently using the site groundwater for drinking or other uses and municipal water serves the area. Municipal water is obtained from reservoirs in upstate New York. Although unlikely, a well could be installed in the future. Depth to groundwater is four to nine feet, therefore incidental ingestion of and dermal contact with contaminated groundwater is possible during construction activities.

Soil vapor is contaminated with benzene, toluene, xylene and chlorinated VOCs. The on-site building is currently vacant and the selected remedy calls for its removal. Any future development will include an evaluation of soil vapor and the potential for exposures associated with soil vapor intrusion. If necessary, remedial or mitigation measures will be taken to minimize potential exposures.

5.4: Summary of Environmental Impacts

This section summarizes the existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The Fish and Wildlife Impact Analysis, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors. The following environmental exposure pathways and ecological risks have been identified:

Analytical results from groundwater samples indicate that groundwater beneath the OU-2 portion of the site is impacted by contaminants resulting from the operation of the MGP. Although this groundwater impact has resulted in significant damage to the groundwater resource at the site, there is no evidence of impact to surface waters. New York Harbor is the nearest surface water body, approximately 600 feet northeast of the site, and the groundwater plume appears to attenuate before reaching it.

Contaminants present at OU-2 of the Clifton site do not pose a current or future risk to wildlife The site and the immediate surrounding areas are occupied by commercial facilities, buildings and paved parking lots and therefore provide minimal habitat to wildlife. Because of the urban nature of these surrounding areas, a wildlife population is not expected. Due to the transient nature of the use of the site by birds and other small animals, the frequency and duration of exposure is limited.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- direct contact with contaminated surface and subsurface soil at concentrations exceeding SCGs;
- ingestion of contaminated surface and subsurface soil at concentrations exceeding SCGs;
- migration of NAPL in the subsurface soil; and
- the source of contamination to the groundwater with a goal of reduction in the groundwater contamination over time.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the former Clifton MGP Site (OU-2) were identified, screened and evaluated in the FS report which is available at the document repositories identified in Section 1.

A summary of the remedial alternatives that were considered for this site are discussed below. The present worth represents the amount of money invested in the current year that will be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. The cost to implement all alternatives has been estimated using a discount rate of 5%, assuming a 30-year period of monitoring. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring will cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated soil and groundwater at the site. All alternatives with the exception of Alternative 1 (which calls for no action) share some common components, which are referred to as common elements. The common elements are: 1) institutional controls; 2) building demolition and; 3) NAPL recovery. The common elements are presented in details with each alternative as appropriate.

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. This alternative will leave the site in its present condition and will not provide any additional protection to human health or the environment. Although this alternative does not require active remedial action, it will require cost for annual monitoring, operation and periodic site reviews. The periodic site review will be performed to assess any changes in the risk to human health and the environment posed by the site.

The cost to implement Alternative 1, based on an annual operation and maintenance (O&M), for a period of 30 years has been estimated as follows:

Present Worth: $389,000
Capital Cost: $0
Annual OM&M: $25,000

Alternative 2: Engineered Environmental Capping and Common Elements

Alternative 2 includes actions that will preclude direct contact with impacted materials underneath the site (See Figure 3). No removal of contaminated soils will be performed. The components of Alternative 2 will include the following:

- Demolition of the existing building to allow cap construction.
- Placement of an engineered cap to prevent contact with contaminated materials in the subsurface. The actual cap type and thickness will be determined during the remedial design phase of the project.
- Installation of recovery wells for passive collection of any NAPL that readily flows into recovery wells for removal and off-site disposal.
- Institutional controls to mitigate the threat of exposure to remaining contamination. These controls will include restrictions on future use of the land, maintenance of site access restrictions (e.g. fencing with lockable gates), a health and safety plan, public education and awareness programs, long-term monitoring, and periodic site reviews.

The cost to implement Alternative 2, based on an annual operation and maintenance (O&M), for a period of 30 years has been estimated as follows:

Present Worth: $10,329,000
Capital Cost: $5,285,000
Annual OM&M: $328,000

Alternative 3: Vertical Barrier Cutoff Walls and Common Elements

Alternative 3 includes actions which will use surface and subsurface containment to encapsulate source materials at OU-2 (see Figure 4). The components of this alternative will include the following:

- Installation of a subsurface containment system consisting of two vertical barrier cutoff walls keyed into the underlying confining layer located approximately 44 feet bgs. The type of walls to be utilized will be evaluated during the design phase of the project. The barrier walls will isolate MGP-byproducts and prevent horizontal off-site migration of site contamination.

- Demolition of the existing building to allow cap construction.

- Excavation of up to one foot of soil to allow for the installation of a soil cover or asphalt cap over approximately 3.5 acres of land to prevent exposure to contaminated soil and inhibit infiltration of precipitation into the subsurface.

- Installation of recovery wells for passive collection of any NAPL that readily flows into recovery wells for removal and off-site disposal.

- Institutional controls to mitigate the threat of exposure to remaining contamination. These will include restrictions on future use of the land, maintenance of site access restrictions (e.g. fencing with lockable gates), a health and safety plan, public education and awareness programs, long-term monitoring, and periodic site reviews.

The cost to implement Alternative 3, based on an annual operation and maintenance (O&M), for a period of 30 years has been estimated as follows:

Present Worth: $15,404,000
Capital Cost: $7,996,000
Annual OM&M: $482,000

Alternative 4: Excavation of soils up to 10 ft below ground surface, Removal of MGP-related Structures, and Common Elements.

This alternative will include actions for removal of source materials in subsurface soil and former MGP-related structures (see Figure 5). The components of Alternative 4 will include the following:

- Demolition of the existing building to allow removal of the impacted materials located beneath.

- Excavation, treatment and disposal of approximately 38,300 cubic yards of contaminated soil, to a depth of approximately 10 feet bgs. Some portions of the areas depicted for removal may not be sufficiently contaminated to warrant removal. The actual depth of soil removal will be based on observed field conditions with the concurrence of the NYSDEC on-site representative. The excavated area will be backfilled with clean soil imported from an off-site source. The clean soil cover will eliminate the need for the site to remain fenced.

Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas.

- Removal of former MGP-related structural foundations determined to contain MGP-byproducts to the extent practical.

- Installation of recovery wells for passive collection of any NAPL that readily flows into recovery wells for removal and off-site disposal.

- Institutional controls to mitigate the threat of exposure to remaining contamination. The components of these controls will include deed restrictions on future use of the land, maintenance of site access restrictions , a health and safety plan, public education and awareness programs, long-term monitoring and periodic site reviews.

The cost to implement Alternative 4, based on an annual operation and maintenance (O&M), for a period of 30 years has been estimated as follows:

Present Worth: $25,997,000
Capital Cost: $21,426,000
Annual OM&M: $298,000

Alternative 5: Excavation of soils up to 10 ft below ground surface, Removal of Former MGP-related Structures, Vertical Barrier Cutoff Walls and Common Elements.

This alternative will combine components of Alternative 3 and 4 with the exception of lockable gates and fencing. The excavation and associated backfill will allow a clean environment for the installation of subsurface features associated with any future development. The barrier walls will contain any remaining NAPL not removed by excavation and will prevent migration into off-site areas (see Figure 6). The components of this alternative are as follows:

- Demolition of the existing building to allow access to the impacted materials located beneath the building.

- Removal of former MGP-related structures determined to contain coal tar with the potential for future mobility, to the extent practicable.

- Excavation, off-site treatment and disposal of approximately 38,300 cubic yards of contaminated soils. The soils will be removed to a depth of approximately 10 feet bgs as depicted in Figure 6. Soil removal beyond 10 feet bgs may be necessary based on field observations. The actual depth of soil removal will be based on observed field conditions with the concurrence of the NYSDEC on-site representative. Materials warranting removal will be soil containing visible coal tar or separate phase materials. Some portions of the areas depicted for removal may not be sufficiently contaminated to warrant removal. A visible demarcation barrier will be installed at the bottom of the excavation for future determination of the extent of soil removal. The clean soil cover will eliminate the need for the site to remain fenced.

- Excavated areas will be backfilled with clean soil from off-site location. Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas. The top two (2) feet of the entire on-site parcel will be filled with clean top soil.

- Installation of subsurface containment consisting of two vertical barrier walls keyed into the underlying confining layer located approximately 44 feet bgs. The type of wall to be utilized will be evaluated during the design phase of the project. The barrier wall will isolate the remaining coal tar and prevent its off-site migration.

- Installation of recovery wells for passive collection of any NAPL that will readily flow into recovery wells, for removal and off-site disposal.

- Institutional controls to mitigate the threat of exposure to remaining contamination. The components will include restrictions on future use of the land, maintenance of site access restrictions, a health and safety plan, public education and awareness programs, long-term monitoring and periodic site reviews. Any future development will include an evaluation of soil vapor and the potential for exposures associated with soil vapor intrusion.

The cost to implement Alternative 5, based on an annual operation and maintenance (O&M), for a period of 30 years has been estimated as follows:

Present Worth: $31,471,000
Capital Cost: $26,427,000
Annual OM&M: $328,000

Alternative 6: Excavation of Source Materials to full depth, Removal of Former MGP-related Structures and Common Elements

This alternative will attempt to remove all contaminated materials from the Site through excavation to a depth of approximately 44 feet bgs (see Figure 7). The material to be removed will include former MGP-related structures and foundations. Collection of NAPL and secure fencing of the site will not be necessary under this alternative, since all source materials will be removed. The main components of this alternative are:

- Excavation, removal, treatment and disposal of approximately 179,000 cubic yards of soils. Soils will be removed to a depth corresponding with the vertical confining unit located at approximately 44 feet bgs.

- Backfilling the excavated areas with clean soil imported from off-site sources. The site will be restored to a pre-disturbance grade. Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas.

The cost to implement Alternative 6, based on an annual operation and maintenance (O&M), for a period of 30 years has been estimated as follows:

Present Worth: $70,635,000
Capital Cost: $69,753,000
Annual OM&M: $57,000

The Annual OM&M cost for this alternative will be cost associated with groundwater sampling and analysis, etc. to monitor the effectiveness of the alternative.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York State. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the NYSDEC has determined to be applicable on a case-specific basis.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability

of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectiveness. Capital costs and operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 2 at the end of the PRAP.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP have been evaluated. The responsiveness summary (Appendix A) presents the public comments received and the manner in which the NYSDEC addressed the concerns raised.

A number of persons expressed concern about the potential health effects that may be associated with the excavation and removal of the contaminated materials at the site. This concern will be addressed by implementing a stringent health and safety plan as well as the New York State Department of Health Community Air Monitoring Plan during the construction of the selected remedy. No other significant public comments were received.

SECTION 8: SUMMARY OF THE SELECTED REMEDY

Based on the Administrative Record (Appendix B) and the discussion presented below, the NYSDEC has selected Alternative 5 which calls for the excavation of soils up to 10 feet bgs, removal of former MGP-related structures and vertical barrier cutoff walls, and other measures, as the remedy for this site. The elements of this remedy are described at the end of this section.

The selected remedy is based on the results of the RI and the evaluation of alternatives presented in the FS. The selected remedy, when fully implemented, will eliminate or mitigate all threats to public health and the environment presented by the contaminated materials present at the OU-2 portion of the site. The selected remedy will achieve the remedial action objectives (RAOs) and comply with environmental laws, regulations and other standards and criteria.

Alternative 1 does not include active remedial actions and thus will not provide protection to human health and the environment over what currently exists. In addition, this alternative will not comply with SCGs, since source material and MGP-related structures will remain in place and continue to pose a threat to both human health and the environment. This alternative was therefore, eliminated from further evaluation.

Alternatives 2,3,4,5 and 6 will all provide some level of protection to public health and the environment and were retained for consideration. Balancing criteria were used to choose between them.

Alternative 2, which calls for capping of the site, will prevent human exposure through direct contact or ingestion of the impacted materials. However, this alternative will not provide any removal or treatment with the exception of some minor excavation associated with the capping. Grossly contaminated material will remain in place, beneath the cap, under this alternative. This alternative will not prevent further migration of site contamination to off-site locations. Though this alternative will include passive NAPL recovery, the majority of site contamination will be left in place, resulting in further contamination of soil and groundwater.

Alternative 3 will build on Alternative 2 by including a subsurface vertical barrier wall keyed into a confining layer located at a depth of approximately 44 feet bgs. While this alternative will provide a higher level of protection of human health and the environment compared to Alternative 2, the former MGP-related structures containing MGP by-product will not be removed and will continue to act as sources of contamination to soil and groundwater. Alternative 3 is less desirable when compared to the selected alternative.

Alternative 4 will remove the contamination most likely to be contacted by humans during construction work, through excavation of up to 10ft of contaminated soil and removal of MGP-related structures. However, it will not prevent off-site migration of the remaining, deeper NAPL.

Alternative 6, which includes near-total removal of contaminated materials to their full depth of 44 feet, will provide a slightly greater amount of protection to human health and the environment than Alternative 5. Under this alternative, only very low levels of contaminated materials will remain following excavation. However, this alternative will create several short-term impacts during implementation. Performing excavation to a depth of 44 feet bgs will result in significant disruption to the community as a result of the need for massive dewatering, treatment and disposal of water. The four-fold increase in soil produced (approximately 179,000 cubic yards) will require roughly 9,000 tandem truck trips through the community to transport the contaminated material off site. Though this alternative will result in a reduction in the volume of contaminated source materials, it will result in greater short-term adverse impacts on nearby residents and commercial establishments during construction and will only provide minimal additional protection of human health and the environment over the selected remedy. The incremental cost of over $50 million and the significantly increased community disruption associated with this alternative over Alternative 5 are not justified by the marginal increase in protection. The proposed remedy is expected to allow natural attenuation of remaining contamination by removing the source of contamination.

Alternative 5 is being selected because, as described below, it satisfies the threshold criteria and provides the best balance of the primary balancing criteria described in Section 7.2. It will achieve the remediation goals for the site by removing most of the source of the site contamination and by preventing off-site migration of the remaining NAPL through the installation of NAPL recovery wells and vertical barrier walls.

Although Alternatives 2 and 3 will achieve the RAOs established for the OU-2 portion of the site, they will not provide the reduction in toxicity, mobility and volume of contaminated materials. Alternative 4 will also meet the RAOs but will not provide immediate reduction in mobility compared to Alternative 5. Alternative 6 will achieve the RAOs but the logistical and implementability issues associated with excavation do not warrant the additional period of disruptive

activities and the significant increase in capital cost (over $50 million) when compared to Alternative 5.

On the basis of the above evaluations, Alternative 5 offers the most balanced and cost effective remedy.

The estimated present worth cost to implement the remedy is $31,471,000. The cost to construct the remedy is estimated to be $26,427,000 and the estimated average annual operation, maintenance, and monitoring costs for 30 years is $328,000.

The elements of the selected remedy are as follows:

1. A remedial design program will be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program.

2. Demolition of the existing building and associated features located in the northeastern portion of the 25 Willow Avenue parcel to allow for the excavation of the impacted materials located beneath the building. All construction and demolition (C&D) debris will be handled and disposed of in accordance with applicable State and local regulations.

3. Installation of two vertical barrier cutoff walls to prevent the migration of NAPL from the site source areas to off-site locations. The walls will be installed in two areas of the site to cut off migration of contamination off the site, as shown on Figure 6. The type and configuration of the walls to be installed will be determined during the design of the selected remedy. The evaluation will take into account the constructibility and compatibility of the wall with subsurface site contamination. The barrier wall may also serve to support excavation.

4. Excavation of source materials to an approximate depth of ten (10) feet below ground surface (bgs) to remove approximately 38,000 cubic yards of contaminated soils. Material to be removed will include soil containing visible coal tar or separate phase materials. The approximate excavation boundaries are shown on Figure 6. Some portion of the areas depicted for removal may not be sufficiently contaminated to warrant removal. The actual extent of removal in these locations will be based on visual observations as the excavation proceeds, with the concurrence of the NYSDEC on-site representative. Dewatering of the excavation will be required for effective operations. Any water generated will be pre-treated prior to discharge to a permitted facility such as a publicly owned treatment works (POTW). Odor, noise and dust control measures will be implemented. A visible demarcation barrier will be installed at the bottom of the excavation to mark the extent of soil removal prior to backfilling the excavation.

5. Former MGP-related structures including foundations and associated grossly contaminated soil determined to contain coal tar with potential for future mobility will be removed to their full depth, to the extent practicable.

6. Excavated areas will be backfilled with clean soil from an off-site location. Visually clean material from onsite building demolition may be used to backfill the lower portion of the excavated areas. The top two (2) feet of the entire on-site parcel will be filled with clean top soil.

7. NAPL recovery wells will be installed to allow for the collection, treatment and disposal of mobile NAPL that may be present in the subsurface after shallow soils and MGP-related structures have been removed. Recovery/monitoring wells will be placed immediately upgradient and down gradient of the walls to ensure recovery of NAPL collecting behind the walls, as well as any significant NAPL that may be present immediately outside of the walls. The actual number and locations of wells, the screen intervals and method of recovery will be determined during the design of the selected remedy.

8. Since the remedy results in contamination above unrestricted levels remaining at the site, an institutional control in the form of an environmental easement will be required for the remedy. The environmental easement will:
(a) restrict the use of the site to "commercial use";
(b) restrict the use of groundwater at the site;
(c) require the management of the site in accordance with the provisions of the site management plan, to be approved by the Department; and
(d) require the property owner complete and submit to the NYSDEC a periodic certification.

9. A site management plan (SMP) will be developed and implemented. The SMP will identify the institutional controls and engineering controls (IC/ECs) required for the remedy and detail their implementation. The SMP for this remedy will include:
   (a) An IC/EC control plan to establish the controls and procedures necessary to; (i) manage remaining contaminated soils that may be excavated from the site during future activities, including procedures for soil characterization, handling, health and safety of workers and the community as well as, disposal/reuse in accordance with applicable NYSDEC regulations and procedures; (ii) evaluate the potential for vapor intrusion for any buildings developed on the site, including mitigation of any impacts identified; (iii) maintain use restrictions regarding site development or groundwater use identified in the environmental easement; and (iv) require the property owner to provide an institutional control/engineering control (IC/EC) certification on a periodic basis.
   (b) A monitoring plan to monitor the vertical barrier walls and NAPL recovery wells. The effectiveness of the cutoff walls will be determined from sampling results obtained from a periodic groundwater monitoring program; and
   (c) An operation and maintenance plan to provide the detailed procedures necessary to operate and maintain the remedy, including the NAPL recovery system. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

10. Contaminated soil was encountered at the Edgewater Plaza parking lot at depths ranging from 6 to 21 feet below grade, the extent of this contamination and the need for remediation will be determined during the design phase of the this project.

SECTION 9: HIGHLIGHTS OF COMMUNITY PARTICIPATION

As part of the remedial investigation process, a number of Citizen Participation activities were undertaken to inform and educate the public about conditions at the site and the potential remedial alternatives. The following public participation activities were conducted for the site:

- Repositories for documents pertaining to the site were established.
- A public contact list, which included nearby property owners, elected officials, local media and other interested parties, was established.
- A public meeting was held on February 9, 2006 to present and receive comments on the Proposed Remedial Action Plan (PRAP). An availability session was held on September 21, 2006 to give the public additional opportunity to ask questions about the site and provide comments on the PRAP.
- A responsiveness summary (Appendix A) was prepared to address the comments received during the PRAP public comment period.

TABLE 1

Nature and Extent of Contamination

Surface Soil	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Semi Volatile Organic Compounds (SVOCs) cPAHs	Benzo(a)anthracene	0.38 - 9.4	0.224	10/10
	Benzo(a)pyrene	0.45 - 8.8	0.061	10/10
	Benzo(b)fluoranthene	0.52 - 8.2	1.1	5/10
	Benzo(k)flouranthene	0.85 - 10	1.1	8/10
	Chrysene	0.55 - 12	0.4	10/10
	Dibenzo(a,h)anthracene	0.046 - 1.6	0.014	9/10
	Indeno(1,2,3-cd)pyrene	0.072 - 4	3.2	1/10
Subsurface Soil	**Contaminants of Concern**	**Concentration Range Detected (ppm)[a]**	**SCG[b] (ppm)[a]**	**Frequency of Exceeding SCG**
Volatile Organic Compounds (VOCs)	Benzene	0.001 - 1,000	0.06	47/127
	Toluene	0.0004- 2,100	1.5	44/127
	Ethylbenzene	0.0005 - 1,500	5.5	40/127
	Xylenes (Total)	0.001- 1,800	1.2	73/127
Semi Volatile Organic Compounds (SVOCs) cPAHs	Benzo(a)anthracene	0.004- 1,700	0.224	71/128
	Benzo(a)pyrene	0.014 - 1,500	0.061	65/128
	Benzo(b)fluoranthene	0.013 - 590	1.1	64/128
	Benzo(k)flouranthene	0.022 - 890	1.1	64/128
	Chrysene	0.003 - 2,200	0.4	65/128
	Dibenzo(a,h)anthracene	0.033 - 2,600	0.014	33/128
	indeno(1,2,3-cd)pyrene	0.012 - 3,200	3.2	46/128

Groundwater	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	0.6 - 8,300	1	48/67
	Toluene	0.3 - 3,500	5	35/67
	Ethylbenzene	1 - 1,800	5	28/67
	Xylenes (Total)	1 - 2,000	5	42/67
Semivolatile Organic Compounds (SVOCs) cPAHs	Benzo(a)anthracene	0.2 - 6	0.002	0/24
	Benzo(a)pyrene	0.2 - 4	0.002	0/24
	Benzo(b)fluoranthene	0.2 - 3	ND	0/24
	Benzo(k)fluoranthene	0.3 - 4	0.002	0/24
	Indeno(1,2,3-cd)pyrene	0.1 - 4	0.002	1/24
	Chrysene	0.2 - 6	0.002	0/24
Sub Slab Soil Vapor	**Contaminants of Concern**	**Concentration Range Detected (mcg/m3)[a]**	**SCG[b] (mcg/m3)[a]**	**Frequency of Exceeding SCG**
VOCs	1,1,1-Trichloroethane	ND - 25,000	N/A	N/A
	1,1-Dichloroethane	ND - 5,400	N/A	N/A
	1,1-Dichloroethylene	ND - 2,800	N/A	N/A
	Tetrachloroethylene	ND - 960	N/A	N/A

[a] ppb = parts per billion, which is equivalent to micrograms per liter, mcg/L, in water;
ND = Non Detect;
N/A = Not Applicable
ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
mcg/m^3 = micrograms per cubic meter
[b] SCG = standards, criteria, and guidance values;

Table 2

Remedial Alternative Costs

Remedial Alternative	Capital Cost	Annual OM&M	Total Present Worth
Alternative 1: No Action	$0	$25,000	$389,000
Alternative 2: Capping and Common Elements	$5,285,000	$328,000	$10,329,000
Alternative 3: Vertical Barrier Cutoff Walls and Common Elements.	$7,996,000	$482,000	$15,404,000
Alternative 4: Excavation to 10 ft bgs, Removal of Former MGP-related Structures and Common Elements	$21,426,000	$298,000	$25,997,000
Alternative 5: Excavation to 10 ft bgs, Removal of Former MGP-related Structures, Vertical Barrier Cuttoff Walls and Common Elements	$26,427,000	$328,000	$31,471,000
Alternative 6: Excavation to Full Depth of Contamination and Common Elements	$69,753,000	$57,000	$70,635,000

APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

Former Clifton MGP Site
Operable Unit No. 2
Staten Island, Richmond County, New York
Site No. 2-43-023

The Proposed Remedial Action Plan (PRAP) for the Former Clifton MGP site, was prepared by the New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health (NYSDOH) and was issued to the document repositories on January 3, 2006. The PRAP outlined the remedial measure proposed for the contaminated soil and groundwater at the Former Clifton MGP site.

