Remedial Design Work Plan
Patchogue Former Manufactured Gas Plant Site
NYSDEC Site No. 1-52-182
Village of Patchogue
Suffolk County, New York

Prepared for

National Grid, Hicksville, New York

February 2012

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175 East Old Country Road
Hicksville, New York 11801

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Certification Statement

I, Jeffrey Caputi, certify that I am currently a NYS registered professional engineer, and that this Remedial Design Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

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2/24/12
Date

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List of Abbreviations

AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
AWQS	Ambient Water Quality Standards
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BC	Brown and Caldwell Associates
BUG	Brooklyn Union Gas
bgs	Below ground surface
CAMP	Community Air Monitoring Plan
CERCLA	Comprehensive Environmental Response Compensation and Liabilities Act
COCs	Contaminants Of Concern
COPC	Chemicals of Potential Concern
COPEC	Chemicals of Potential Ecological Concern
DER	Division of Environmental Remediation
DER-10	Division of Environmental Remediation, DER-10, Technical Guidance for Site Investigation and Remediation (May 2010)
DER-31	Division of Environmental Remediation, DER-31, Green Remediation (January 2011)
FFS	Focused Feasibility Study
HASP	Health and Safety Plan
ISS	In-Situ Solidification
IC/EC	Institutional Controls and Engineering Controls
LILCO	Long Island Lighting Company
msl	Mean Sea Level
MGP	Manufactured Gas Plant
NAPL	Non-Aqueous Phase Liquid
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
POTW	Publicly Owned Treatment Works
PRAP	Proposed Remedial Action Plan
PSA	Preliminary Site Assessment
QHHEA	Qualitative Human Health Exposure Assessment
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RDWP	Remedial Design Work Plan
RDR	Remedial Design Report
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
RPM	Revolutions per Minute
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHS	Suffolk County Department of Health Services
SCGs	Standards, Criteria, and Guidance
SMP	Site Management Plan
SPDI	Supplemental Pre-Design Investigation
SSM	Shallow-Zone Soil Mixing
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
TAGM	Technical and Administrative Guidance Memorandum
TCN	Total Cyanide
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

Section 1

Introduction

Brown and Caldwell Associates (BC) has been retained by National Grid to prepare this Remedial Design Work Plan (RDWP) which presents the activities and procedures proposed to be involved in the development of a construction design and work plan for implementing the selected remedy to address known soil and groundwater impacts at the Patchogue Former Manufactured Gas Plant (MGP) Site (i.e., herein referred to as the Site). The remedy to be implemented at the Site is described in a document entitled "Record of Decision, Patchogue Former Manufactured Gas Plant (MGP) Site, Patchogue, New York" prepared by the New York State Department of Environmental Conservation (NYSDEC) and dated March 31, 2011. Further, this RDWP describes the pre-remedial design activities that will be performed to gather additional data to support of the design of the approved remedy.

This RDWP has been prepared in accordance with the Order on Consent, Index Number D1-0001-99-05 (the Order) signed by KeySpan Corporation (a predecessor company of National Grid) and the NYSDEC. The Order on Consent was signed September 30, 1999. The development of an RDWP is a requirement of the Order on Consent based on the findings of the presence of contamination requiring remedial action.

This RDWP has been prepared in accordance with the following applicable regulations and guidance documents:

- New York State regulations for "Environmental Remedial Programs" 6 NYCRR Part 375, dated December 14, 2006;
- NYSDEC Division of Environmental Remediation (DER) guidance document DER-10 entitled "Technical Guidance for Site Investigation and Remediation," dated May 3, 2010.

1.1 Remedial Design Work Plan Objectives

The objectives of this RDWP are:

- To describe the pre-remedial design activities to be performed in support of the design of the remedy;
- To describe the methods and procedures that will be used to evaluate and gather additional data to support the design of the remedy;
- To identify the project plans [e.g., Health and Safety Plan (HASP), etc.] that will be used during the implementation of the pre-remedial design field activities in order to gather the data needed to design the remedy;
- To describe the documents to be submitted to the NYSDEC for approval of the design of the remedy;
- To provide a preliminary discussion of the remedial technologies;
- To discuss property access and permits required for implementing the remedy; and
- To provide a schedule for the implementation of the pre-design activities and design of the remedy.