The release of the PRAP was announced by a notice to the public contact list in January 2006, informing the public of the opportunity to comment on the proposed remedy.

A public meeting was held on February 9, 2006, which included a presentation of the Remedial Investigation (RI) and the Feasibility Study (FS) as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period was to have ended on February 22, 2006, however it was extended to March 10, 2006, at the request of the public. Also, an Availability Session was held on September 21, 2006 to give the public an additional opportunity to comment on the PRAP.

This responsiveness summary responds to all questions and comments raised during the public comment period and at the two meetings. The following are the comments received, with the NYSDEC's responses:

COMMENT 1: There is no information as to how the NYSDEC intends to seal the area during soil removal activities to prevent the particles from getting into the air.

RESPONSE 1: The NYSDEC typically requires the use of temporary enclosures when there are concerns about odors and dust generation during soil excavation activities. These enclosures can resemble large tents, which cover the active excavation areas and staging areas where contaminated soils are excavated, stockpiled, and loaded for shipment off site or may also be trench shrouds, where appropriate. Air inside the enclosure is maintained at a slightly lower pressure than the outside pressure, to ensure that odors and dust are drawn inwards into the enclosure, rather than escaping to the outside air. Odor and particulate control measures will be determined during design.

It is expected that KeySpan will install such a temporary enclosure unit equipped with an air handling system to process air from within the enclosure to remove contaminants before discharge to the atmosphere. Monitoring systems will be placed around the site as

part of a community air monitoring plan to ensure that air leaving the unit is free of contamination and meets the NYSDEC and NYSDOH air emission requirements.

Trucks transporting contaminated soils off site will be covered with tarps to control dust and, when necessary, may be covered with a layer of foam to suppress odors.

As noted above, all site remedial actions will be conducted under the terms of a community air monitoring plan (CAMP) approved by NYSDOH.

COMMENT 2: Although the NYSDEC documents indicate that the border is the train trestle, there is another parcel of land on Greenfield Avenue that is part of Operable Unit 2 and is probably equally contaminated, but that is not marked as part of your site.

RESPONSE 2: This area noted by the comment was investigated and found to be free of contamination. The parcel of land on Greenfield Avenue is identified in the final Remedial Investigation Report as the "Northwest Parcels." Several soil borings and groundwater monitoring wells were placed along Greenfield Avenue to assess the soil and groundwater conditions in the area. Site-related contamination was not observed at any of these locations.

COMMENT 3: Since the vapor intrusion under the slab of the building at 25 Willow Avenue was found to reach levels of 25,000 micrograms per cubic meter, given the contaminants can move through the surface, how can you deny the possibility of vapor intrusion in the homes?

RESPONSE 3: The physical settings of the 25 Willow building and the homes on Lynhurst Avenue are very different. The 25 Willow Avenue Building sits partially on top of the original MGP plant, with high levels of soil contamination found at relatively shallow depths beneath the building.

The homes on Lynhurst Avenue are not built on top of MGP structures. Although some MGP tar has been detected beneath these homes, it is located at a greater depth beneath the ground surface and has clean groundwater sitting on top of it. This layer of clean groundwater minimizes the generation of contaminated soil vapors which will be of concern for possible intrusion into the homes.

Several groundwater samples were collected between the MGP site (Operable Unit 1) and the homes on Lynhurst Avenue. Groundwater down to a depth of approximately 25 feet below the ground was clean with no MGP contaminants identified. In addition, soil vapor samples were also collected from the backyards of each of the homes on Lynhurst, with low levels of site-related contaminants detected. Soil vapor will also be evaluated after installation of the barrier wall in accordance with the Record of Decision for OU-1.

COMMENT 4: The PRAP refers to excavation and removal of "source materials" for off- site treatment and disposal. How are these materials defined? What material will be left behind?

RESPONSE 4: The ROD calls for the removal of the MGP structures that remain in the subsurface and their contents. At other MGP sites, we have often encountered soil heavily contaminated

with coal tar or MGP constituents immediately outside of and beneath these structures, and the ROD also requires removal of any heavily contaminated soils encountered to a depth of approximately ten feet below the ground surface. These highly concentrated materials are considered "source" materials, in the sense that they function as sources of both NAPL and dissolved groundwater contamination, which can move through the subsurface serving as source of contamination to other soil and groundwater.

The shape of the contaminated soil mass is often highly complex, so predicting exactly where these materials will be encountered before excavation begins is difficult. Decisions on which soils must be removed and which can remain are best made by trained personnel on the scene as the excavation work progresses. In most cases, visual identification of MGP tar contamination is quicker and reliable in the field. NYSDEC seeks to maintain an on-site presence during intrusive work so that these decisions can be made quickly and consistently. In making this professional judgement, NYSDEC staff apply the following definitions:

"Source area" or "source" means a portion of a site or area of concern at a site where the investigation has identified a discrete area of soil, sediment, surface water or groundwater containing contaminants in sufficient concentrations to migrate in that medium, or to release significant levels of contaminants to another environmental medium, which could result in a threat to public health or the environment. A source area typically includes, but is not limited to, a portion of a site where a substantial quantity of any of the following are present:
(1) Concentrated solid or semi-solid hazardous substances;
(2) Non-aqueous phase liquids; or
(3) Grossly contaminated media.
"Grossly contaminated media" means soil, sediment, surface water or groundwater which contains sources or substantial quantities of mobile contamination in the form of NAPL that is identifiable either visually, through strong odor, by elevated contaminant vapor levels or is otherwise readily detectable without laboratory analysis.

The description of the soil removal component of the remedy has been clarified in the final ROD to address this potential ambiguity.

The following statement was submitted in the form of a petition with 70 signatures

COMMENT 5: Digging up the contaminated soil is the most hazardous way to remediate the contamination. We have no confidence that there is an effective method which can be used by these agencies to contain the soil particles and keep them from getting into the air when undertaking the monumental task of removing 10 feet of topsoil from a 3.5 acre contaminated lot.

RESPONSE 5: Please see response to comment No. 1. Temporary containment structures have been used successfully at several MGP site cleanups in New York State and elsewhere.

APPENDIX B

Administrative Record

Administrative Record

Former Clifton MGP Site
Operable Unit No. 2
Site No. 2-43-023

1.Proposed Remedial Action Plan for the Former Clifton MGP site, Operable Unit No.2 dated January 2006.

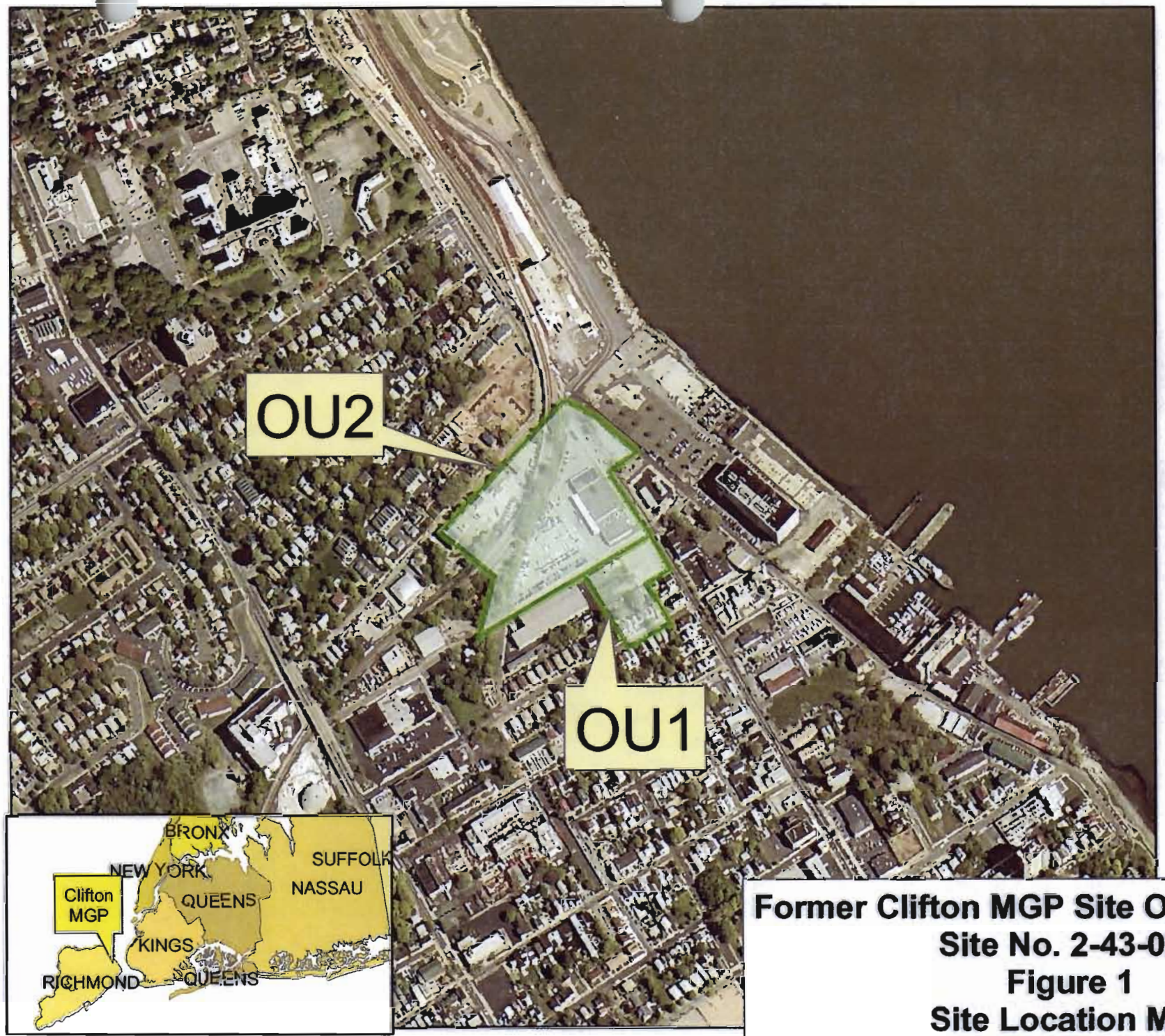
2.Order on Consent, Index No. D2-0001-98-04, between NYSDEC and KeySpan Corporation, executed on April 1998.

3.Final Remedial Investigation Report, Clifton Former MGP Site, Operable Unit 2, dated February 2006, prepared by GEI Consultants.

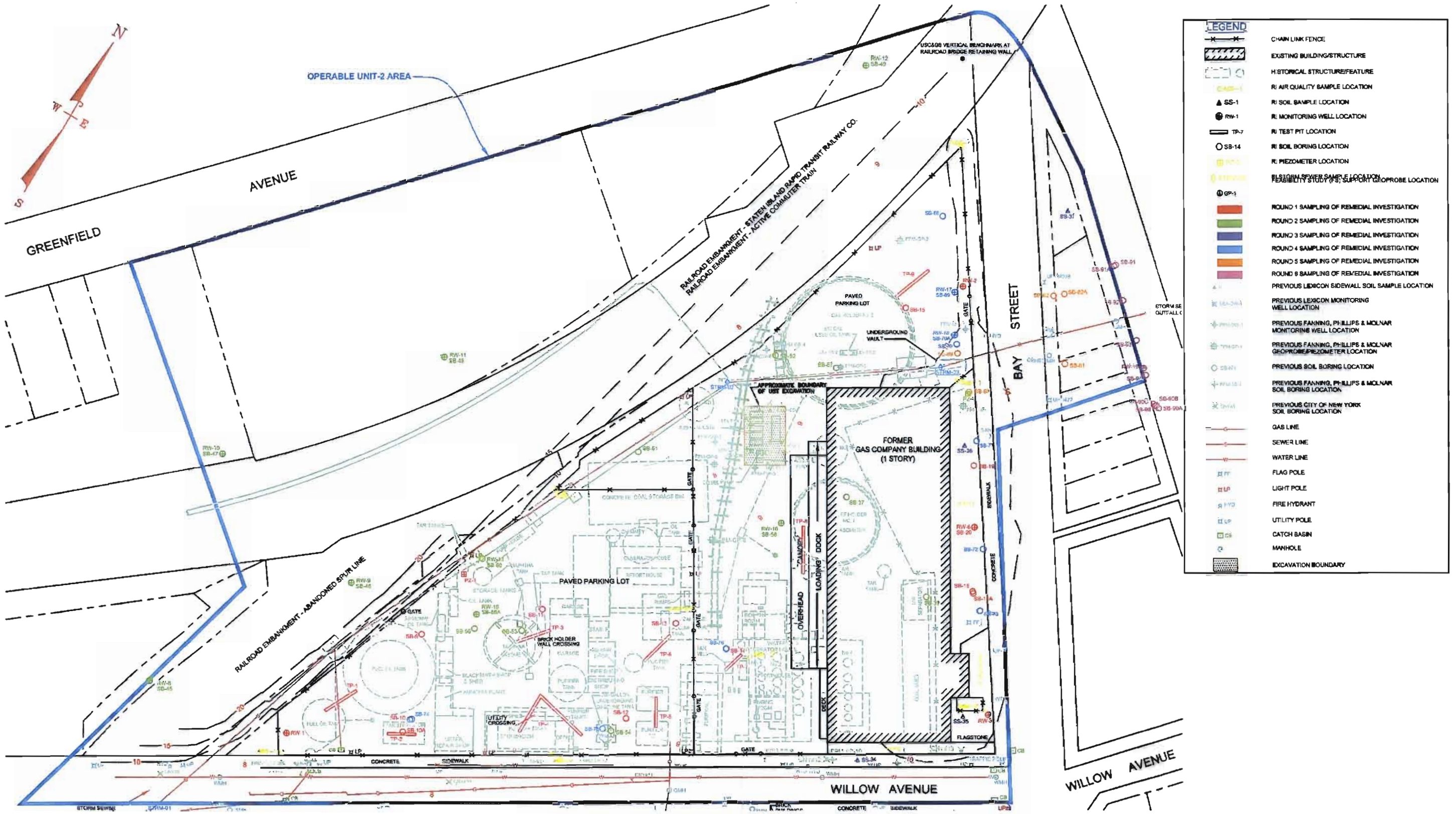
4.Final Feasibility Study Report for the Former Clifton Manufactured Gas Plant (MGP) Site, 25 Willow Avenue Parcel, Operable Unit 2, dated October 2006.

5.Fact Sheet, January 2006, Remedial Action Plan Proposed for the OU-2 Portion of the Former Clifton MGP Site.

6.Fact Sheet, Februay 2006, Comment Period Extended for the Remedial Action Plan Proposed for the OU-2 Portion of the Former Clifton MGP Site.



Former Clifton MGP Site Operable Unit 2
Site No. 2-43-023
Figure 1
Site Location Map



SOURCES:

1. "FOLLOW-UP SOIL AND GROUNDWATER INVESTIGATION AT THE BROOKLYN UNION GAS COMPANY CLIFTON STATION FACILITY, 40 WILLOW AVENUE, STATEN ISLAND, NY" BY FANNING, PHILLIPS & MOLNAR, AUGUST 29, 1994.
2. "MAP OF PROPERTY, EXIST. BLDG & YARD CONNECTIONS, NEW YORK AND RICHMOND GAS COMPANY - 1921" BY FANNING, PHILLIPS & MOLNAR ENGINEERS, RONKONKOMA, NEW YORK. SCALE 1"=20'. DATED 2/8/94 - REVISED TO 2/13/98.
3. "TOPOGRAPHY AND SAMPLE LOCATIONS, #49 - #67 LYNHURST AVENUE" BY GEI CONSULTANTS, INC., COLCHESTER, CONNECTICUT FOR KEYSPAN ENERGY. SCALE 1"=10'. DATED 7/8/02.
4. "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)", PREPARED BY GEI CONSULTANTS, INC. AND DATED SEPTEMBER 2002.

SOURCE:

1. BASE MAP OF SITE PREPARED BY GEI CONSULTANTS, INC. TAKEN BOFROM PLAN ENTITLED, "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)," DATED SEPTEMBER 2002.

40 20 0 40

GRAPHIC SCALE IN FEET

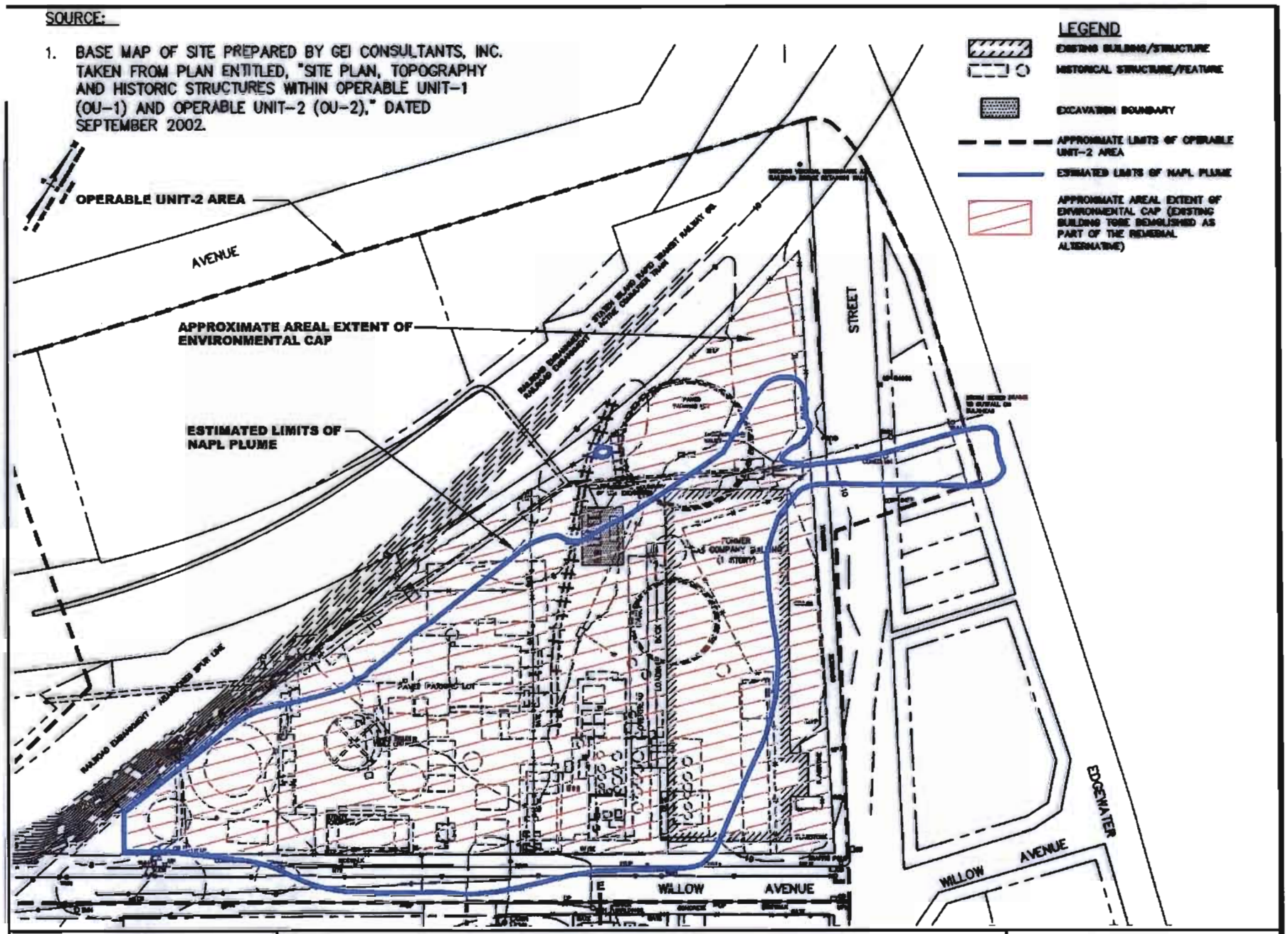
FORMER CLIFTON MGP SITE OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

SITE LAYOUT MAP

FIGURE 2

SOURCE:

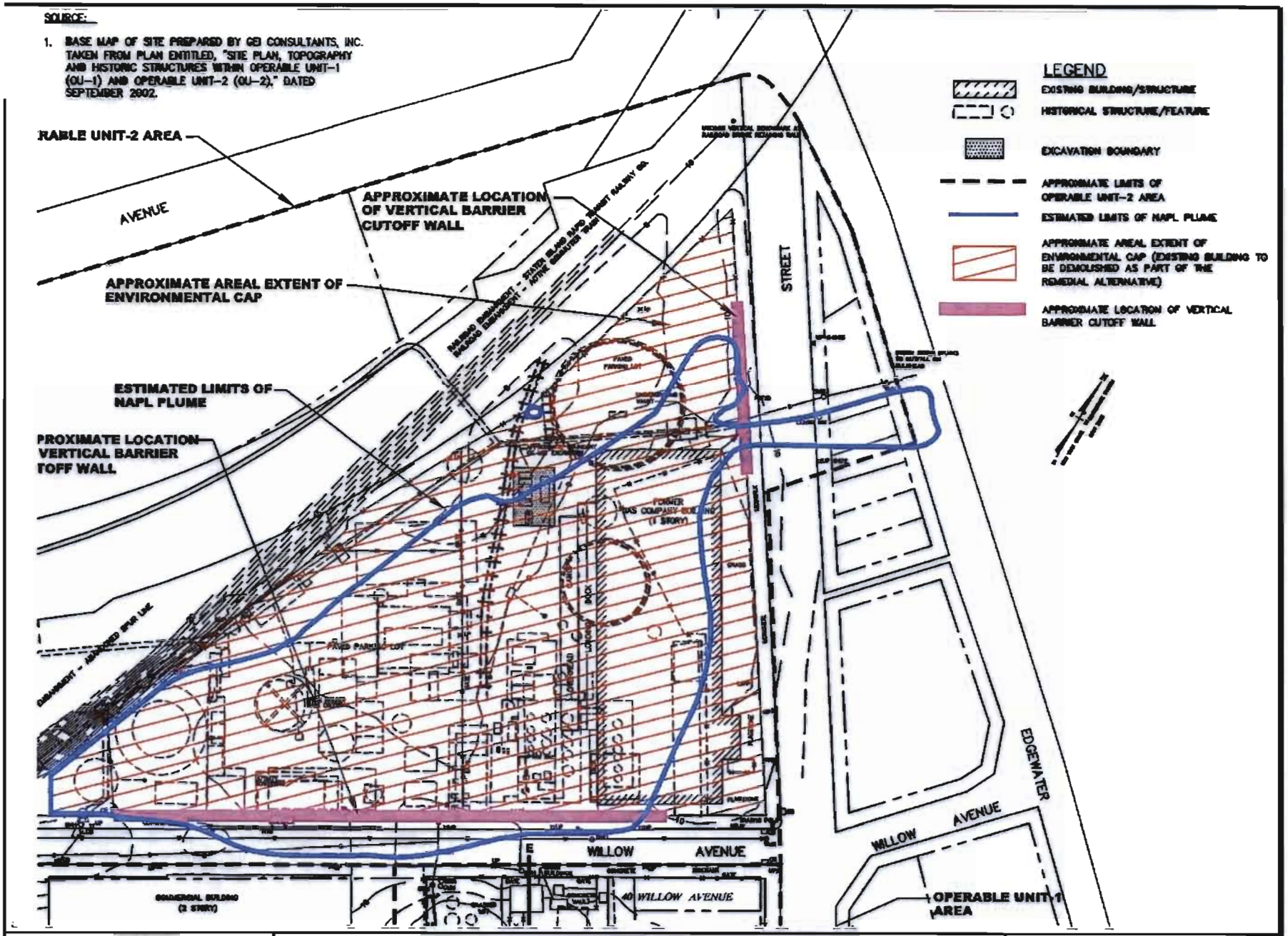
1. BASE MAP OF SITE PREPARED BY GEI CONSULTANTS, INC. TAKEN FROM PLAN ENTITLED, "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)," DATED SEPTEMBER 2002.



FORMER CLIFTON MGP SITE - OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

ALTERNATIVE 2 - CAPPING

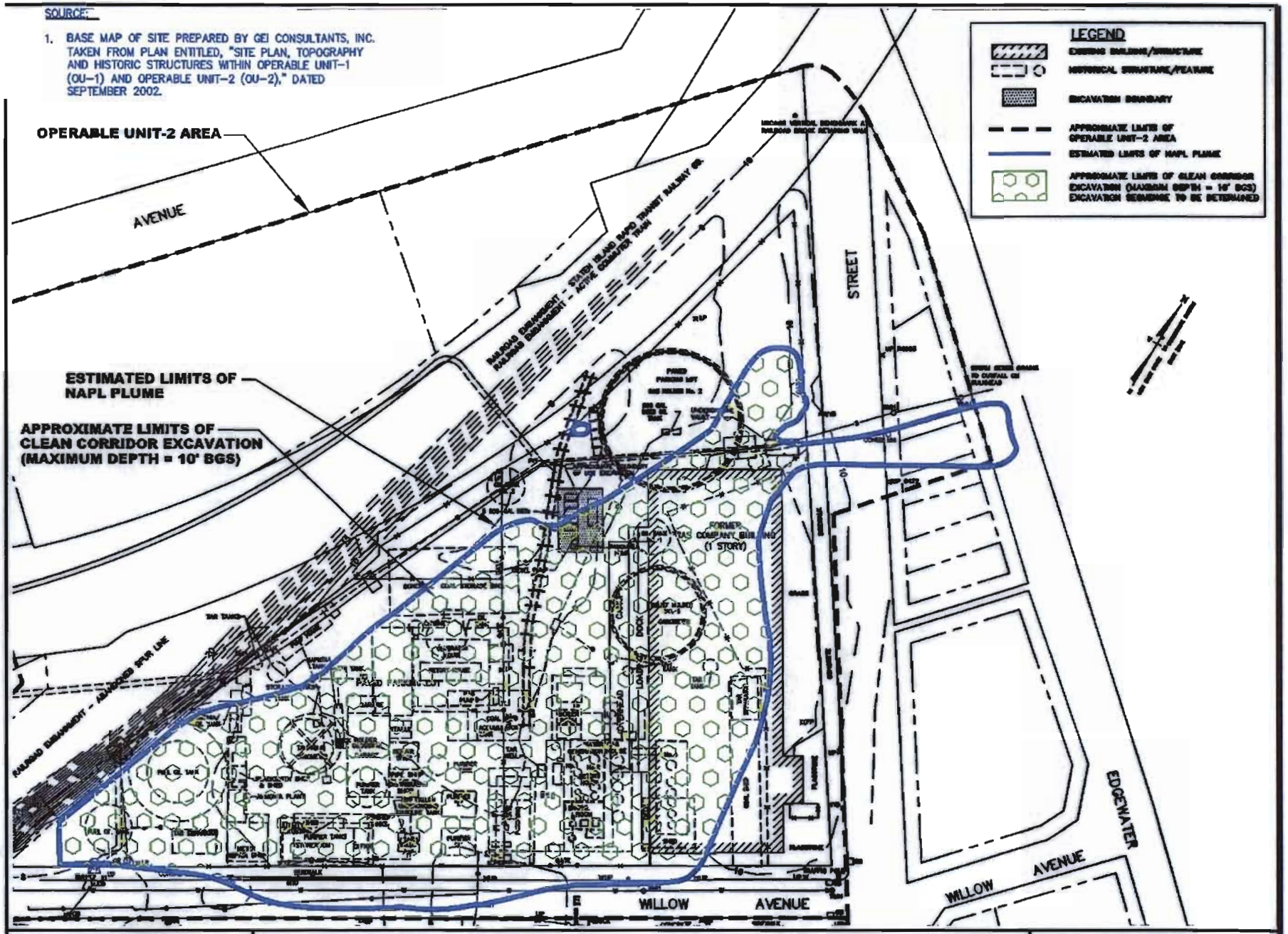
FIGURE 3



FORMER CLIFTON MGP SITE - OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

ALTERNATIVE 2 - CAPPING

FIGURE 4



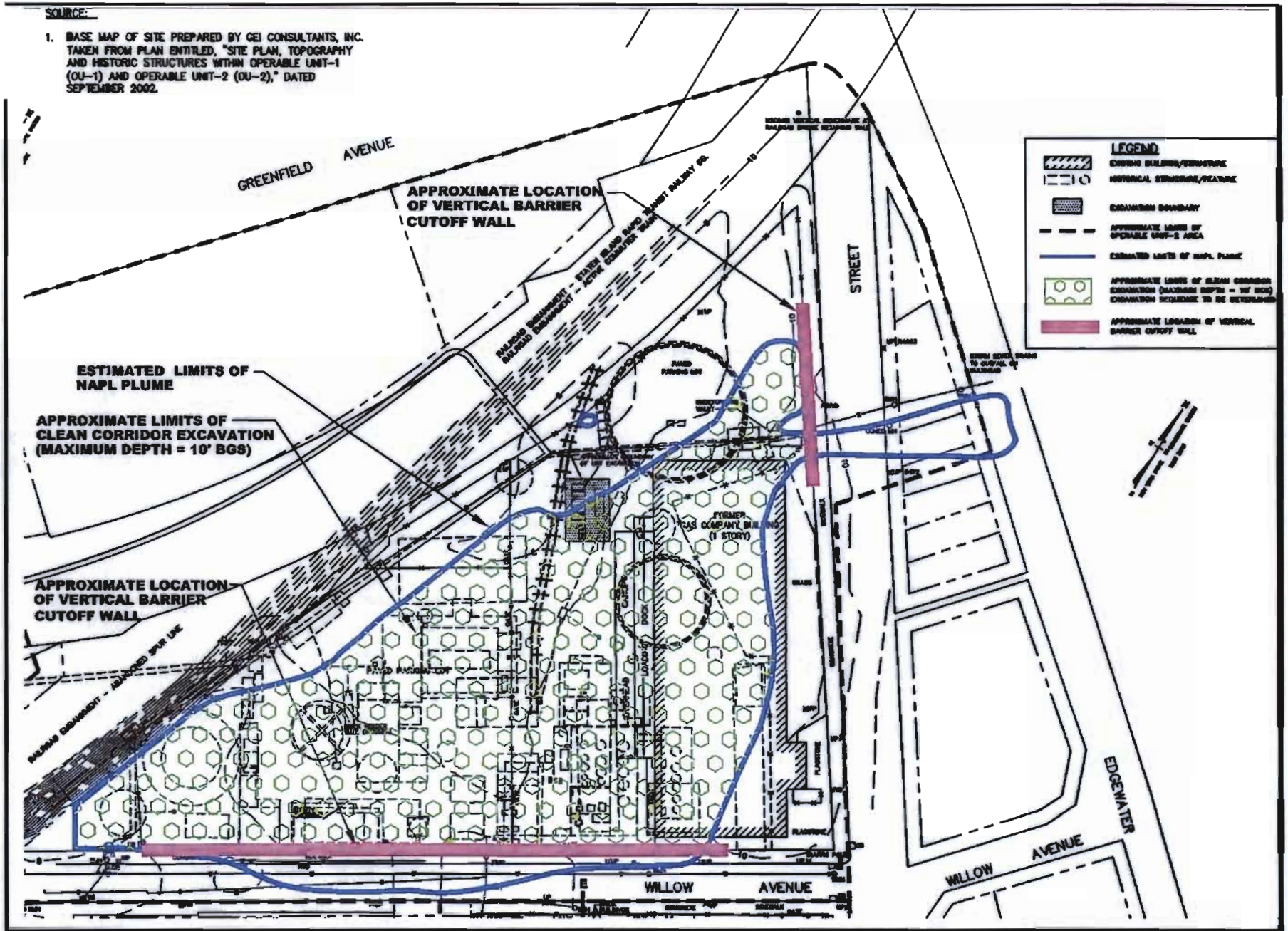
FORMER CLIFTON MGP SITE OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

ALTERNATIVE 4: 10 FT EXCAVATION, REMOVAL OF MGP STRUCTURES

FIGURE 5

SOURCE:

1. BASE MAP OF SITE PREPARED BY GEI CONSULTANTS, INC. TAKEN FROM PLAN ENTITLED, "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)," DATED SEPTEMBER 2002.



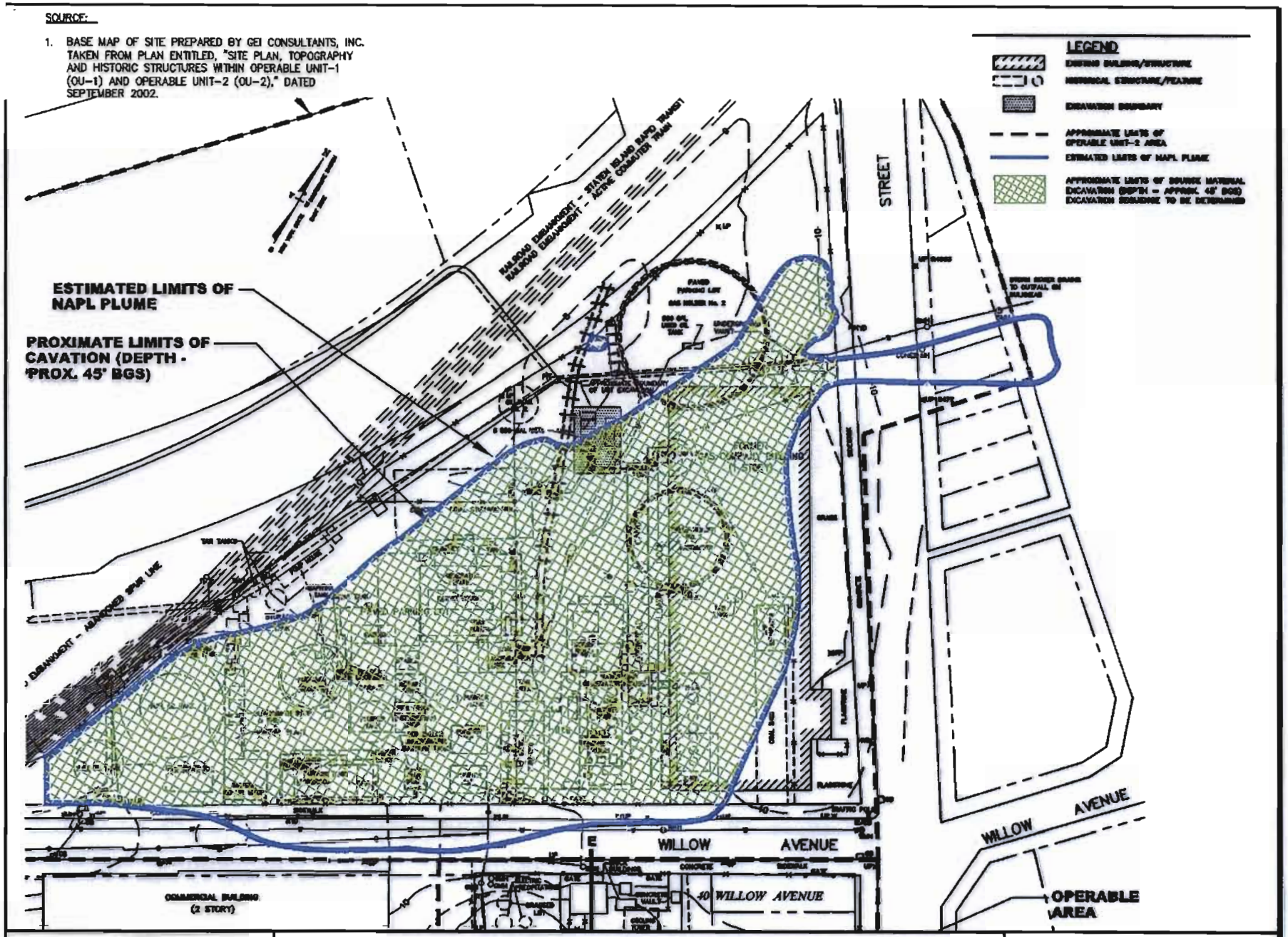
FORMER CLIFTON MGP SITE OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

ALTERNATIVE 5: 10 FT EXCAVATION, REMOVAL OF MGP STRUCTURES, VERTICAL CUTOFF WALLS

FIGURE 6

SOURCE:

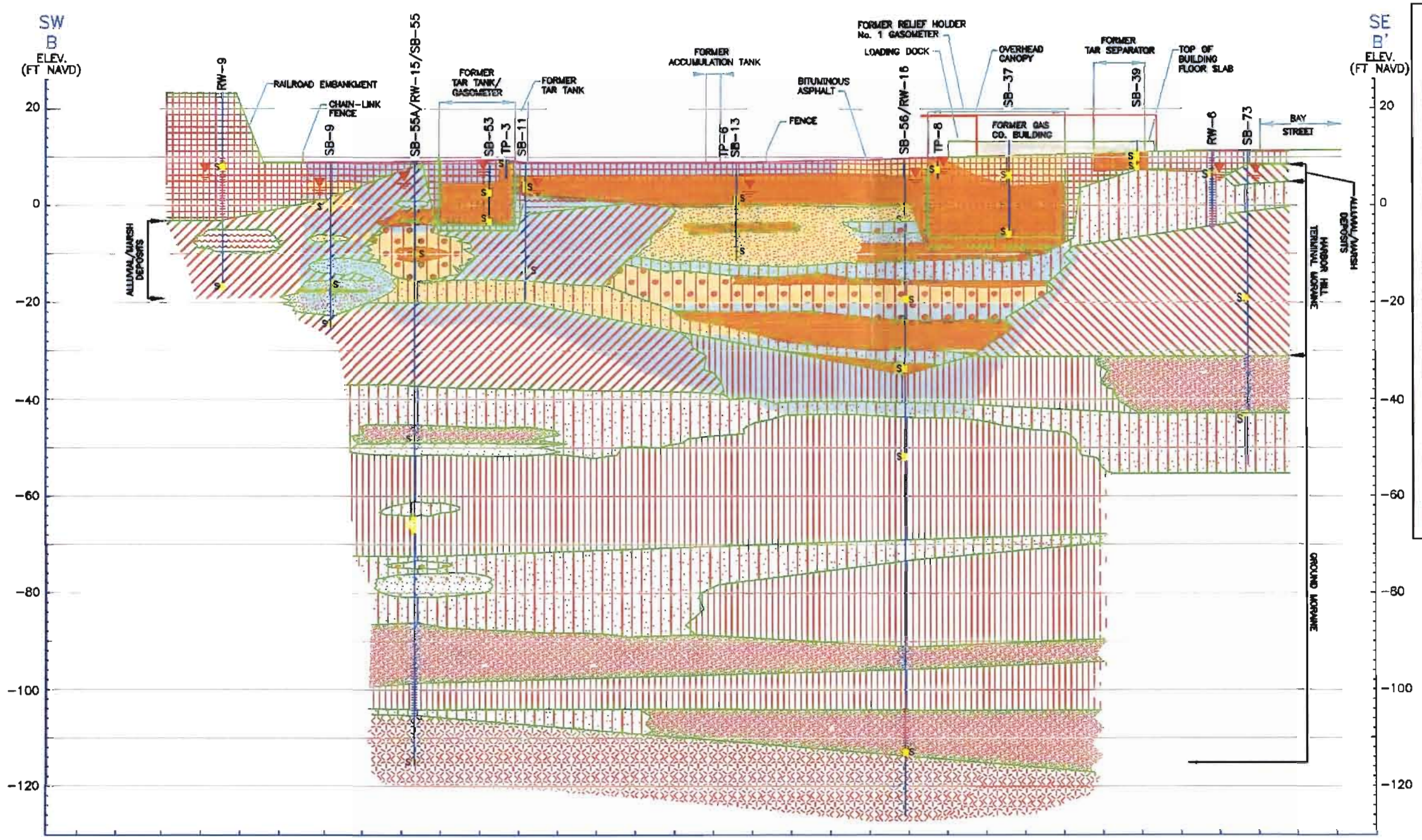
1. BASE MAP OF SITE PREPARED BY GEI CONSULTANTS, INC. TAKEN FROM PLAN ENTITLED, "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)," DATED SEPTEMBER 2002.