1.2 Site Description

The Patchogue Former MGP Site is located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (Figure 1-1). The Site is located in a mixed commercial and residential area, and is currently undeveloped and vacant. The perimeter of the Site is secured with a locked perimeter fence. The Site is generally rectangular in shape and encompasses approximately 3.6 acres with a maximum length (north-south) of approximately 680 feet and a maximum width (east-west) of 180 feet. The Site has relatively flat topography with a typical elevation of approximately five feet above mean sea level (msl). The Site is, in general, bordered as follows:

- To the north by West Main Street beyond which is a property occupied by Briarcliff College and Patchogue Lake;
- To the east by an unpaved access driveway and two commercial properties beyond which is the Patchogue River;
- To the south by a residential area and an overflow pond to the south/southwest; and
- To the west by a steep slope beyond which are a residential area and a municipal storage yard.

As detailed in the Remedial Investigation Report (RIR), the Site is informally divided into three areas: the Northern Area, the Central/Core Area, and the Southern Area. The overall layout of the Site is shown on Figure 1-2.

The Northern Area is a rectangular area comprising the northern portion of the Site bordered to the north by West Main Street, to the east by an unpaved access road beyond which is a commercial property, to the south by the Central/Core Area, and to the west by a commercial area of Patchogue, fronting West Main Street. The Northern Area is enclosed with a chain link fence and is mostly clear of vegetation. The ground surface is comprised of two adjacent concrete slabs with a combined size of approximately 240 feet by 60 feet.

The Central/Core area consists of the central portion of the Site where the majority of the former MGP structures were located. The Central/Core Area is bounded by the Northern Area to the north, a commercial property and the Patchogue River to the east, the Southern Area to the south and a commercial/residential area of Patchogue to the west. The Central/Core area is rectangular in shape and is enclosed by a chain-link fence. This area is vegetated primarily by grass, weeds and low brush and the ground surface, comprised by fill, is uneven. A steep slope runs along the western boundary of the Site beyond which is a residential area and municipal storage yard.

The Southern Area is bounded to the north by the Central/Core Area and comprises the tapered southern end of the property with the Patchogue River forming the eastern boundary of this area and with commercial/residential areas to the west. This area has considerable concrete debris and dense vegetation.

1.3 Site History

The Site history is presented in the Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York", (TetraTech EC, Inc., December 2009) (referred to as RIR) and the "Preliminary Site Assessment Report, Order on Consent D1-0001-99-05, NYSDEC Site No. 1-52-182, Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York", [Vanasse, Hangen, Brustlin (VHB) March 2002] (referred to as PSA) and is summarized below for reference.

The Site was owned and operated by the Patchogue Gas Company either independently (1904 through 1926) or, from 1927, under ownership of the Long Island Lighting Company (LILCO). The MGP was constructed by the Patchogue Gas Company in approximately 1904. Identification of retorts on the earliest Sanborn Fire Insurance (Sanborn) Maps indicates that the initial gas production activities

included the coal gasification process, although in Browns Directory it was reported that the Lowe water gas process was used. Furthermore, a boiler, which is a component of the water gas process, is depicted on the Sanborn map. Routine production of manufactured gas ended in 1914, and from 1922 to 1925, the facility was used for emergency gas production. In 1914, the facility was modified to store and distribute high pressure gas produced at other facilities. High pressure gas stored at, and distributed from, the Site was purchased from Suffolk Gas & Electric (Bay Shore) from 1915 through 1917 and from 1918 the gas supplier is identified only as LILCO. From 1922 through 1925 emergency gas production occurred at the Site.

Review of a 1926 Sanborn Map included in the PSA Report (VHB, 2002) indicated a group of seven horizontal aboveground storage tanks (ASTs) were installed sometime after 1910. According to documentation from KeySpan (now National Grid), these ASTs were used for additional gas storage capacity at the Site and are incorrectly labeled as "oil tanks" on the Sanborn Maps.

The 60,000 cubic foot gas holder, initially present on the Site, is consistent with the limited production of manufactured gas at the facility; larger manufactured gas production operations would likely have required additional and larger gas holders. A gas sphere present at the Site during later operations stored gas under high pressure and is consistent with the use of the Patchogue facility for distribution of gas produced elsewhere.