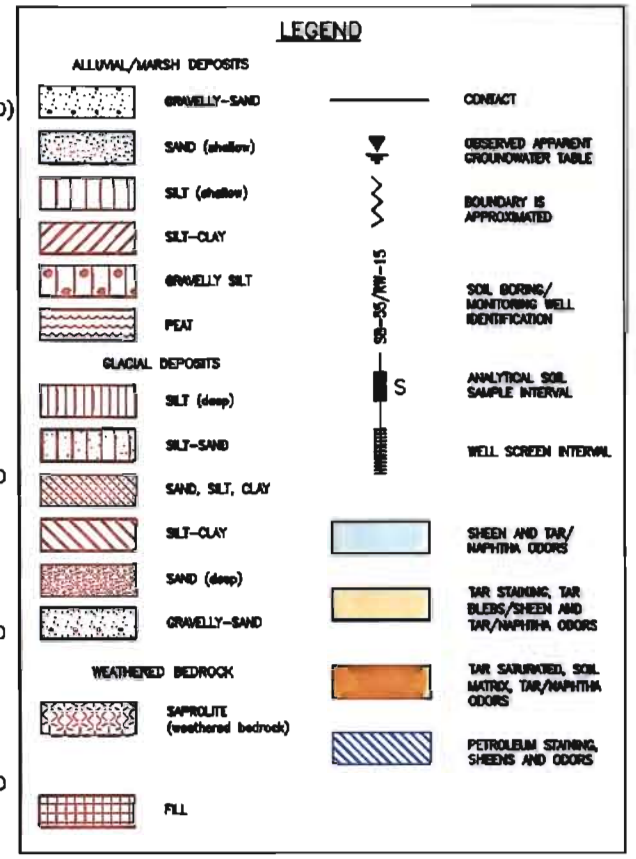


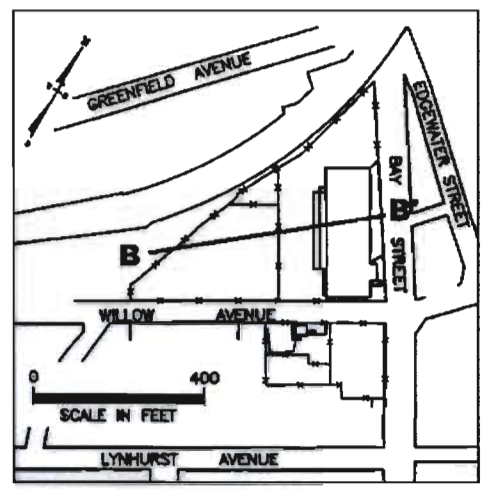
FORMER CLIFTON MGP SITE OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

ALTERNATIVE 6: EXCAVATION TO FULL DEPTH

FIGURE 7







TRANSECT LOCATION

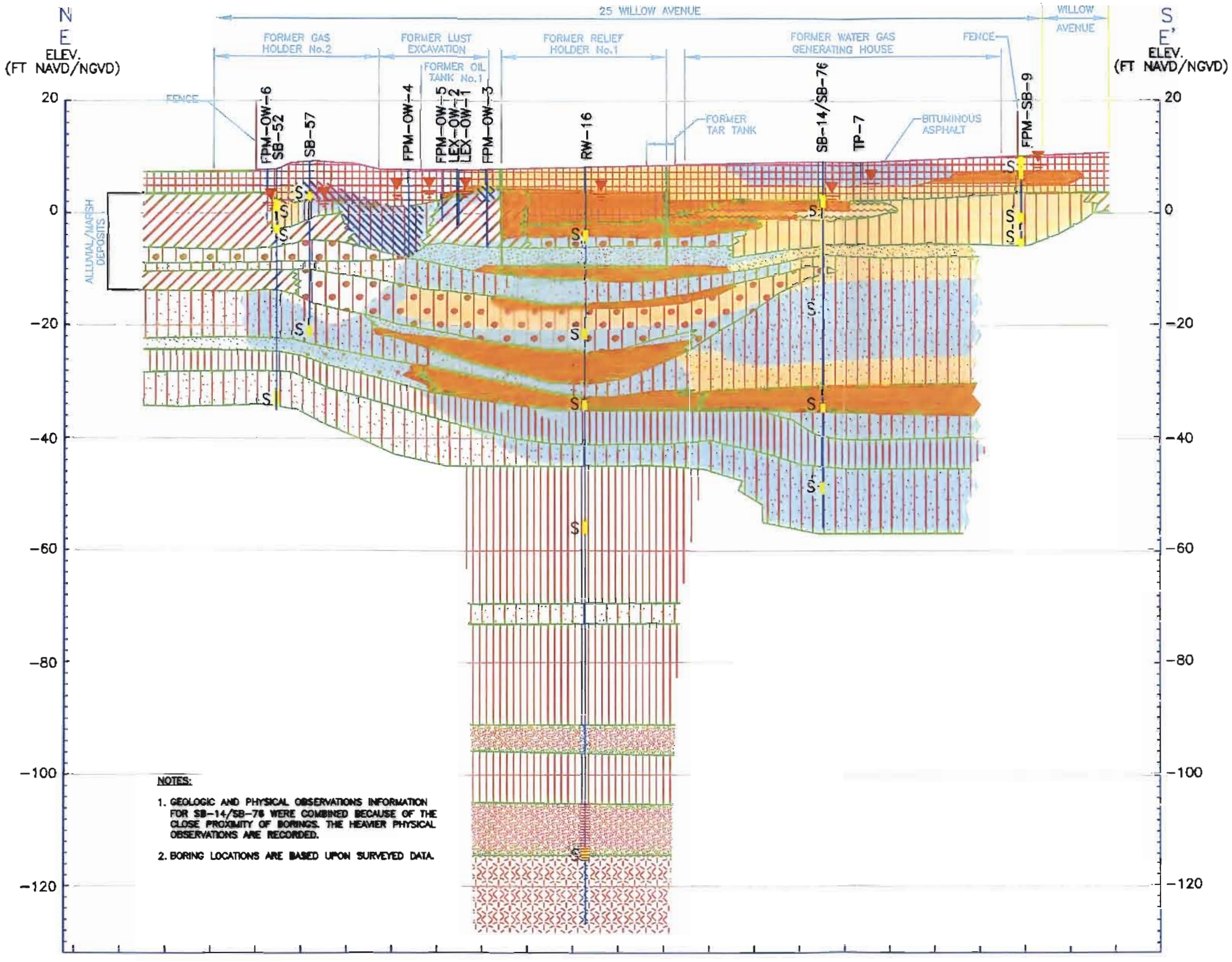
SOURCE:

1. BASE MAP OF SITE PREPARED BY GEI CONSULTANTS, INC. TAKEN FROM PLAN ENTITLED, "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)," DATED SEPTEMBER 2002.

FORMER CLIFTON MGP SITE OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

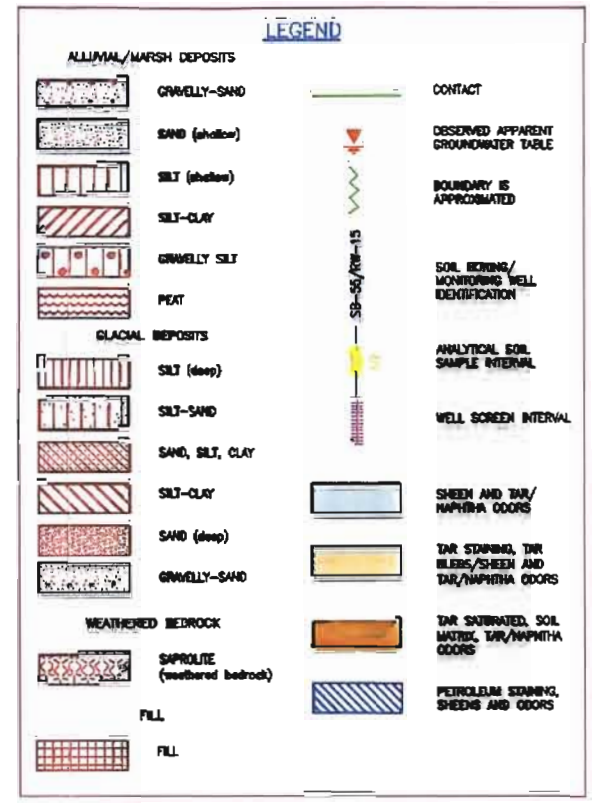
CROSS SECTIONS

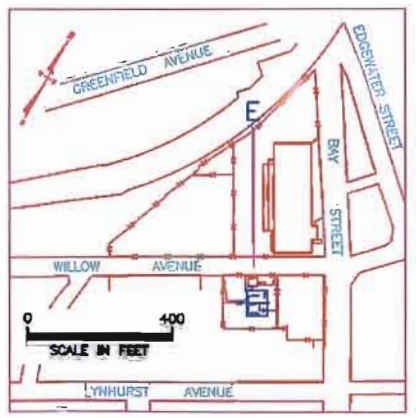
FIGURE 8



NOTES:

1. GEOLOGIC AND PHYSICAL OBSERVATIONS INFORMATION FOR SB-14/SB-76 WERE COMBINED BECAUSE OF THE CLOSE PROXIMITY OF BORINGS. THE HEAVIER PHYSICAL OBSERVATIONS ARE RECORDED.
2. BORING LOCATIONS ARE BASED UPON SURVEYED DATA.





TRANSECT LOCATION

SOURCE:

1. BASE MAP OF SITE PREPARED BY GEI CONSULTANTS, INC. TAKEN FROM PLAN ENTITLED, "SITE PLAN, TOPOGRAPHY AND HISTORIC STRUCTURES WITHIN OPERABLE UNIT-1 (OU-1) AND OPERABLE UNIT-2 (OU-2)," DATED SEPTEMBER 2002.

FORMER CLIFTON MGP SITE OPERABLE UNIT 2
STATEN ISLAND, RICHMOND COUNTY
SITE NO. 2-43-023

CROSS SECTIONS

FIGURE 9

Appendix B

PDI Quality Assurance Project Plan (QAPP) (Will be developed prior to field work)

Appendix C

PDI Site-Specific Health and Safety Plan (HASP)

Prepared for:
Keyspan Corporation

HEALTH AND SAFETY PLAN

Remedy Design and Implementation

Pre-Design Investigation

Former Clifton Manufactured Gas Plant Site

Operable Unit No. 2

Richmond County, New York

ENSR Corporation
December 2008

ENSR

Prepared for:
Keyspan Corporation

HEALTH AND SAFETY PLAN

Remedy Design and Implementation

Pre-Design Investigation

Former Clifton MGP Site - Operable Unit No. 2

Richmond County, New York

Kathleen Harvey

Prepared By – Kathleen Harvey

Reviewed By

ENSR Corporation
December 2008

ENSR | AECOM

Contents

1.0 INTRODUCTION

1.1 HASP Applicability

This site-specific Health and Safety Plan (HASP) has been developed by ENSR Corporation (ENSR). It establishes the health and safety procedures needed to minimize potential risk to ENSR personnel and ENSR contractor personnel implementing the proposed pre-design investigation (PDI) activities at the former Clifton Manufactured Gas Plant (MGP) – Operable Unit No. 2 (OU-2) located at 25 Willow Avenue in Clifton, Richmond County, New York. ENSR is performing this work on behalf of KeySpan Corporation.

The provisions of this plan apply to ENSR personnel and ENSR contractor personnel who may potentially be exposed to safety and/or health hazards related to activities described in Section 3.0 of this document.

This HASP has been written to comply with the requirements of the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). All activities covered by this HASP must be conducted in complete compliance with this HASP and with all applicable federal, state, and local health and safety regulations. Personnel covered by this HASP who cannot or will not comply will be excluded from site activities.

This plan will be distributed to each employee involved with the proposed pre-design investigative activities. Each employee must sign a copy of the attached health and safety plan sign-off sheet (see Attachment A).

1.2 Health and Safety Expectations

Commitment to safety, health, and environmental excellence requires that all work proceed only after it is safe and environmentally sound to do so. The responsibility for ensuring that this takes place rests with every worker present at this property. Effectively meeting these responsibilities depends upon open communication between individuals and their supervisors prior to work beginning, and – in certain cases – after safety, health and/or environmental issues are identified.

The safety and health of on-site personnel will take precedence over cost and schedule considerations for all project work. All ENSR personnel have the authority to STOP WORK if they see a potential or actual hazard that may threaten the safety of people or the environment. Upon stopping work, the Site Safety Officer (SSO) must be immediately notified and provided with information regarding the nature of the safety, health or environmental concern. The SSO should meet with the worker with the intent of resolving the worker's concerns. Once the concerns are resolved to the satisfaction of the worker, work can proceed.

If the concerns are not resolved to the satisfaction of the worker and/or the SSO, work does not proceed. The ENSR Regional Health and Safety Manager (RHSM) will be contacted to obtain assistance in resolving the concerns. Using his/her expertise, safety, health, and environmental rules, regulations, and procedures, the ENSR RHSM will attempt to resolve the matter with all parties involved. Work will not resume until this criterion is met.

1.3 Organization/Responsibility

The implementation of health and safety at this project location will be the shared responsibility of the ENSR Project Manager (PM), the ENSR Regional Health and Safety Manager (RHSM), the ENSR Project Site Safety Officer (SSO) and other ENSR personnel and ENSR's contractors implementing the proposed scope of work.

1.3.1 ENSR Project Manager

The ENSR PM (Dave Work) is the individual who has the primary responsibility for ensuring the overall health and safety of this project. As such, the PM is responsible for ensuring that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies, including ENSR subcontractors, have received a copy of it;
- Providing the RHSM with updated information regarding conditions at the site and the scope of site work;
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of all necessary safety procedures;
- Supporting the decisions made by the SSO and RHSM;
- Maintaining regular communications with the SSO and, if necessary, the RHSM; and,
- Coordinating the activities of all ENSR subcontractors and ensuring that they are aware of the pertinent health and safety requirements for this project

1.3.2 ENSR Regional Health and Safety Manager

The ENSR RHSM (Kathleen Harvey) is the individual responsible for the preparation, interpretation and modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the RHSM. Specific duties of the RHSM include:

- Writing, approving and amending the HASP for this project;
- Advising the PM and SSO on matters relating to health and safety on this site;
- Recommending appropriate personal protective equipment (PPE) to protect personnel from potential site hazards;
- Conducting accident investigations; and,
- Maintaining regular contact with the PM and SSO to evaluate site conditions and new information which might require modifications to the HASP.

1.3.3 ENSR Site Safety Officer

All ENSR field technicians are responsible for implementing the safety requirements specified in this HASP. However, one field technician will serve as the SSO. The SSO will be appointed by the PM. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies, including all subcontractors, have submitted a completed copy of the HASP receipt and acceptance form;
- Assuring that all personnel to whom this HASP applies have attended a pre-entry briefing and any subsequent safety meetings that are conducted during the implementation of the program;
- Maintaining a high level of health and safety consciousness among employees implementing the proposed monitoring activities;
- Performing the required worker protection air monitoring during the proposed intrusive activities;
- Implementing the proposed community air monitoring plan during the proposed activities;

- Procuring and distributing the PPE and safety equipment needed for this project for ENSR employees;
- Verifying that all PPE and health and safety equipment used by ENSR is in good working order;
- Verifying that ENSR contractors are prepared with the PPE and safety equipment required for this program;
- Stopping work in the event that an immediate danger situation is perceived;
- Notifying the PM of all noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Monitoring and controlling the safety performance of all personnel to ensure that required safety and health procedures are being followed;
- Conducting accident/incident investigations and preparing accident/incident investigation reports;
- Conducting the pre-entry briefing prior to beginning work and subsequent safety meetings as necessary; and,
- Initiating emergency response procedures in accordance with Section 11.0 of this HASP.

1.3.4 ENSR Field Personal

All ENSR field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading the HASP in its entirety prior to the start of on-site work;
- Submitting a completed HASP Acceptance Form to the ENSR SSO prior to the start of work;
- Attending the required pre-entry briefing prior to beginning on-site work and any subsequent safety meetings that are conducted during the implementation of the program;
- Stopping work in the event that an immediate danger situation is perceived;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the SSO prior to the start of work;
- Reporting all accidents, injuries and illnesses, regardless of their severity, and all near-miss incidents to the ENSR SSO; and,
- Complying with the requirements of this HASP and the requests of the SSO.

1.3.5 Contractor

The selected contractor and the employees they assign to this program are responsible for the following:

- Complying with the requirements of this HASP and the requests of the SSO;
- Designating a SSO that will work with ENSR's SSO for the duration of the program;
- Actively participating in the required pre-entry briefing prior to beginning on-site work, and any subsequent safety meetings that are conducted during the implementation of the program;
- Bringing forth any questions or concerns regarding the content of the HASP to the SSO or PM prior to the start of work;
- Ensuring, via daily inspections, that their equipment is in good working order;
- Operating their equipment in a safe manner;
- Stopping work in the event that an immediate danger situation is perceived; and,

- Reporting all accidents, injuries and illnesses, regardless of their severity, to the SSO.

1.4 Management of Change/Modification of the HASP

1.4.1 Management

The procedures in this HASP have been developed based on a review of previous investigative reports for the site, the proposed remedial design and the current proposed PDI scope of work. Every effort has been made to address the physical and chemical hazards that may be encountered during the implementation of the proposed subsurface investigation program. However, unanticipated site-specific conditions or situations may occur during the implementation of this project. Also, ENSR and/or the contractors may elect to perform certain tasks in a manner that is different from what was originally intended due to a change in field conditions. As such, this HASP must be considered a working document that is subject to change to meet the needs of this dynamic project.

ENSR and/or ENSR's contractors will complete a Job Safety Analysis (JSA) when new tasks or different techniques not addressed in the HASP are proposed. The use of new techniques will be reviewed and if new hazards are associated with the proposed changes, they will be documented on the JSA form. An effective control measure must also be identified for each new hazard. JSA forms will be reviewed by the SSO prior to being implemented. Once approved, the completed forms will be reviewed with all field staff during the daily safety meeting. A blank JSA form is presented as Attachment B.

1.4.2 HASP Modification

Should significant information become available regarding potential on-site hazards, it may be necessary to modify this HASP. All proposed modifications to this HASP must be reviewed and approved by the ENSR RHSM before such modifications are implemented. Any significant modifications must be incorporated into the written document as addenda and the HASP must be reissued. The ENSR PM will ensure that all personnel covered by this HASP receive copies of all issued addenda. Sign-off forms will accompany each addendum and must be signed by all personnel covered by the addendum. Sign-off forms will be submitted to the ENSR PM. The HASP addenda should be distributed during the daily safety meeting so that they can be reviewed and discussed. Attendance forms will be collected during the meeting.

2.0 Site Location and History

2.1 Site Location

The former Clifton MGP site is situated at the northwestern corner of the intersection of Bay Street and Willow Avenue in the Clifton section of Staten Island, New York and encompasses an area of approximately 3.53 acres. OU-2 is the focus of this report and includes the following parcels: 25 Willow Avenue, adjacent parcels located to the northwest on Greenfield Avenue, railroad embankment and active railroad right of way (ROW), and a small triangular shaped parcel located between Bay Street and Edgewater Street. OU-2 also encompasses the (ROW) of Willow Avenue, Edgewater Street and Bay Street adjacent to the 25 Willow Avenue parcel, as well as the property located at One Edgewater Street.

The 25 Willow Avenue parcel is currently improved with an unoccupied single-story, multi-bay, commercial building. The building was formerly utilized as an automotive repair and new car preparation facility. Automotive repair operations were conducted within the building and included the storage and handling of petroleum products (*i.e.*, motor oil, gasoline, diesel fuel, *etc.*). With the exception of a small landscaped strip of land that separates the site building from the adjacent Bay Street, the remainder of the site is surfaced with bituminous pavements and utilized for automobile parking.

The 25 Willow Avenue parcel is currently zoned for manufacturing. The area surrounding the site is characterized by a combination of urban, residential and commercial uses. Commercial parcels are located on Greenfield Avenue to the northwest of the 25 Willow Avenue Parcel. A vacant lot, currently utilized for parking, is located to the northeast of the site between Bay and Edgewater Streets.

2.2 Site Impacts

Several environmental investigations were performed at the site and indicate that MGP-related compounds are present in soil and groundwater on and adjacent to the site. These impacts include:

- Tar/non-aqueous phase liquids (NAPL)-saturated soils;
- Soils with tar blebs, globs, lenses, grain-coating, sheens, and
- Stained soil, and/or soils with naphthalene/hydrocarbon-like odors.

2.3 Remedial Design

ENSR has prepared a remedial design work plan for the former Clifton MGP site OU-2. The work plan provides the framework for implementing the New York State Department of Environmental Conservation (NYSDEC) selected remedy in accordance with the record of decision (ROD) for the site [NYSDEC, 2006] and the Administrative Order on Consent [Index No. D2-0001-98-04, (NYSDEC, 1998)] between Brooklyn Union (now KeySpan) and the NYSDEC.

The work plan provides details of the remedial action and the methods and procedures by which the anticipated activities will be completed in order to satisfy the remedial objectives. The work plan also includes the details of the PDI activities. The components of the remedy as defined in the ROD are as follows:

- Demolition of the existing building on the site to allow for the excavation of the contamination located beneath the building;
- Removal of former MGP-related structures including their foundations which contain coal tar to the extent practicable;

- Excavation of approximately 38,300 cubic yards of grossly contaminated soils, down to an approximate depth of ten (10) feet below ground surface (bgs);
- Backfill of the excavated areas with clean fill from an off-site location. Visually clean material from on-site building demolition may be used to backfill the lower portion of the excavated areas. The top two (2) feet will consist of clean soil capable of supporting vegetation;
- Installation of vertical cutoff walls in the subsurface to prevent off-site migration of dense nonaqueous phase liquids DNAPL (coal tar) from the site;
- Installation of recovery wells to allow for collection, treatment and disposal of DNAPL that remain at depth in the subsurface after the excavation work is complete; and,
- Development of a site management plan and environmental easement

3.0 Scope of Work

3.1 Objectives of Pre-Design Investigation

During PDI activities, the following information will be collected for design of the final remedy:

- Soil analytical data needed to characterize the soils to be excavated for off-site disposal at a KeySpan approved facility. This data is required by the off-site facilities where the soils will be taken for final disposal.
- Geotechnical data around the perimeter of the site, including along Willow Avenue and Bay Street. This data will be used to help design the cutoff wall, temporary excavation bracing; and dewatering system necessary to allow excavation of soils at the site.
- Testing of soil at the site for dewatering and soil management parameters. This information is necessary to predict how the soil will need to be handled on site before sending it off-site for disposal.
- Testing of groundwater to define the likely design/effluent permitting requirements for on-site treatment systems.

3.2 Investigative Field Program

The field tasks that are being conducted as part of this pre-design investigation include the following:

- Advance geotechnical soil borings, using a hollow stem auger, in areas along the proposed barrier wall alignment and along the remaining areas of the perimeter of impacts to be excavated;
- Collect soil samples for geotechnical testing;
- Advance soil borings, using direct-push techniques, in a grid pattern within the proposed excavation area;
- Advance monitoring wells (exact number and placement will be decided during PDI as per investigation results) up gradient of the proposed vertical cut off barrier walls.
- Collect soil samples from the soil borings for waste pre-characterization analyses;
- Excavate test pits, using a backhoe, to locate structures not detailed during previous investigations and to evaluate the presence of obstructions along the barrier wall alignments;
- Collect groundwater samples for the design of water treatment system; and,
- Gauge DNAPL present in select monitoring wells and collect samples analysis of physical and chemical characteristics.

4.0 Chemical Hazard Assessment and Controls

4.1 Chemical Hazards

Typical wastes associated with former MGP operations could include volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), tar-like materials, purifier box wastes (potentially containing cyanide complexes and compounds), and certain trace metals associated with ash and clinkers.

4.1.1 Volatile Organic Compounds

The VOCs associated with MGP wastes include BTEX. Exposure to the vapors of BTEX above their respective OSHA permissible exposure limits (PELs) may produce irritation of the mucous membranes of the upper respiratory tract, nose, and mouth. Overexposure may also result in the depression of the central nervous system (CNS). Symptoms of such exposure include drowsiness, headache, fatigue and drunken-like behaviors. Prolonged overexposure to benzene vapors has detrimental effects on the blood-forming system ranging from anemia to leukemia.

The PEL for benzene is 1 part per million (ppm), as an 8 hour time-weighted average (TWA). The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a threshold limit value (TLV) of 0.5 ppm. The OSHA PEL for ethylbenzene is 100 ppm. The PEL for toluene is 200 ppm. However, the ACGIH recommends a TLV of 50 ppm for toluene. Xylene is a flammable, colorless liquid with an OSHA PEL of 100 ppm as an 8-hour TWA.

4.1.2 Polycyclic Aromatic Hydrocarbons

Typical coal gasification byproducts (coal tar) are referred to as PAH compounds. PAH compounds are a family of multiple ring aromatic compounds commonly found in fossil fuels and formed from the incomplete combustion of organic materials. Repeated contact with PAH compounds may cause photosensitization of the skin, producing skin burns after subsequent exposure to ultra-violet light. Certain PAHs as a group are considered potential human carcinogens (CaPAH). OSHA regulates PAHs as coal tar pitch volatiles (CTPV) and has established a PEL for CTPV of 0.2 mg/m3, as an 8-hr TWA.

Of the PAH compounds typically present at MGP sites, naphthalene is typically present at higher concentrations than the other compounds. Naphthalene is easily detected due to its characteristic moth-ball like odor. The inhalation of high concentrations of naphthalene vapor may result in nausea, vomiting, abdominal pain, and irritation of the bladder. Prolonged overexposure may result in renal shut down. The OSHA PEL for naphthalene, as an 8-hr TWA, is 10 ppm.

4.1.3 Oxide Box Wastes

Blue staining is the characteristic associated with the presence of oxide box wastes (ferrocyanide). Therefore, the presence of this material is very easily identified during field investigations. The cyanides associated with oxide box wastes are present in a form that is generally unavailable or complexed with metals such as iron, which makes the cyanide more stable. Thus, the reported effects of free cyanide are not applicable. OSHA has not established a PEL for ferro/ferri cyanide compounds. Similarly, the ACGIH has not recommended a TLV for these compounds.

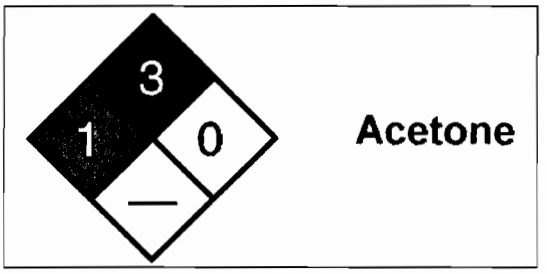
4.1.4 Metals

Lead is a common component of urban fill and soils present at industrial sites, such as former MGP and electrical generating sites. In general, the inhalation of metal dusts is irritating to the upper respiratory tract and nasal mucous membranes. Most metal dusts may cause dermatitis and/or eye irritation. The early symptoms of lead poisoning, as a result of overexposure (either through ingestion or inhalation) include fatigue, sleep disturbance, headache, aching bones and muscles, digestive irregularities, abdominal pains, and decreased appetite. Chronic overexposures to lead affect the CNS and male and female reproductive systems. Lead has also been identified as a fetotoxin. The OSHA PEL for inorganic lead is 50 micrograms per cubic meter (ug/m^3).

4.1.5 Hazardous Substances Brought On-Site by ENSR and Contractors

A material safety data sheet (MSDS) must be available for each hazardous substance that ENSR or their contractors bring on the property. A MSDS for each substance that ENSR or its subcontractors bring on the property must be on site during field work. This includes solutions/chemicals that will be used to decontaminate sampling equipment and calibration gases for the screening instrumentation.

In addition, all containers of hazardous materials must be labeled in accordance with OSHA's Hazard Communication Standard. Either the original manufacturer's label or an NFPA 704M label specific for the material (as shown at the right) is considered to be an acceptable label.



4.2 Chemical Exposure and Control

4.2.1 Chemical Exposure Potential

Most of the proposed investigations are taking place in impacted areas of the site where future impacted soil excavation is being proposed. As such, the field team should be prepared to encounter contamination during the proposed pre-design investigation of the property. The most likely routes of potential chemical exposure during the implementation of this field program include the following:

- Inhalation of vapors and/or dusts of the contaminants of concern during soil boring, test pit excavation and sampling activities;
- Direct dermal contact with potentially contaminated soils during sampling; and,
- Direct dermal contact with NAPL (if encountered) during investigative activities.

4.2.2 Chemical Exposure Control

The potential chemical hazards associated with the proposed activities can be controlled in several ways, including:

- Direct-reading air monitoring instrumentation will be used, as described in Section 6.0 of this HASP, to determine the concentration of VOC vapors may be present in the work area and in the employee's breathing zone during intrusive site activities as described above. If necessary, respiratory protection, as defined in Section 7.2 of this HASP, may be donned to control employee exposure to the vapors of VOCs.
- Dusts from contaminated soils may be generated during intrusive site activities. If necessary, a light mist of water can be applied to the borehole or excavation to suppress dust generation. A MIE Data-Ram total dust monitor, or its equivalent, will be used to monitor the effectiveness of these engineering controls and to determine if respiratory protection is required.

- If necessary, odor control foam and plastic sheeting will be used to minimize odors generated during test pitting.
- To avoid direct dermal contact with contaminated media, protective clothing, as described in Section 7.1, will be required when handling and collecting samples and decontaminating equipment.
- Although highly unlikely, exposure to all of the contaminants of concern may occur via ingestion (hand-to-mouth transfer). The decontamination procedures described in Section 9.0 address personal hygiene issues that will limit the potential for contaminant ingestion.

5.0 Physical Hazards and Controls

5.1 Utility Hazards

5.1.1 Underground Utilities

New York law requires that a utility clearance be performed at least two (2) days prior to initiation of any subsurface work. The drilling contractor and excavation contractor will contact New York City – Long Island One Call Center (1-800-272-4480) to request a mark-out of natural gas, electric, telephone, cable television, water and sewer lines in the proposed soil boring and test pit locations. Work will not begin until the required utility clearances have been performed.

Public utility clearance organizations typically do not mark-out underground utility lines that are located on private property. Therefore, utilities that may be located in the area where the soil borings and test pits are being advanced must be identified via other mechanisms. As such, the contractor must exercise due diligence and try to identify the location of any private utilities on the property being investigated. The contractor can fulfill this requirement in several ways, including:

- obtaining as-built drawings for the areas being investigated from the property owner;
- visually reviewing each proposed soil boring location with the property owner or knowledgeable site representative;
- performing a geophysical survey to locate utilities;
- hiring a private line locating firm to determine the location of utility lines that are present at the property; or,
- hand clearing to a depth of at least 5 feet below ground surface (bgs) in the soil boring locations if insufficient data is available to accurately determine the location of the utility lines.

For this program, proposed boring locations will be hand-cleared to five feet bgs to ensure the locations are free of underground utilities. Once clear, drilling and excavation activities will proceed slowly and carefully for the top ten feet of each investigation location to further avoid disruption of, or damage to, subsurface utilities. Proposed sampling locations will be shifted to avoid subsurface and overhead utilities as appropriate.

5.1.2 Overhead Utilities

Field personnel should be particularly aware of overhead lines, especially slack lines, in the work area. All equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a minimum clearance of 20 feet {29 CFR 1910.133 (c) (3) (iii)} is maintained. Operating or erecting any machinery within 20 feet of high-voltage lines is a prohibited activity as defined in 12 NYCRR Part 57 (high voltage proximity). The conventional drill rig mast must be lowered before moving.

If the required clearance cannot be maintained at any work area at the site, additional precautions must be taken to ensure contact with the overhead lines does not occur. Options include, but may not be limited to, de-energizing the line or placing an insulating barrier over the line. Both of these options will require coordination with the owner of the lines in question.

5.2 Traffic/ Pedestrian Hazards

5.2.1 On-Site

With the exception of a small landscaped strip of land that separates the 25 Willow Avenue building from the adjacent Bay Street, the remainder of the site is surfaced with bituminous pavements and utilized for automobile parking. Geoprobe soil borings are being advanced across the KeySpan property and within the areas used for automobile parking. ENSR and KeySpan will work together to ensure that all automobiles are removed from the proposed areas of investigation.

If automobiles will be moved on a regular basis while ENSR is working at the site, the following on-site traffic control measures will be implemented:

- Notify the property owner of your work location, dates of work and the anticipated work times. Suggest the possibility of a detour around the work area.
- Wear an ANSI-approved Class II safety vest.
- Set up traffic cones 50 feet in front of the work area. "Men at Work" signs should also be placed in a conspicuous area to warn others of your presence.

5.2.2 Off-Site

Currently, there are several geotechnical soil borings that are being installed in the sidewalk on Willow Avenue and Bay Street. ENSR will work with County officials to acquire a street opening permit and determine proper procedures and protocols such as signage for drilling within the sidewalks to the east and south of the KeySpan property. Copies of access agreements and permits will be kept onsite during the performance of the field investigations to ensure compliance with requirements.

ENSR and KeySpan must also ensure safe pedestrian passage along the sidewalks on Willow Avenue and Bay Street.

If any soil borings are being advanced within the streets themselves, ENSR must prepare a formal Traffic Management Plan that meets the requirements for temporary traffic control as outlined in the United States Department of Transportation Federal Highway Administration's Manual on Uniform Traffic Control Devices for Street and Highways. The plan must provide specific drawings that detail how traffic will be managed around the work area, what signage and warning devices will be displayed in the road to warn motorists of the change in traffic flow.

5.3 On-Site Vehicle Safety

The following requirements will be implemented, as applicable, by all members of the project team:

- The parking brake must be set on all personal vehicles used on this project. Additionally, the wheels of all support vehicles must be chocked when the machine is placed in position and/or parked for the night.
- Vehicles may not have engines idling for more than three (3) minutes unless the vehicle engine is required to power equipment.
- Polyethylene sheeting, a minimum of 10 ml in thickness, must be placed under any vehicle where there is a spill potential that could be detrimental to the environment.

5.4 Drilling Hazards

5.4.1 Geoprobe Hazards

Use of the Geoprobe System to advance soil borings and collect soil samples will require all personnel in the vicinity of the operating unit to wear steel-toed boots, hardhats, hearing protection and safety eyewear. Personnel shall not remain in the vicinity of operating equipment unless it is required for their work responsibilities. Additionally, the following safety requirements must be adhered to:

- A remote vehicle ignition is located on the control panel of the Geoprobe unit. This allows the operator to start and stop the vehicle engine from the rear. This device must be tested prior to job initiation and periodically thereafter. All employees should be aware of how to access and operate the rear ignition.
- The driller must never leave the controls while the probe is being driven.
- Drillers, helpers and geologists must secure all loose clothing when in the vicinity of drilling operations.
- The Geoprobe vehicle shall not be moved any distance with the probe in the extended position. Check for clearance at roof or the vehicle before folding the Geoprobe out of the carrier vehicle.
- Be sure the parking brake is set before probing.
- Never allow the derrick foot to be lifted more than 6" off of the ground surface.
- Deactivate hydraulics when adding or removing probe rods, anvils or any tool in the hammer.
- Verify that all threaded parts are completely threaded together before probing.

5.4.2 Auger Drilling

Use of a drill rig to advance geotechnical soil borings will require all personnel in the vicinity of the operating rig to wear steel-toed boots, hardhats, hearing protection and safety eyewear. Personnel shall not remain in the vicinity of operating equipment unless it is required for their work responsibilities. Additionally, the following safety requirements must be adhered to:

- All drill rigs and other machinery with exposed moving parts must be equipped with an operational emergency stop device. Drillers and geologists must be aware of the location of this device. This device must be tested prior to job initiation and periodically thereafter. The driller and helper shall not simultaneously handle augers unless there is a standby person to activate the emergency stop.
- The driller must never leave the controls while the tools are rotating unless all personnel are kept clear of rotating equipment.
- A long-handled shovel or equivalent must be used to clear drill cuttings away from the hole and from rotating tools. Hands and/or feet are not to be used for this purpose.
- A remote sampling device must be used to sample drill cuttings if the tools are rotating or if the tools are readily capable of rotating. Samplers must not reach into or near the rotating equipment. If personnel must work near any tools which could rotate, the driller must shut down the rig prior to initiating such work.
- Drillers, helpers and geologists must secure all loose clothing when in the vicinity of drilling operations.
- Only equipment which has been approved by the manufacturer may be used in conjunction with site equipment and specifically to attach sections of drilling tools together. Pins that protrude excessively from augers shall not be allowed

- No person shall climb the drill mast while tools are rotating.
- No person shall climb the drill mast without the use of ANSI-approved fall protection (approved belts, lanyards and a fall protection slide rail) or portable ladder which meets the requirements of OSHA standards.

5.5 Excavation Hazards

5.5.1 Working Around Heavy Equipment

The use of heavy equipment poses a potential hazard to the support crew working around the equipment. Use of heavy equipment at the site requires all employees working in the exclusion zone to wear ANSI-approved hard hats, steel-toed safety shoes/boots, safety glasses and hearing protection, as well as traffic vests.

Operators will inspect the equipment daily before use to ensure safe operating conditions and to determine that the brakes and operating systems are in proper working condition and that all required safety devices are in place and functional (i.e reverse gear alarms are working properly).

ENSR employees will be overseeing the excavation of test pits and will be screening soils for the presence of contamination during the excavation program. This will place the spotter within close proximity to the operating machinery. When working around heavy equipment, employees should:

- make sure that the operator is aware of your presence/activities;
- develop a series of hand signals to facilitate communication with the operator.
- stay in the operator's line of sight, don't work in his/her blind spot;
- approach areas where equipment is operating from a direction visible to the operator;
- be aware of the swing radius of the excavator;
- do not walk or work underneath loads handled by digging equipment;
- do not ride in buckets of loaders; and,
- stand away from soil stockpile areas to avoid being struck by any spillage or falling materials.

5.5.2 Cave-In

Unshored excavations will exist as soils are removed from the test pits. It is anticipated that soil samples will be collected remotely or from the bucket of the backhoe, hence eliminating the need to enter the excavation. If it is does become necessary for ENSR employees or ENSR subcontractors to enter an excavation, the following precautions must be implemented:

- A stairway, ladder, ramp or other similar means of egress must be located in trench excavations greater than 4 feet in depth so as to require no more than 25 feet of lateral travel for employees in the trench excavation. Remember that more than one means of egress may be required.
- The excavation must be free of accumulated water before entry is allowed.
- No person shall enter an excavation greater than 5 feet in depth unless:
  - the walls of the excavation have been sloped back to an angle not steeper than one and half horizontal to one vertical (1.5H:1V) {i.e., 34 degrees from the horizontal) as specified in 1926.652(b)

Example - An excavation that was planned to be 5 feet deep and 3 feet wide at the base, would have to be sloped back so that it was 18 feet wide at the top.

- the walls of the excavation have been shored in accordance with the requirements specified in 29 CFR 1926.652(c), (d), and (e) or

- the work in the excavation is to be performed within the confines of an approved shield system (e.g., trench box) that has been constructed and is used in accordance with the requirements of 1926.652(g)

- A stand-by employee must be present at all times when employees are in the excavation.
- All materials, including spoils, shall be placed at least 2 feet from the edge of the excavation to prevent the material from rolling into the excavation. All personnel should remain 2 feet away from the edge of the excavation while personnel are in the excavation.

5.5.3 Open Excavations

To the extent possible, all excavations should be backfilled as soon as possible after work is completed. If excavations are to be left open, the perimeter of the excavation will be marked with high-visibility snow fencing.

5.5.4 Excavations as Confined Spaces

A test pit meets the physical definition of a confined space. As such, no employee will enter the excavation to collect the soil samples.

5.6 Noise Exposure

Use of a drill rig and excavation machinery may expose employees to excessive amounts of noise. Exposure to noise can result in the following:

- Temporary hearing losses where normal hearing returns after a rest period;
- Interference with speech communication and the perception of auditory signals;
- Interference with the performance of complicated tasks; and,
- Permanent hearing loss due to repeated exposure resulting in nerve destruction in the hearing organ.

Since personal noise monitoring will not be conducted during the proposed activities, employees must follow this general rule of thumb: If the noise levels are so loud that you must shout at someone who is 5 feet away from you, you need to be wearing hearing protection. ENSR employees can wear either disposable earplugs or earmuffs but all hearing protection must have a minimum noise reduction rating (NRR) of 27 db.

5.7 Back Safety

Using the proper techniques to lift and move heavy pieces of equipment is important to reduce the potential for back injury. The following precautions should be implemented when lifting or moving heavy objects:

- Use mechanical devices to move objects that are too heavy to be moved manually
- If mechanical devices are not available, ask another person to assist you.
- Bend at the knees, not the waist. Let your legs do the lifting.

- Do not twist while lifting
- Bring the load as close to you as possible before lifting
- Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards

5.8 Use of Hand and Power Tools

A variety of hand and power tools may be used during this program.

5.8.1 Hand Tools

The greatest hazards posed by hand tools result from misuse and improper maintenance.

- When using hand tools be sure you have selected the right tool for the job. If a chisel is used as a screwdriver, the tip of the chisel may break or fly off, hitting the user or others.
- Inspect tools for damage such as mushroomed chisel heads or broken hammer handles. If jaws of the wrench are sprung, the wrench may slip. If a wooden handle is loose, splintered, or cracked, the head of the tool may fly off.
- Do not use damaged tools.
- Be sure you know how to use the tool you are working with.

5.8.2 Knives and Blades

Geoprobe™ soil samples are contained within an acetate liner that must be cut open in order to retrieve the sample. As such, employees are at an increased risk of cutting themselves since a knife or blade is typically used to open the liner and the liner is often placed on an irregular or unstable work surface (*i.e.*, the back of the Geoprobe™ van or the ground). Tube-cutters are available and should be used to eliminate this hazard. If it is necessary to use knives or blades, follow the safety precautions listed below:

- Keep your free hand out of the way.
- Secure your work if cutting through thick material.
- Use only sharp blades; dull blades require more force which results in less knife control.
- Pull the knife toward you; pulling motions are easier to manage.
- Use a self-retracting blade.

5.8.3 Power Tools

To prevent hazards associated with the use of power tools, workers should observe the following general precautions:

- Never carry a tool by the cord or hose.
- Never yank a cord or the hose to disconnect it from the receptacle.
- Keep cords away from heat, oil, and sharp edges.
- Disconnect tools when not using them, before servicing or cleaning them, and when changing accessories such as blades, bits, and cutters.

- Secure work with clamps or vise, freeing up both hands to operate the tool.
- Avoid accidental starting. Do not hold fingers on the switch button when carrying a plugged-in tool.
- Keep tools sharp and clean for best performance.
- Wear appropriate clothing. Loose clothing or jewelry can become caught in moving parts.
- Keep all guards in place.

5.8.4 Use of a Pneumatic Jackhammer

If the specific piece of equipment used to pre-clear a drilling location is equipped with an air compressor, the drillers must hold a New York City Fire Department Certificate of Fitness to operate an air compressor.

Most pneumatic impact tools, such as jackhammers, receive its impact from a rapidly moving reciprocating piston driven by compressed air at about 90 p.s.i. pressure. Before operating the jackhammer,

- Read the operator's instruction manual before using the tool.
- Be sure electric models with a three-wire system are properly grounded, to reduce the risk of fire and electric shock. This is not necessary for double insulated models. Use a ground fault interrupter (GFI) for maximum safety protection.
- Be sure the extension cord for electric models is a size large enough for the distance from the receptacle to tool.
- On engine-driven, air models always fill the gas tank out of doors with engine shut off and cool. Never handle fuel while smoking or in the presence of sparks or open flame. Allow the engine to cool briefly if you need to refuel during operation.
- Always wear proper protective equipment including safety glasses, hearing protection and safety shoes with metatarsal protection.
- Insulated protective gloves with leather work gloves covering the insulated gloves should be worn when hammering in an area where the presence of underground electric lines is unknown or where lines have been located in close proximity to the hammering operation.
- Check all bits to see that they are sharp. If not, sharpen according to the manufacturer's recommendations. Always use eye protection when operating a grinder.
- Check the air hose connections from the compressor to the jackhammer. Most hoses have provisions for safety clips, at the coupling, to ensure the hose does not vibrate loose under pressure.
- Do not exceed manufacturers listed or recommended air pressure.
- Cover the hammer grips with rubber to reduce vibration and fatigue.

When operating the jackhammer,

- Always disconnect the electric power or air supply before inserting or removing tools.
- Be sure all tools are properly locked into the unit before operating.
- Keep all bystanders out of the work area.
- Prevent back injuries by using your leg muscles to lift the machine into operating position.

- Allow the tool to do the work by using a grip light enough to maintain control.
- Take rest breaks as needed.
- If stopping work for a short period of time or for the day, unplug the electricity or stop the compressor.

If jackhammers are used, the operator will wear metatarsal protectors while using the tool.

5.9 Electrical Hazards

If using portable tools that are electrically powered, follow the safety precautions listed below:

- Check to see that electrical outlets used to supply power during field operations is of the three wire grounding type.
- Extension cords used for field operations should be of the three wire grounding type and designed for hard or extra-hard usage. This type of cord uses insulated wires within an inner insulated sleeve and will be marked S, ST, STO, SJ, SJO, or SJTO.
- NEVER remove the ground plug blade to accommodate ungrounded outlets.
- Do not use extension cords as a substitute for fixed or permanent wiring. Do not run extension cords through openings in walls, ceilings, or floors.
- Protect the cord from becoming damaged if the cord is run through doorways, windows, or across pinch points.
- Examine extension and equipment cords and plugs prior to each use. Damaged cords with frayed insulation or exposed wiring and damaged plugs with missing ground blades MUST BE REMOVED from service immediately.
- All portable or temporary wiring which is used outdoors or in other potentially wet or damp locations must be connected to a circuit that is protected by a ground fault circuit interrupter (GFCI). GFCI's are available as permanently installed outlets, as plug-in adapters, and as extension cord outlet boxes. DO NOT CONTINUE TO USE A PIECE OF EQUIPMENT OR EXTENSION CORD THAT CAUSES A GFCI TO TRIP.
- When working in flammable atmospheres, be sure that the electrical equipment being used is approved for use in Class I, Division I atmospheres.
- Do not touch a victim who is still in contact with current. Separate the victim from the source using a dry, nonmetallic item such as a broomstick or cardboard box. Be sure your hands are dry and you are standing on a dry surface. Turn off the main electrical power switch and then begin rescue efforts.

5.10 Generator Safety

A generator may need to be used to power the equipment used during the investigation. When using a generator, follow these safety guidelines:

- Make sure the wattage of the generator is sufficient for your project needs.
- Make sure the voltage rating of the generator matches the rating of the equipment you need to operate.
- Gasoline and it's vapors may ignite if they come in contact with hot components or an electrical spark. Turn the generator off and make sure it has cooled down (*i.e.*, 10-minutes) before re-fueling.

- Properly ground the generator and locate the generator in an outdoors location.
- Keep water away from the generator. Protect it from rain.
- Use a heavy-duty, three-prong, grounded extension cord that is rated for outdoor use.

5.11 Slip, Trips and Falls

5.11.1 Site Conditions

On any work area, it is expected that the ground may be uneven. The ground surface may be unreliable due to settling. Surface debris may be present and wet or swampy areas may exist. Employees should walk around, not over or on top of debris or trash piles. When carrying equipment, identify a path that is clear of any obstructions. It may be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

5.11.2 Good Housekeeping

Maintaining a work environment that is free from accumulated debris is the key to preventing slip, trip and fall hazards at construction sites. Essential elements of good housekeeping include:

- orderly placement of materials, tools and equipment;
- placing trash receptacles at appropriate locations for the disposal of miscellaneous rubbish; and
- promptly removing and securing storage of items that are not needed to perform the immediate task at hand.

5.12 Cold Stress

This current scope of work is being conducted in late fall of 2008. Therefore, the hazards of cold stress are addressed in this plan.

Types of Cold Stress

Cold injury is classified as either localized, as in frostbite, frostnip or chilblain; or generalized, as in hypothermia. The main factors contributing to cold injury are exposure to humidity and high winds, contact with wetness and inadequate clothing.

The likelihood of developing frostbite occurs when the face or extremities are exposed to a cold wind in addition to cold temperatures. The freezing point of the skin is about 30° F. When fluids around the cells of the body tissue freeze, skin turns white. This freezing is due to exposure to extremely low temperatures. As wind velocity increases, heat loss is greater and frostbite will occur more rapidly.

Symptoms of Cold Stress

The first symptom of frostbite is usually an uncomfortable sensation of coldness, followed by numbness. There may be a tingling, stinging or aching feeling in the effected area. The most vulnerable parts of the body are the nose, cheeks, ears, fingers and toes.

Symptoms of hypothermia, a condition of abnormally low body temperature, include uncontrollable shivering and sensations of cold. The heartbeat slows and may become irregular, the pulse weakens and the blood

pressure changes. Pain in the extremities and severe shivering can be the first warning of dangerous exposure to cold.

Maximum severe shivering develops when the body temperature has fallen to 95° F. Productive physical and mental work is limited when severe shivering occurs. Shivering is a serious sign of danger. Immediately remove any person who is shivering from the cold.

Methods to Prevent Cold Stress

When the ambient temperature, or a wind chill equivalent, falls to below 40° F (American Conference of Governmental Industrial Hygienists recommendation), site personnel who must remain outdoors should wear insulated coveralls, insulated boot liners, hard hat helmet liners and insulated hand protection. Wool mittens are more efficient insulators than gloves. Keeping the head covered is very important, since 40% of body heat can be lost when the head is exposed. If it is not necessary to wear a hard hat, a wool knit cap provides the best head protection. A facemask may also be worn.

Persons should dress in several layers rather than one single heavy outer garment. The outer piece of clothing should ideally be wind and waterproof. Clothing made of thin cotton fabric or synthetic fabrics such as polypropylene is ideal since it helps to evaporate sweat. Polypropylene is best at wicking away moisture while still retaining its insulating properties. Loosely fitting clothing also aids in sweat evaporation. Denim is not a good protective fabric. It is loosely woven which allows moisture to penetrate. Socks with a high wool content are best. If two pairs of socks are worn, the inner sock should be smaller and made of cotton, polypropylene or similar types of synthetic material that wick away moisture. If clothing becomes wet, it should be taken off immediately and a dry set of clothing put on.

If wind conditions become severe, it may become necessary to shield the work area temporarily. The SSO and the PM will determine if this type of action is necessary. Heated break trailers or a designated area that is heated should be available if work is performed continuously in the cold at temperatures, or equivalent wind chill temperatures, of 20° F.

Dehydration occurs in the cold environment and may increase the susceptibility of the worker to cold injury due to significant change in blood flow to the extremities. Drink plenty of fluids, but limit the intake of caffeine.

6.0 Air Monitoring

6.1 Direct Reading Instrumentation

The VOCs associated with MGP wastes are volatile enough to pose a potential vapor hazard to those working in the immediate drilling and excavation areas. Therefore, monitoring in the worker's breathing zone will be conducted to ensure that the concentrations of total VOC vapors and airborne dusts, if any, are maintained at safe levels during all subsurface field investigations.

6.1.1 VOC Monitoring

A photoionization detector (PID), such as a RaeSystems MiniRae 2000 PID equipped with a 10.6 ev lamp or equivalent, will be used to screen the breathing zone of employees during all subsurface investigations as site conditions warrant but no less than at least once every hour.

6.1.2 Dust Monitoring

Dust control measures, as described in this HASP, will be implemented to prevent and/or control the concentration of airborne dust levels during the subsurface activities. A MIE Data-Ram total dust monitor, or its equivalent, will be used to monitor the effectiveness of these engineering controls and to determine if measures to mitigate the dust are effective and/or if respiratory protection is required.

6.2 Action Limits for Implementing Controls

Exceedance of the following action limits will require that work be temporarily stopped and cause of the exceedance assessed. If the cause of the condition can be isolated such that the condition no longer persists or the activity that produced the exceedance can be modified to prevent future exceedance, then the work can continue in Level D PPE. If these alternatives cannot be realized then wearing of Level C respiratory protection will be required, as described in Section 7.2 of this HASP.

If breathing zone concentrations of total VOCs are sustained (15 minutes) at 1 unit above background, a measurement will be made for the presence of benzene using a colorimetric detector tube. In the absence of benzene, control measures will be implemented if total VOC concentration is sustained at 25 units as indicated by the PID. If benzene is present at concentrations of 1 ppm or more as indicated by the detector tube, control measures will be implemented.

An action level of 150 ug/m^3 has been established for total dust (sustained downwind at breathing zone for 15-minutes). The total dust monitor will be used to determine that total dust levels upwind and downwind of the work area.

6.3 Personal Exposure Monitoring

Personal exposure monitoring will not be conducted during the proposed pre-design investigation.

6.4 Calibration and Recordkeeping

Equipment used by ENSR will be calibrated in accordance with the quality assurance plan and ENSR's standard operating procedures. The PID will be calibrated to an isobutylene-in-air mixture. The dust monitor

will be zeroed daily. All calibrations will be recorded in a field notebook or separate equipment calibration sheets.

6.5 Community Air Monitoring Plan

Community air monitoring requires real-time monitoring for VOC and particulates at the downwind perimeter of each designated work area when certain activities are in progress at the site. The community air monitoring is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (*i.e.*, off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigation work activities. The Community Air Monitoring Plan (CAMP) for the PDI is provided as Appendix A to this HASP and specifies action levels which require increased monitoring, corrective actions to abate emissions, and/or work shutdown for the PDI.

7.0 Personal Protective Equipment

Personal protective equipment (PPE) will be worn during these activities to prevent on-site personnel from being injured by the safety hazards posed by the site and/or the activities being performed. The following table describes the PPE and chemical protective clothing to be worn for general site activities and for certain specific tasks.

7.1 Chemical Protective Clothing

PPE Item	Installation of Borings Using Geoprobe	Installation of Borings using HSA	Excavation of Test Pits	Collection of Soil Samples
Hard Hat	✓	✓	✓	
ANSI-approved Class II Safety Vest	When working in or near street	When working in or near street	✓	When working in or near street
Steel Toed Safety Shoes	✓	✓	✓	
Safety Glasses with Sideshields	✓	✓	✓	
Ansell Chemi-Pro nitrile gloves				✓
Polycoated Tyvek coveralls	If NAPL is encountered	If NAPL is encountered	If NAPL is encountered	
Kevlar gloves	When cutting acetate liners	When handling drill rods		
Hearing Protection	✓	✓	✓	If sampling near operating machinery

7.2 Respiratory Protection

As described in Section 6.1 of this HASP, direct reading instrumentation will be used to screen the breathing zone of employees during subsurface investigations and sampling activities. Exceedance of the following action limits will require that work be temporarily stopped and cause of the exceedance assessed. If the cause of the condition can be isolated such that the condition no longer persists or the activity that produced the exceedance can be modified to prevent future exceedance, then the work can continue in Level D PPE. If these alternatives cannot be realized then wearing of Level C respiratory protection will be required, as described below.

Contaminant	Action Limit (Sustained for 15 minutes)	Respirator Selection
Total VOCs (in the absence of benzene as determined by colorimetric indicator tube)	25 units on PID	Half-mask air-purifying respirator (APR) with organic vapor cartridges.
Benzene (as indicated by colorimetric indicator tube)	1 ppm to 10 ppm > 10 ppm	Half-mask air-purifying respirator (APR) with organic vapor cartridges. Suspend work and contact PM and RHSM.
Dust	150 ug/m^3	Apply light mist of water to borehole or excavation. If engineering controls are not sufficient, don half-mask APR with P-100 filters.

Level C Specification – Half-mask air-purifying respirator equipped with organic vapor cartridges and P-100 filters

All employees who are expected to wear respirators must have successfully passed a qualitative fit-test within the past year for the brand, model and size respirator they plan to wear for this program.

7.3 Other Safety Equipment

The following additional safety items should be available at the site:

- Portable, hand-held eyewash bottles
- First aid kit
- Potable Water for drinking and hand-washing
- Type A-B-C fire extinguisher (located on drill rig and excavator)
- Portable phones

8.0 Site Control/Decontamination

To prevent both exposure of unprotected personnel and migration of contamination due to tracking by personnel or equipment, hazardous work areas will be clearly identified and decontamination procedures will be required for personnel and equipment leaving those areas.

8.1 Designation of Zones

ENSR designates work areas or zones as suggested in the "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," NIOSH/OSHA/USCG/EPA, November 1985. They recommend that the areas surrounding each of the work areas to be divided into three zones:

- Exclusion or "Hot" Zone
- Contamination Reduction Zone (CRZ)
- Support Zone

8.1.1 Exclusion Zone

Formal exclusion zones will be established around each drilling and excavation location. Zones will be demarcated with caution tape or traffic cones to identify the perimeter of each work area. All personnel entering the work areas must wear the prescribed level of protective equipment.

If work is conducted within the streets, the exclusion zones will be established in accordance with the formal and documented traffic control and management plans.

8.1.2 Contamination Reduction Zone

A mini-decontamination zone will be established adjacent to each work area. Personnel will remove gloves and other disposable items in this area and place them in a plastic bag until they can be properly disposed of.

Additionally, following procurement of appropriate agreements and permits, ENSR will mobilize to the site and set up a decontamination area, drum storage area, and heavy equipment laydown area for the PDI activities. This area will be placed within KeySpan property in a centrally located area

8.1.3 Support Zone

At this site, the support zone will include the area outside of the exclusion zone.

8.2 General Site Safety Practices

The following measures are designed to augment the specific health and safety guidelines provided in this plan.

- ENSR personnel should avoid working alone on sites that pose a security risk. On most sites, client, subcontractor, or public personnel are generally nearby in case of an emergency or accident. ENSR personnel, through coordination, can rely upon these personnel for assistance in an emergency. If no one else is nearby, scheduled call-ins on a cell phone may be used to assure personal safety or the buddy system will be implemented.

- Smoking is prohibited in all work areas. Matches and lighters are not allowed in these areas.
- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activities.
- The use of alcohol or illicit drugs is prohibited during the conduct of field operations.
- All equipment must be decontaminated or properly discarded before leaving the site in accordance with the project work plan.

9.0 Decontamination

9.1 Personal Decontamination

Proper decontamination is required of all personnel before leaving the exclusion zone. Decontamination will occur within the contamination reduction zone. Disposable PPE, such as gloves, will be removed in the decontamination reduction zone and placed in garbage bags for disposal as general refuse.

Regardless of the type of decontamination system required, as a minimum, a container of potable water and liquid soap should be made available so employees can wash their hands and face before leaving the site for lunch or for the day. Employees should always wash their face and hands with soap and water before eating, smoking or drinking.

9.2 Equipment Decontamination

Decontamination of equipment will be performed in order to prevent contaminated material from being spread offsite.

9.2.1 Sampling Equipment

Prior to sampling, all non-dedicated sampling equipment (bowls, spoons, interface probes, *etc.*) will be either steam cleaned or washed with potable water and a phosphate-free detergent (such as Alconox™). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, *etc.* The sampling equipment will then be rinsed with potable water followed by a deionized water rinse. Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. At no time will washed equipment be placed directly on the ground. Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

9.2.2 Heavy Equipment

A temporary decontamination area lined with polyethylene sheeting will be constructed for decontaminating the drilling and excavation equipment. Water collected from the decontamination cleaning activities will be collected in 55-gallon drums and managed as investigation-derived waste (IDW).

All drilling equipment including the drilling rig, augers, bits, rods, tools, split-spoon samplers, and tremie pipe will be cleaned with a high-pressure steam cleaning or hot water pressure washing unit, as appropriate, before beginning work. Tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning or pressure washing. Direct contact with the ground will be avoided. All augers, rods, and tools will be decontaminated between each drilling location according to the above procedures. The back of the drill rig and all tools, augers, and rods will be decontaminated at the completion of the work and prior to leaving the site.

9.3 Investigation-Derived Waste

All investigation-derived waste (IDW) generated during the PDI will be collected in properly labeled 55-gallon drums and grouped by environmental matrix. Subsequently, the drums will be characterized with laboratory analyses and properly disposed in accordance with management of IDW procedures prepared for this program.

10.0 Training Requirements

10.1 Medical Monitoring

All personnel performing activities covered by this HASP must be active participants in a medical monitoring program that complies with 29 CFR 1910.120(f). Each individual must have completed an annual surveillance examination and/or an initial baseline examination within the last year prior to performing any work on the site covered by this HASP.

10.2 Health and Safety Training

10.2.1 HAZWOPER

All personnel performing activities covered by this HASP must have completed the appropriate training requirements specified in 29 CFR 1910.120 (e). Each individual must have completed an annual 8-hour refresher training course and/or initial 40-hour training course within the last year prior to performing any work on the sites covered by this HASP. Also, on-site managers and supervisors directly responsible for supervising individuals engaged in hazardous waste operations must have completed the specified 8-hour managers training course. (Note that ENSR corporate policy requires that whenever three or more ENSR employees are performing work on the same site, at least one of these individuals must have completed the manager's training course.)

10.2.2 First Aid/CPR

At least one ENSR employee working on site must be currently trained and certified to provide First Aid and CPR.

10.2.3 Pre-Entry Briefing

Prior to the commencement of on-site activities, a pre-entry briefing will be conducted by the SSO to review the specific requirements of this HASP. Attendance of the pre-entry meeting is mandatory for all personnel covered by this HASP and must be documented on the attendance form provided in Attachment C. HASP sign-off sheets should also be collected at the time of the pre-entry briefing. All documentation should be maintained in the project file.

The pre-entry briefing must be completed for each new employee before they begin work at the site. Short safety refresher meetings will be conducted, as needed, throughout the duration of the project. Specific topics that will be discussed during the pre-entry briefing include:

- Discussion of site history
- Discussion of work scope
- Review of the potential hazards associated with contaminants of concern and how these potential hazards will be controlled
- Discussion of the potential physical hazards associated with implementing scope of work
- Review of air monitoring requirements and action limits
- Review of PPE and engineering control requirements

- Review of emergency egress and hospital location/directions
- Review of decontamination procedures

10.3 Daily Safety Meetings

Daily meetings will also be held by the SSO to ensure that all workers are prepared for and knowledgeable of that day's scope of work. Safety concerns will also be discussed at these meetings. All ENSR and contractor field employees must be present and sign the attendance sheet.

11.0 Emergency Response

OSHA defines emergency response as any "response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result in an uncontrolled release of a hazardous substance." According to ENSR policy, ENSR personnel shall not participate in any emergency response where there are potential safety or health hazards (i.e., fire, explosion, or chemical exposure). ENSR response actions will be limited to evacuation and medical/first aid as described within this section below. As such this section is written to comply with the requirements of 29 CFR 1910.38 (a).

The basic elements of an emergency evacuation plan include:

- employee training,
- alarm systems,
- escape routes,
- escape procedures,
- critical operations or equipment,
- rescue and medical duty assignments,
- designation of responsible parties,
- emergency reporting procedures and
- methods to account for all employees after evacuation.

11.1 Employee Training

Employees must be instructed in the site-specific aspects of emergency evacuation. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.

11.2 Alarm System/Emergency Signals

An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be direct verbal communications. Each site must be assessed at the time of initial site activity and periodically as the work progresses. Verbal communications must be supplemented anytime voices can not be clearly perceived above ambient noise levels (i.e., noise from heavy equipment; drilling rigs, backhoes, etc.) and anytime a clear line-of-sight can not be easily maintained amongst all ENSR personnel because of distance, terrain or other obstructions.

Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. The property is unoccupied. ENSR will bring a portable phone to the site to ensure that communications with local emergency responders is maintained, when necessary.

11.3 Escape Routes and Procedures

During an on-site emergency, ENSR employees will leave the site via the gates located at Willow Avenue and Bay Street. Personnel on site are responsible for knowing the escape route from the site and where to assemble after evacuation.

11.4 Rescue and Medical Duty Assignments

The phone numbers of the police and fire departments, ambulance service, local hospital, and ENSR representatives are provided in the emergency reference sheet. This sheet will be posted in the site vehicle.

In the event an injury or illness requires more than first aid treatment, the SSO will accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the on-site project manager and the RHSM.

If the injured employee can be moved from the accident area, he or she will be brought to the CRZ where their PPE will be removed. If the person is suffering from a back or neck injury the person will not be moved and the requirements for decontamination do not apply. The SSO must familiarize the responding emergency personnel about the nature of the site and the injury. If the responder feels that the PPE can be cut away from the injured person's body, this will be done on-site. If this not feasible, decontamination will be performed after the injured person has been stabilized.

11.5 Designation of responsible parties

The SSO is responsible for initiating emergency response. In the event the SSO can not fulfill this duty, the alternate SSO will take charge.

11.6 Employee Accounting Method

The SSO is responsible for identifying all ENSR personnel on-site at all times. On small, short duration jobs this can be done informally as long as accurate accounting is possible.

11.7 Near Miss Reporting

A *Near Miss Incident* is defined as any undesired event that, under slightly different circumstances (*e.g.,* timing, distance, chance, *etc.*) could have resulted in personal harm, property damage, an environmental release or any undesired loss of resources. In other words, a *Near Miss Incident* is a situation in which an accident almost occurred. The purpose of reporting, and following up on, Near Miss Incidents is the same as that for incidents that result in injuries, illnesses, property damage or environmental releases: to prevent their reoccurrence. By reporting and following up on Near Miss Incidents, thereby theoretically reducing their frequency, corporations can reduce the frequency of more serious accidents and incidents.

11.8 Accident Reporting and Investigation

Any incident (other than minor first aid treatment) resulting in injury, illness or property damage requires an accident investigation and report. The investigation should be conducted as soon as emergency conditions are under control. The purpose of the investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided. An ENSR accident investigation form is presented in Attachment D of this HASP. The injured ENSR employee's supervisor and the RHSM should be notified immediately of the injury.

If a subcontractor employee is injured, they are required to notify the ENSR SSO. Once the incident is under control, the subcontractor will submit a copy of their company's accident investigation report to the ENSR SSO.

EMERGENCY REFERENCES

Ambulance:	911
Fire:	911
Police:	911
Medical Services:	718-226-9000
	Staten Island University Hospital
	475 Seaview Ave – Staten Island

1. Start at **25 WILLOW AVE, STATEN ISLAND** going toward **BAY ST** go **< 0.1** mi
2. Turn **RIGHT** on **BAY ST** go **0.9** mi
3. Turn **RIGHT** on **SCHOOL RD** go **0.3** mi
4. Bear **LEFT** on **LILY POND AVE** go **0.7** mi
5. Bear **RIGHT** on **FR CAPODANNO BLVD** go **1.5** mi
6. Turn **RIGHT** on **SEAVIEW AVE** go **0.5** mi
7. Arrive at **475 SEAVIEW AVE, STATEN ISLAND,** on the **RIGHT** go **< 0.1** mi

On Site Telephone: Bring portable communications.

ENSR Project Representatives:

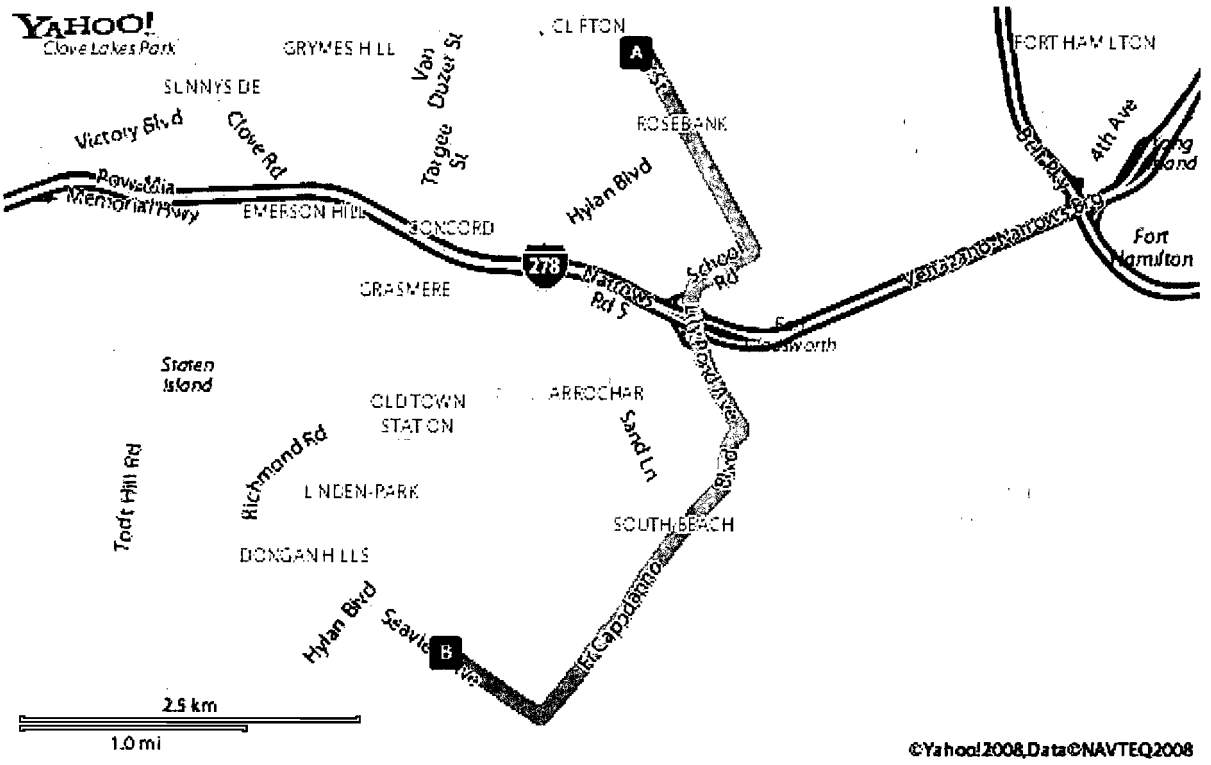
ENSR/Westford, MA	(978) 589-3000
-Kathy Harvey (RHSM)	x 3325
ENSR/Nyack, NY	(845) 348-1520
-Dave Work (PM)	

Map from Property to Staten Island University Hospital

START A **25 Willow Ave, Staten Island, NY 10305-1814**

FINISH B **475 Seaview Ave, Staten Island, NY 10305-3436**

Total Distance: 3.9 miles, Total Time: 13 mins (approx.)



Attachment A

Health and Safety Plan Receipt and Acceptance Form

Health and Safety Plan Receipt and Acceptance Form

Pre-Design Investigation

Former Clifton MGP Site – Operable Unit 2

Richmond County, New York

I have received a copy of the Health and Safety Plan prepared for the above-referenced site and activities. I have read and understood its contents and I agree that I will abide by its requirements.

Name	Signature	Company	Date

Attachment B

Job Hazard Analysis Form

Job Safety Analysis

JSA Type: ☐ Investigation ☐ O&M ☐ Office ☐ Construction ☐ Other	☐ New ☐ Revised	Date:
Work Activity:		
Personal Protective Equipment (PPE):		

Development Team	Position/Title	Reviewed By	Position/Title	D

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Cri
		•	•
		•	•
		•	•
		•	•
		•	•
		•	•
		•	•
		•	•
		•	•
		•	•
		•	•
		•	•

1 – Target number of job steps: six to ten

2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Elimination, Engineering Controls, Safe Work Practice / SOP, Administrative Controls, and/or PPE.

4 – Stop Work Trigger: Condition or situation that would require work to be stopped and hazards re-assessed.

Attachment C

Health and Safety Plan Pre-Entry Briefing Attendance Form

Health and Safety Plan Pre-Entry Briefing Attendance Form

Pre-Design Investigation

Former Clifton MGP Site – Operable Unit 2

Richmond County, New York

Conducted by:		**Date Performed:**	
Topics Discussed:	1. Review of the content of the HASP (Required)		
	2.		
	3.		
	4.		

Printed Name	Signature	Representing

Attachment D

Supervisor's Accident Investigation Report Form

H&S SOP NO: 4.2

SUPERVISOR'S ACCIDENT INVESTIGATION REPORT

Injured Employee _____ Job Title _____

Home Office _____ Division/Department _____

Date/Time of Accident _____

Location of Accident _____

Witnesses to the Accident _____

Injury Incurred? _____ Nature of Injury _____

_____

Engaged in What Task When Injured? _____

_____

Will Lost Time Occur? _____ How Long? _____ Date Lost Time Began _____

Were Other Persons Involved/Injured? _____

_____

How Did the Accident Occur? _____

_____

_____

_____

_____

What Could Be Done to Prevent Recurrence of the Accident? _____

_____

_____

What Actions Have You Taken Thus Far to Prevent Recurrence? _____

_____

_____

Supervisor's Signature _____ Title _____ Date _____

Reviewer's Signature _____ Title _____ Date _____

Note: If the space provided on this form is insufficient, provide additional information on a separate page and attach. The completed accident investigation report must be submitted to the Regional Health and Safety Manager within two days of the occurrence of the accident.

Appendix A of Health and Safety Plan

Draft Community Air Monitoring Plan for Pre-Design Investigation

Former Clifton MGP Site
Operable Unit No. 2
Clifton, Richmond County, New York

Prepared by:

ENSR Corporation
20 Exchange Place, 12th Floor
New York, NY 10005

ENSR Project Number: 01765-070

Prepared for:

National Grid USA
287 Maspeth Avenue
Brooklyn, NY 11211

August 22, 2008

Appendix A of Health and Safety Plan

Draft Community Air Monitoring Plan for Pre-Design Investigation

Former Clifton MGP Site
Operable Unit No. 2
Clifton, Richmond County, New York

Prepared by:

ENSR Corporation
20 Exchange Place, 12th Floor
New York, NY 10005

ENSR Project Number: 01765-070

Prepared for:

National Grid USA
287 Maspeth Avenue
Brooklyn, NY 11211

Prepared by:

_____

Shail N. Pandya, Project Engineer

Reviewed by:

_____

Dave Work, P.E., Senior Engineer

August 22, 2008

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1 Introduction

This document provides the Community Air Monitoring Plan (CAMP) that will be implemented during the Pre-Design Investigation (PDI) of the National Grid former Clifton Manufactured Gas Plant (MGP) Site - Operable Unit No. 2 (OU-2) located in Clifton, Richmond County, New York (Site).

With the exception of a small landscaped strip of land that separates the Site building from the adjacent Bay Street, the remainder of the Site is surfaced with bituminous pavements and utilized for automobile parking. The 25 Willow Avenue parcel is currently zoned for manufacturing. The area surrounding it is characterized by a combination of urban residential and commercial uses. Commercial parcels are located on Greenfield Avenue to the northwest of the 25 Willow Avenue Parcel. A vacant lot, currently utilized for parking, is located to the northeast between Bay and Edgewater Streets. This CAMP presents methods and procedures that will be used to provide protection to potential receptors by assuring that the investigation work activities do not spread constituents off-site through the air.

This CAMP specifically applies to the PDI phase of work for the former MGP site. The PDI fieldwork is scheduled to be performed in the spring of 2009, as described in Section 2.0 of the document "*Remedial Design Work, former Clifton Former MGP Site, OU-2, Richmond County, New York*", dated April, 2008.

The PDI fieldwork involves the completion of test pits, subsurface soil borings, the installation of monitoring wells, the collection of soil and groundwater samples, and the ex-situ soil dewatering pilot study.

The objectives of this CAMP are to:

- Ensure that the airborne concentrations of constituents of concern (COC) are minimized to protect human health and the environment;
- Provide an early warning system so that potential emissions can be controlled on site at the source; and
- Measure and document the concentrations of airborne COC to confirm compliance with regulatory limits.

The community air monitoring will be performed around the site perimeter, and will measure the concentrations of organic vapors and dust during all ground-intrusive activities (soil boring, well installations, test pitting, and ex-situ soil dewatering study).

This CAMP is a companion document to ENSR's site-specific Health and Safety Plan (HASP). The HASP is a separate document and is directed

primarily toward protection of on-site workers within the designated work zones.

2 Constituents of Concern and Action Levels

The former MGP site is known to have tar impacts dating from the site's historical use as a MGP. As such, the constituents of concern are volatile and semi-volatile organic compounds (VOCs and SVOCs). The primary VOCs of concern are benzene, ethylbenzene, toluene, and xylene (the BTEX compounds). VOCs are more volatile than SVOCs and are generally of greater concern when monitoring the air quality during MGP site investigations.

Airborne dust is also a concern and must be monitored and controlled due to its ability to co-transport adsorbed constituents and because of its nuisance properties.

Odors, though not necessarily indicative of high constituent concentrations, could create a nuisance and will be monitored and controlled to the extent practicable.

State and federal regulatory agencies have provided action levels for many of these constituents. The action levels are the allowable airborne concentrations above which respiratory protection or other health and safety controls are required. For work at the former MGP site, the following levels should not be exceeded for more than 15 consecutive minutes at the downwind perimeter of the site:

- Benzene 1 part per million (ppm).
- Total VOCs 5 ppm.
- Dust 100 micrograms per cubic meter ($\mu g/m^3$).

The action levels cited here are above (in addition to) the background ambient (upwind) concentration.

3 Air Monitoring Equipment and Methods

Air quality monitoring will be performed for total VOCs, benzene, and dust as outlined below.

Two perimeter locations will be established each day and an air monitoring technician will check the instrumentation at each of these locations frequently during the work. Typically there will be monitoring locations at one upwind site perimeter location and one downwind perimeter locations. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. Field personnel will be prepared to monitor multiple locations in the event that there is little wind or if the wind direction changes frequently.

The monitoring instruments will be calibrated at the start of each workday, and again during the day if the performance of an instrument is in question.

3.1 VOC and Benzene Monitoring

3.1.1 Ambient Air Monitoring

VOC monitoring will be performed using three field photoionization detectors (PIDs) (RAE Systems MiniRAE or equivalent). The monitoring instruments will be checked by a technician every 15 minutes, and the real-time measurements recorded. The PIDs will be equipped with an audible alarm to indicate exceedance of the action level.

If requested by the NYSDEC, 15-minute running average concentrations may be calculated, which can then be compared to the action levels. If real-time measurements of total VOCs indicates that the action level is exceeded, then the benzene concentration will also be determined at that location using benzene-specific colorimetric tubes.

PID measurements will be made at one upwind and one downwind location around the work area. The locations of the instruments may be changed during the day to adapt to changing wind directions.

3.2 Particulate (Dust) Monitoring

Particulate (dust) monitoring will be performed during drilling activity at the Site. Two particulate monitors (TSI DustTrak or equivalent) will be used for continuous real-time dust monitoring. The monitoring instruments will be checked by a technician every 15 minutes, and the real-time measurements recorded. If requested by the on-site NYSDEC representative, a 15-minute average concentration may be determined.

In addition, fugitive dust migration will be visually assessed during all work activities, and the observations recorded.

Measurements will be made at one upwind and one downwind locations around the work area. The locations of the instruments may be changed during the day to adapt to changing wind directions.

4 Emission Control Plan

4.1 Ambient Air

Odor, vapor, and dust control will be required for this project due to the close proximity commercial buildings and public roadways and sidewalks. The attached Table 1 provides a response chart for the monitoring and control of vapor emissions. Table 2 provides a list of emergency contacts.

- If the ambient air concentration of total VOC levels at the downwind perimeter of the work area or exclusion zone exceeds 5 ppm (or the benzene level exceeds 1 ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm (and the benzene level drops below 1 ppm) over background, work activities can resume with continued monitoring.

- If total VOC levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm (or the benzene level persists over 1 ppm) over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions until the concentrations drop below the action levels, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities woll be shutdown.

Site perimeter particulate concentrations will also be monitored continuously. In addition, dust migration will be visually assessed during all work activities.

- If the downwind particulate level is 100 $\mu g/m^3$ greater than the background (upwind perimeter) level for a 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work may continue with dust suppression techniques provided that downwind particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind particulate levels are greater than 150 $\mu g/m^3$ above the upwind

level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind particulate concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

Typical emission control measures may include:

- Apply water for dust suppression;
- Relocate operations, if applicable; and
- Reassess the existing control measures.

5 Odor Control Procedures

This section outlines the procedures to be used to control odors that may be generated during the PDI field activities. The investigation program will be conducted using two principal remedial investigation techniques that may generate odors: test pit excavations and subsurface soil borings. The remainder of this section is intended to provide site managers, representatives of NYSEC and NYSDOH, and the public with information summarizing typical odor control options, and to provide some guidance for their implementation. A description of potential sources of odors and methods to be used for odor control is presented in the following sections.

5.1 Potential Sources of Odors

Generally, the residuals encountered at former MGP sites are well defined. They are related to residual coal tar-like materials and petroleum, and principally contain VOCs, polynuclear aromatic hydrocarbons (PAHs), and a number of inorganic constituents, including metal-complexed cyanide compounds, and metals. Constituents of MGP tar or petroleum products can produce odor emissions during investigation activities when they are unearthed during in backhoe test pits and soil borings. When this occurs, VOCs and light-end SVOCs can volatilize into the ambient air. Some MGP residuals can cause distinctive odors that are similar to mothballs, roofing tar, or asphalt driveway sealer. However, the constituent concentrations generally associated with these odors are typically significantly less than levels that might pose a potential health risk. It is important to note that the CAMP will provide for continual monitoring of VOCs and dust during the fieldwork to monitor for any potential release of constituents which may pose a threat to health.

5.2 Odor Monitoring

The field investigation personnel will record observations of odors generated during the implementation of the PDI Work Plan. When odors attributable to the uncovering of impacted media are generated in the work area during intrusive activities such as soil borings or excavation of test pits, observations will also be made at the down-wind limit of the former MGP site, in order to assess the potential for off-site odors. The down-wind odor monitoring will be performed in conjunction with the PID and dust monitoring program described in this CAMP.

Upon detection of odors at the site perimeter, site controls, starting in the work area, will be implemented. The site controls described in the following sections will be used to assist with odor mitigation. Note that the goal of the Odor Mitigation Plan is to minimize, and to prevent where practicable, the off-site migration of odors. Due to the short distances between any work area

at the site and the property line, site controls will be implemented proactively when odors are detected in the breathing zone at any work area.

5.3 General Site Controls

Several general excavation or drilling procedure site controls that will be implemented include:

- Every effort will be made to minimize the amount of time that impacted material is exposed to ambient air at the site.

- For the test pit excavations, it may be possible to move some amount of soil around within the footprint of the test pit excavation in order to minimize the amount of soil removal and subsequent stockpiling of impacted soil at the ground surface. The use of in-excavation stockpiling of test pit soil will be evaluated on a case-by-case basis, and will only be performed with the approval of the NYSDEC field representative, and will be completed only if it does not impede the collection of subsurface soils or the full delineation of the subsurface features being investigated.

- Drill cuttings from the soil borings will be containerized as soon as possible during completion of each soil boring.

- Loading of excavated debris or soil that has been found by the site manager to be unsuitable material to return to test pits may generate odors. Every effort will be made to complete this work as quickly as possible and to keep these materials covered at all times.

- Meteorological conditions are also a factor in the generation and migration of odors. Some site activities may be limited to times when specific meteorological conditions prevail, such as when winds are blowing away from a specific receptor.

5.4 Secondary Site Controls

If substantial odors still present an issue following implementation of the above procedures, secondary controls will be enacted. The ENSR field representative will work through the applicable list of secondary controls until the perimeter odor issues are resolved. The ENSR field representative will work closely with National Grid and NYSDEC during this task if present. Final selection of controls will be dependent on field conditions encountered. Secondary controls include the following:

- For stockpiled impacted soil, temporary tarps or polyethylene covers will be used to control odors.

- The placement of portable barriers close to small active source areas (test pits) can elevate the discharge point of emissions to facilitate dispersion and minimize the effect on downwind

receptors. The barriers can be constructed using materials such as plastic "Jersey barriers", or fence poles and visual barrier fabric/plastic. The barriers are placed as temporary two or three-sided structures around active test pit or other intrusive investigation areas, oriented such that the barriers are placed on the upwind and downwind sides of the source. If only one side of the source can be accessed, then the barrier should be placed on the downwind side.

- Two agents that can be sprayed over impacted soil have been determined to be effective in controlling emissions. They include odor suppressant solution (BioSolve™), and hydro-mulch. These agents may be used where tarps cannot be effectively deployed over the source material, or where tarps are ineffective in controlling odors:

  - BioSolve™ can provide immediate, localized control of odor emissions. Information regarding the preparation and use of BioSolve™ is provided in Appendix A.

  - Hydromulch - Although it is unlikely that it will be necessary, a modified hydromulch slurry may be used to cover inactive sources for extended periods of time (up to several days). The hydromulch, typically cellulose fibers (HydroSealR) is modified by mixing a tackifier (glue) with the mulch and water to form a slurry. It is applied using a standard hydroseed applicator to a thickness of ¼ inch. The material forms a sticky, cohesive, and somewhat flexible cover. Reapplication may be necessary if the applied layer becomes desiccated or begins to crack.

5.5 Record Keeping and Communication

Similar to readings recorded during the monitoring specified in the CAMP, all odor monitoring results will be recorded in the field log book or other air monitoring forms, and be available for review by the agencies.

The ENSR field representative, in consultation with National Grid, will also provide information on odor monitoring and odor management to residents of the neighborhood should they inquire. In the event that odors persist after these efforts, work will be temporarily discontinued until a mutually agreeable solution with National Grid, NYSDEC, and NYSDOH staff can be worked out which allows the work to be completed while minimizing the off-site transport of nuisance odors.

6 Documentation and Reporting

Data generated during perimeter air monitoring will be recorded in field logs and summarized daily in spreadsheets. The electronic measurements from the PIDs and dust meters will be downloaded each day, reviewed, and archived. Exceedances of the action levels, if any, and the actions to be taken to mitigate the situations, will be discussed immediately with the on-site representatives. Summaries of all air monitoring data will be provided to NYSDEC as requested.

Table 1 Vapor Emission Response Chart

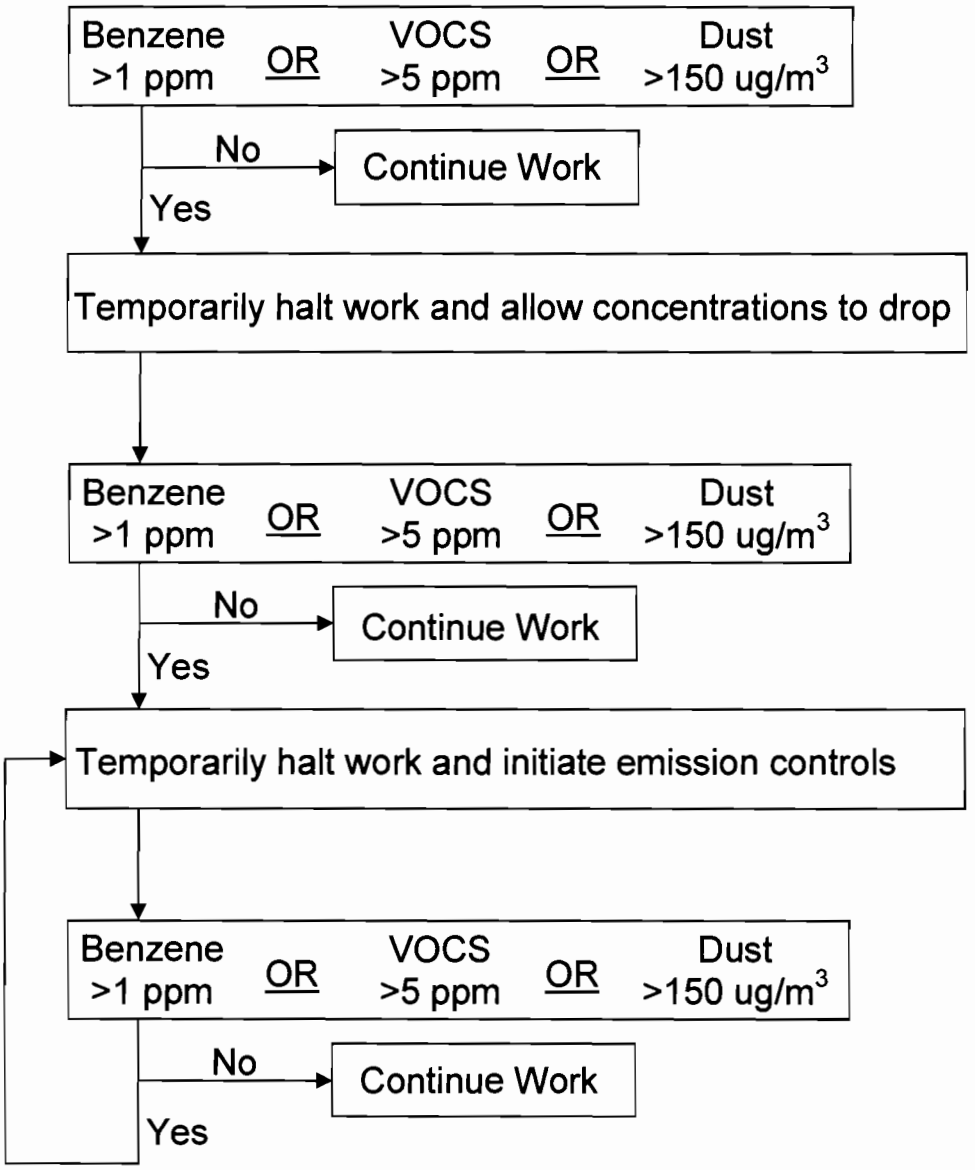

Table 2 Emergency Contacts and Telephone Numbers

Fire:	911	
Police:	911	
Ambulance:	911	
ENSR Contacts	Shail Pandya Dave Work Kevin Kachel	(718) 309-5643 (cellular) (718) 772-8474 (cellular) (610) 639-8860 (cellular)
National Grid Contacts	Andrew Prophete Thor Helgason (Demaximis)	(718) 963-5412 (781) 642-8775

Appendix D

ENSR Field Procedures

Field log books

All field activities will be carefully documented in field log books. Entries will be of sufficient detail that a complete daily record of significant events, observations, and measurements is obtained. The field log book will provide a legal record of the activities conducted at the site. Accordingly:

- Field books will be assigned a unique identification number.
- Field books will be bound with consecutively numbered pages.
- Field books will be controlled by the Field Team Leader while field work is in progress.
- Entries will be written with waterproof ink.
- Entries will be signed and dated at the conclusion of each day of fieldwork.
- Erroneous entries made while fieldwork is in progress will be corrected by the person that made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction.
- Corrections made after departing the field will be made by the person who made the original entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.
- At a minimum, daily field book entries will include the following information:
  - location of field activity;
  - date and time of entry;
  - names and titles of field team members;
  - names and titles of any site visitors and site contacts;
  - weather information, for example: temperature, cloud coverage, wind speed and direction;
  - purpose of field activity;
  - a detailed description of the field work conducted;
  - sample media (NAPL, groundwater, *etc.*);
  - sample collection method;
  - number and volume of sample(s) taken;
  - description of sampling point(s);
  - volume of groundwater removed before sampling;
  - preservatives used;
  - analytical parameters;

- date and time of collection;
- sample identification number(s);
- sample distribution (*e.g.*, laboratory);
- field observations;
- any field measurements made, such as pH, temperature, conductivity, water level, *etc.*;
- references for all maps and photographs of the sampling site(s); and
- information pertaining to sample documentation such as:
  - bottle lot numbers;
  - dates and method of sample shipments;
  - Chain-of-Custody (COC) record numbers; and
  - Federal Express Air Bill Number

Field equipment decontamination and management of investigation derived wastes

1.0 Decontamination area

Equipment will be decontaminated after each use at each location. A layer of poly will be placed between the equipment and the ground. Water collected from the decontamination cleaning activities will be collected in 55-gallon drums and managed as Investigation Derived Waste (IDW).

1.1 Equipment decontamination

The following procedures will be used to decontaminate equipment used during the IRM activities:

- Weighted steel tape used to gauge DNAPL will be decontaminated after each well location. Direct contact with the ground will be avoided.
- Oil/water interface probe used to gauge the groundwater after each well location will be decontaminated. Direct contact with the ground will be avoided.

1.1.1 Sampling equipment decontamination

Suggested materials:

- potable water
- phosphate-free detergent (*e.g.*, Alconox™, Simple Green™)
- distilled water
- aluminum foil
- plastic/polyethylene sheeting
- plastic buckets and brushes
- personal protective equipment (PPE)

Procedures:

- Prior to sampling, all non-dedicated sampling equipment (interface probes, *etc.*) will be washed with potable water and a phosphate-free detergent (such as Alconox™ or Simple Green™). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, *etc.*
- The sampling equipment will then be rinsed with potable water followed by a deionized water rinse.

- Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. At no time will washed equipment be placed directly on the ground.

- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

1.2 Decontamination fluids

Decontamination fluids will be collected in 55-gallon drums. The drums will be labeled as IDW water subsequently characterized and disposed.

1.3 Personal protective equipment

All PPE will be placed in 55-gallon drums for proper disposal.

1.4 Dedicated IDW sampling equipment

All dedicated IDW sampling equipment, if used, will be placed in 55-gallon drums for proper disposal

Nonaqueous phase liquid sampling procedures

1.0 Introduction

Nonaqueous phase liquid (NAPL) includes both light nonaqueous phase liquid (LNAPL) and dense nonaqueous phase liquid (DNAPL) sampling will be conducted at the site. Procedures for obtaining samples are described in this section.

1.1 Nonaqueous phase liquid sampling

1.1.1 Suggested equipment and supplies

- field book;
- project plans;
- PPE in accordance with the HASP;
- oil/water interface probe;
- disposable polyethylene bailers or low flow sampling pump;
- polypropylene rope;
- decontamination supplies;
- Waterra pump or other purge pump;
- plastic tubing;
- plastic sheeting;
- Photovac PID;
- clear tape, duct tape;
- coolers and ice;
- laboratory sample bottles; and
- Federal Express labels

1.2 NAPL sampling method

1.2.1 Sampling

- Prior to sampling, the static water level and thickness of any free product will be measured to the nearest 0.01 foot from the surveyed well elevation mark on the top of the PVC casing with a decontaminated oil/water interface probe. NAPL thickness will be determined by calculating the depth to the water table minus the depth to the LNAPL. The DNAPL thickness will be determined by calculating the depth to the bottom of the well minus the depth of the DNAPL. The depth measurements will be

collected using an oil-water interface probe. The measurement will be recorded in the field book.

- The probe will be decontaminated according to procedures outlined in the procedures for field equipment decontamination.

- Samples will be collected using dedicated ¼-inch polyethylene tubing or a weighted bailer attached to string.

- The sample volume to be collected will depend on whether the sample is more aqueous or oily. For an aqueous matrix, the sample volume needed will be the same as standard water samples with appropriate preservatives. For an oily matrix, the sample volume needed is as follows:

  VOCs - 5g, SVOCs - 1g, and TOC in 4oz jar with appropriate preservatives.

- The sample containers will be labeled, placed in a laboratory-supplied cooler and packed on ice (to maintain a temperature of 4°C). The cooler will be shipped overnight or delivered to the laboratory for analysis.

- COC procedures will be followed.

- NAPL sampling data will be documented.

Air monitoring

1.0 Introduction

Air monitoring will be performed during the site investigation. Work zone monitoring will be performed for protection of the workers performing the NAPL collection.

1.1 Breathing zone air monitoring during sampling

Air monitoring of the breathing zone within the work site will be conducted periodically during all sampling activities to assure proper health and safety protection for the team.

- An organic vapor meter equipped with a photoionization detector (PID) will be used to monitor for volatile organic compounds or other organic vapors in the breathing zone and borehole, and to screen the samples.

- Additional air monitoring may be required as specified in the site specific HASP.

The PID readings will be recorded in the field book. The procedure for the PID operation and calibration is included in the field instrument calibration procedures and the site specific HASP. Note that equipment calibration will be performed as often as needed to account for changing conditions or instrument readings. The minimum frequency of calibration is specified in the field instrument calibration procedures; more frequent calibration will be performed if spurious readings are observed or there are other problems with the instruments.

1.2 Community Air Monitoring

Community air monitoring requires real-time monitoring for volatile organic compounds (VOCs), particulates (i.e., dust), and MGP related odors at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The community air monitoring is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels for community air monitoring require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, community air monitoring helps to confirm that work activities do not spread contamination off-site through the air.
The procedures and action levels for community air monitoring are outlined in detail in Section 4.2 of the HASP.

Field instruments and calibration

All field analytical equipment will be calibrated immediately prior to each day's use and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. All instrument calibrations will be documented in the project field book and in an instrument calibration log. Records of all instrument calibration will be maintained by the field team leader and will be subject to audit by the quality assurance officer (QAO). Copies of all of the instrument manuals will be maintained on-site by the field team leader. All changes to instrumentation will be noted in the field log book.

A PID will be used during the IRM field work.

1.1 Portable photoionization analyzer

- The PID will be a Thermo 580B (or equivalent), equipped with a minimum 10.2 or 10.6 eV lamp. The PID is capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the volatile organic compounds on the Target Compound List.

- Calibration must be performed at the beginning of each day of use with a standard calibration gas having an approximate concentration of 100 parts per million of isobutylene. If the unit experiences abnormal perturbation or erratic readings, additional calibration will be required.

- All calibration data must be recorded in field notebooks and on calibration log sheets to be maintained on-site.

- A battery check must be completed at the beginning of each working day.

- All changes to the PID will be noted in the field notes (such as bulb or filter cleaning or replacement).

Field sample custody

1.1 Chain of custody

- A chain of custody (COC) record will accompany the sample containers during selection and preparation at the laboratory, during shipment to the field, and during return shipment to the laboratory.

- The COC will identify each sample container and the analytical parameters for each, and will list the field personnel that collected the samples, the project name and number, the name of the analytical laboratory that will receive the samples, and the method of sample shipment.

- If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample shipment.

- The COC will be completed by field personnel as samples are collected and packed for shipment.

- Erroneous markings will be crossed-out with a single line and initialed by the author.

- The REMARKS space will be used to indicate if the sample is a matrix spike, matrix spike duplicate, or matrix duplicate.

- Trip and field blanks will be listed on separate rows.

- After the samples have been collected and sample information has been listed on the COC form, the method of shipment, the shipping cooler identification number(s), and the shipper airbill number will be entered on the COC.

- Finally, a member of the sampling team will write his/her signature, the date, and time on the first RELINQUISHED BY space. Duplicate copies of each COC must be completed.

- One copy of the COC will be retained by sampling personnel. The other copy and the original will be sealed in a plastic bag and taped inside the lid of the shipping cooler.

- Sample shipments will be refrigerated at 4°C, typically by packing with ice, to preserve the samples during shipment.

- After the shipping cooler is closed, custody seals provided by the laboratory will be affixed to the latch and across the front and back of the cooler lid, and signed by the person relinquishing the samples to the shipper.

- The seal will be covered with clear tape, and the cooler lid will be secured by wrapping with packing tape.
- The cooler will be relinquished to the shipper, typically an overnight carrier.
- The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the project manager, and the samples will not be analyzed.
- The samples must be delivered to the laboratory within 48 hours of collection.

1.2 Sample documentation

The field team leader will retain a copy of the COC, and, in addition, the field team leader will ensure that the following information about each sample is recorded in the field book:

- sample identifier;
- identification of sampled media (e.g., NAPL, IDW);
- sample location with respect to known reference point;
- physical description of sample location;
- field measurements (*e.g.*, pH, temperature, conductivity, and water levels);
- date and time of collection;
- sample collection method;
- number of sample containers;
- analytical parameters; and
- preservatives used

1.3 Shipping information:

- dates and method of sample shipments;
- COC Record numbers;
- Federal Express Air Bill numbers; and
- sample recipient (*e.g.*, laboratory name)

Drilling and Soil Sampling Procedures

1.1 Introduction

Drilling activities to be conducted at the Clifton former MGP site consist of:

- Soil borings
- Monitoring well/Peizometer installations

These procedures are described in the following section.

1.2 Soil Borings and Subsurface soil Sampling

The following methods will be used for conducting the soil borings.

1.2.1 Suggested Equipment

- Field book
- Project plans
- Personal protective equipment in accordance with the HASP
- Metal detector
- Stakes and flagging
- One pint containers for lithology samples
- Tape measure
- Decontamination supplies
- Water level indicator
- Photoionization detector (PID) with a 10.2 or 10.6 eV lamp
- Camera
- Clear tape, duct tape
- Aluminum foil
- Laboratory sample bottles
- Coolers and ice
- Shipping supplies

1.3 Drilling and Geologic Logging Method

- Soil borings will be advanced using a rotosonic or hollow stem auger drilling methods. The rotosonic method is preferred.

- Soil samples will be collected continuously to the bottom of the borings using 5 to 10-foot long 4-inch diameter sonic sample bags, 4-foot long, 2-inch diameter macro core samplers or 2-foot long by 2-inch diameter split spoon samplers.

- Soil samples retrieved from the borehole will be visually described for:

  - Percent recovery
  - Soil type
  - Color: use geotechnical color charts. Colors may be combined e.g. red-brown. Color terms should be used to describe the "natural color" of the sample as opposed to staining caused by contamination (see below)
  - Moisture content
  - Texture
  - Grain size and shape
  - Consistency
  - Visible evidence of staining
  - Any other observations

The descriptions will be in accordance with the Unified Soil Classification System (USCS), American Society for Testing and Materials (ASTM) guidelines, or the modified Burmeister system. The following additional guidance will be incorporated in geologic logs:

- Log of each sample interval should be prepared as follows:

  [Coarse Grained Example] NARROWLY GRADED SAND (SP); mostly fine sand; <5% fines; red-brown, moist, environmental/depositional/geologic descriptions.

  [Fine Grained Example] SANDY SILT (ML); heterogeneous till structure, nonplastic, ~30% fine to coarse, subangular sand; ~10% subangular fine gravel, max. size ~ 10 mm; brown; environmental/depositional/geologic descriptions.

- Representativeness – Soil logs should include particular notes if the field representative believes that there is a possibility the soil sample being described is not representative of the interval sampled.

- Intervals for Description – if using a 2' (split spoon) or 4' (Macro-core) long sampler – the field description should not necessarily be for the entire sample interval. It is important to look for, identify, and describe small-scale units and changes within each sample interval.

- Visible Contamination Descriptors
  - Sheen - iridescent petroleum-like sheen. Not to be used to describe a "bacterial sheen" which can be distinguished by its tendency to break up on the water surface at angles whereas petroleum sheen will be continuous and will not break up. A field test for sheen is to put a soil sample in a jar of water and shake the sample (jar shake test), then observe the presence/absence of sheen on the surface of the water in the jar.
  - Stained - used w/ color (i.e. black or brown stained) to indicate that the soil matrix is stained a color other than the natural (unimpacted) color of the soil.
  - Coated - soil grains are coated with tar/free product – there is not sufficient free-phase material present to saturate the pore spaces.
  - Blebs - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically this is residual product.
  - Saturated - the entirety of the pore space for a sample is saturated with the tar/free product. Care should be taken to ensure that you're not observing water saturating the pore spaces if you use this term. Depending on viscosity, tar/free-phase saturated materials may freely drain from a soil sample.
  - Oil - used to characterize free and/or residual product that exhibits a distinct fuel oil or diesel fuel like odor; distinctly different from MGP-related odors/impacts.
  - Tar - used to describe free and/or residual product that exhibits a distinct "coal tar" type odor (e.g. naphthalene-like odor). Colors of product can be brown, black, reddish-brown, or gold.
  - Solid Tar - used to describe product that is solid or semi-solid phase. The magnitude of the observed solid tar should be described (e.g. discrete granules or a solid layer).
  - Purifier Material - purifier material is commonly brown/rust or blue/green wood chips or granular material. It is typically associated with a distinctive sulfur-like odor. Other colors may be present.

- Olfactory Descriptors

- Use terms such as " tar-like odor" or "naphthalene-like odor" or "fuel oil-like odor" that provide a qualitative description (opinion) as to the possible source of the odor.
- Use modifiers such as strong, moderate, faint to indicate intensity of the observed odor.

- DNAPL/LNAPL
  - A jar shake test should be performed to identify and determine whether observed tar/free-phase product is either denser or lighter than water. In addition, MGP residues can include both light and dense phases - this test can help determine if both light and dense phase materials are present at a particular location.

- Viscosity of Free-Phase Product – If free-phase product/tar is present a qualitative description of viscosity should be made. Descriptors such as:
  - Highly viscous (e.g. taffy-like)
  - Viscous (e.g. No. 6 fuel oil or bunker crude like)
  - Low viscosity (e.g. No. 2 fuel oil like)

- Soil samples will be immediately screened for the evolution of organic vapors with a PID.

- A representative portion of the sample will be placed in a plastic "ziplock" bag or an eight-ounce sample jar filled approximately half full. The container will be labeled with the boring number and interval sampled. Aluminum foil will be placed on the top of the jar and the cap will be screwed on tightly.

- After a minimum of 10 minutes, the lid will be unscrewed and the tip of the PID will be inserted through the aluminum foil across the cap or into the bag to measure the headspace for organic vapors.

- Remaining soil will be disposed of in accordance with methods specified in the procedure for the management of IDW.

- All borings will be completed as monitoring wells, backfilled with cuttings if soil is not impacted, or sealed with bentonite or cement/bentonite grout following completion.

- All drilling equipment will be decontaminated between each boring in accordance with methods specified in the procedure for field equipment decontamination.

- The designated field geologist will log borehole geology and headspace measurements in the field book and the drilling record along with any other observations (for example odors, NAPL, soil staining, *etc.*).

1.3.1 Soil Sampling

- The number and frequency of samples to be collected from each boring and the associated analytical parameters are summarized in Section 4 of the RIWP Plan.
- Samples for VOC analyses will be collected directly from the sonic liners or split spoons, placed into appropriate containers, and compacted to minimize head space and pore space. The remaining sample volume will be placed into a stainless steel bowl or plastic bag, homogenized, and placed in appropriate containers for the other analyses.
- The sample containers will be labeled, placed in a laboratory-supplied cooler, and packed on ice (to maintain a temperature of 4°C). The coolers will be shipped overnight to the laboratory for analysis.
- Chain-of-custody procedures will be followed as outlined in the QAPP.
- The sampling equipment will be decontaminated between samples in accordance with procedures described in the procedure for field equipment decontamination.
- Excess soil remaining after sampling will be contained in accordance with methods specified in the procedure for the management of IDW.
- The sample locations, descriptions, and depths will be recorded in the field book.

1.4 Monitoring Well Installation and Development

The following methods will be used for drilling, installing, and developing the monitoring wells.

1.4.1 Suggested Equipment

- Field book
- Project plans
- Personal protective equipment in accordance with the HASP
- Metal detector
- One pint containers for lithology samples
- Tape measure
- Decontamination supplies
- Water level indicator
- PID
- Camera
- Clear tape, duct tape
- Aluminum foil
- Laboratory sample bottles

- Coolers and ice
- Shipping supplies
- Polyethylene disposable bailers (development)
- Polypropylene rope (development)
- Waterra pump or other purge pump (development)
- Stainless steel or glass beakers (development)
- Turbidity meter (development)
- Temperature, conductivity, pH meter (development)

1.4.2 Monitoring Well Installation

The monitoring wells will be installed in accordance with the following specifications:

- The monitoring well borings will be advanced with 6-inch diameter sonic casing pipe or 4.25-inch inner diameter (ID) hollow stem augers.

- Wells will be constructed with two-inch, inside diameter (ID), threaded, flush-joint, PVC casings and screens.

- Screens will be 10 feet long with 0.01-inch or 0.02-inch slot openings with a 2-foot sump at the base. Alternatives may be used at the discretion of the field geologist and approval of Con Edison, based on site conditions.

- The annulus around the screens will be backfilled with silica sand having appropriate size (*e.g.*, Morie No. 1) to a minimum height of two feet above the top of the screen. Auger flights will be withdrawn as sand is poured in a manner that will minimize hole collapse and bridging.

- A bentonite pellet seal or slurry seal with a minimum thickness of one foot will be placed above the sand pack. The bentonite seal (pellets) will be allowed to hydrate before placement of grout above the seal.

- The remainder of the annular space will be filled with a cement-bentonite grout to ground surface. The grout will be pumped through a tremie pipe from the bottom up. The grout will be allowed to set for a minimum of 24 hours before wells are developed.

- Each monitoring well will have a locking expandable gas-tight cap and will be contained in a flush-mounted vault.

- The concrete seal or pad will be sloped to channel water away from the well, and be deep enough to remain stable during freezing and thawing of the ground.

- The top of the PVC well casing will be marked and surveyed to 0.01 foot, and the elevation will be determined relative to a fixed benchmark or datum.

- The measuring point on all wells will be on the innermost PVC casing.

- Monitoring well construction details will be recorded in the field book and on a construction log.

1.4.3 Monitoring Well Development

- After a minimum of 24 hours after completion, the monitoring wells will be developed by surging and pumping. Pumping methods may include using a centrifugal or peristaltic pump and dedicated polyethylene tubing, using a Waterra positive displacement pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist.

- Water levels will be measured in each well to the nearest 0.01 foot prior to development.

- The wells will be developed until the water in the well is reasonably free of visible sediment (50 NTU if possible or until pH, temperature, and specific conductivity stabilize). A portable nephelometer will be used to make this measurement.

- Development water will be contained in accordance with methods specified in the procedure for the management of IDW.

- Following development, wells will be allowed to recover for at least 14 days before groundwater is purged and sampled. All monitoring well development will be overseen by a field geologist and recorded in the field book.

Groundwater Sampling Procedures

1.1 Introduction

Groundwater sampling will be conducted at the site. Procedures for obtaining samples of groundwater are described in this section.

1.2 Groundwater Sampling

1.2.1 Suggested Equipment and Supplies

- Field book
- Project plans
- Personal protective equipment in accordance with the HASP
- Water level indicator
- Disposable polyethylene bailers or low flow sampling pump
- Polypropylene rope
- Temperature, conductivity, pH meters
- Turbidity meter
- Dissolved oxygen meter
- 250-mL glass beaker
- Flow through cell (if low flow sampling pump is used)
- Decontamination supplies
- Water pump or other purge pump
- Plastic tubing
- Plastic sheeting
- Photovac PID
- Clear tape, duct tape
- Coolers and ice
- Laboratory sample bottles
- Federal Express labels

1.2.2 Groundwater Sampling Method

Purging

- The number and frequency of groundwater samples to be collected and the associated analytical parameters are summarized in Section 4 of the RIWP.

- Prior to sampling, the static water level and thickness of any free product will be measured to the nearest 0.01 foot from the surveyed well elevation mark on the top of the PVC casing with a decontaminated oil/water interface probe. NAPL thickness will be determined using a clear bailer or a weighted string. The measurement will be recorded in the field book.

- The probe will be decontaminated according to procedures outlined in the procedures for field equipment decontamination.

- The well will be purged by removing groundwater until field parameters stabilize to within 10% of previous reading; up to 3 well volumes are removed or 1 hour of purging is performed. Purging will be conducted using a low-stress sampling technique such as the USEPA Region 1 Low-Stress sampling guidance.

- If a well goes dry before the required volumes are removed, it will be allowed to recover, purged a second time until dry or the required parameters are met, and sampled when it recovers sufficiently, in accordance with low flow sampling protocol.

- Purge water will be managed and disposed of in accordance with procedures described in the management of IDW.

Sampling

- Samples will be collected using dedicated ¼-inch polyethylene tubing and micro purging techniques consistent with low flow sampling protocol.

- Prior to filling the sample bottles, one 250-mL beaker will be filled with water. The temperature, pH, conductivity, oxidation reduction potential, dissolved oxygen, and turbidity will be measured with a pre-calibrated probe and recorded in the field book. If low flow sampling methods are used, these parameters (except turbidity) will be measured within a flow through cell.

- The sample containers will be labeled, placed in a laboratory-supplied cooler and packed on ice (to maintain a temperature of 4°C). The cooler will be shipped overnight or delivered to the laboratory for analysis.

- Chain-of-custody procedures will be followed as outlined in the QAPP.

- Well sampling data will be recorded on groundwater sampling records.

- Any observations of sheen, blebs, free-phase product/tar, staining or coating of the sampling equipment, odor, etc. that made during sampling of groundwater are to be included in the groundwater sample collection log.

Appendix E

Historic Boring Logs (will be included prior to field work)