The distribution facility remained until the 1970s when LILCO sold the property to third parties. From the mid-1970s through early 2005, the Site was used as a refrigeration equipment and scrap storage yard. LILCO was acquired by Brooklyn Union Gas (BUG) in 1999 and the two merged to form KeySpan. KeySpan reacquired the Site in 2005 for purposes of remediation. National Grid acquired KeySpan in 2008 and currently maintains ownership of the Site.

On September 30, 1999, KeySpan (a predecessor company to National Grid) entered into Order on Consent D1-001-99-05 with NYSDEC to conduct a PSA of the Former Patchogue MGP Site. The PSA was conducted in 2001 and the results were documented and submitted to the NYSDEC in March 2002 in the PSA Report (VHB, 2002). In 2008 and 2009, RI activities were performed and the results were documented and submitted to the NYSDEC in the RIR (TetraTech EC, December 2009).

1.4 Investigation Findings and Conceptual Site Model

The following subsections of this RDWP provide a summary of the findings from assessment and investigation activities into the subsurface conditions and the nature and extent of MGP-related impacts at the Site. These investigations are as follows:

- The Preliminary Site Assessment (PSA) as presented in "Preliminary Site Assessment Report Order on Consent D1-0001-99-05, NYSDEC Site No. 1-52-182 Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York", [Vanasse, Hangen, Brustlin ([VHB) March 2002].
- The Remedial Investigation (RI) as presented in "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York", (TetraTech EC, Inc., December 2009)
- Pre-Design Investigation (PDI) and Supplemental Pre-Design Investigation (SPDI) as presented in "Focused Feasibility Study, Patchogue Former Manufactured Gas Plant (MGP) Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, May 2011).

Site Stratigraphy

The Site is generally flat with an elevation less than five feet above mean sea level (msl). A layer of fill, consisting of sand, silt, gravel and debris, covers the Central/Core area of the Site. The fill varies in thickness but is typically approximately two to five feet thick. Beneath the fill is a layer of alluvial deposits which are likely floodplain sediments associated with the Patchogue River. These deposits consist of layers of sands, silts, clays and organic material, including peat deposits. Much of the sand in the alluvial deposits is likely derived from the underlying sand unit and locally the alluvial deposits can be similar in character to this underlying unit. The alluvial deposits are generally thin and are locally discontinuous. Underlying the alluvial deposits is a unit of sand with varying amounts of gravel. This unit is likely glacial outwash deposits deposited during the Pleistocene Epoch. The sand unit extends to a depth of at least 30 feet bgs, which was the depth of the deepest borings drilled during the site investigation activities.

Groundwater Occurrence and Flow

The water table is shallow at the Site, occurring within the fill at depths typically ranging from between less than one foot to about five feet below ground surface (bgs). Groundwater flow is toward the south-southeast direction and discharges to the Patchogue River. Where it is saturated with groundwater, the glacial outwash unit described above is referred to regionally as the "upper glacial aquifer". On-site groundwater is not utilized as a drinking water source. The Village of Patchogue is serviced by a public, municipal water source. The Village of Patchogue's Department of Public Works indicated that the installation of private water wells is prohibited.

MGP Tar/Non-Aqueous Phase Liquids (NAPL)

Former MGP operations resulted in the release of tar to the subsurface. MGP tar at the Site is characterized as a non-aqueous phase liquid (NAPL). The tar is denser than water and thus is referred to as a dense NAPL or DNAPL. The MGP tar and related constituents in soil and groundwater are the primary environmental impact to the subsurface from the former MGP operations. MGP-related tar/NAPL was observed at investigation locations generally corresponding with the former locations of MGP related structures located in the Central/Core Area. The NAPL is present in two areas within the Central/Core Area as shown on Figure 1-3. The two areas are as follows:

- The larger of the two areas is located in the central and northeastern part of the Central/Core Area. The area is located in the vicinity of the former purifier house and east of the former gas holder extending eastward in a limited area onto the adjacent property.
- The smaller of the two areas (significantly smaller than the previously described area) is located in the northwestern corner of the Central/Core Area.

In the central and northeastern portion of the Central/Core Area, the majority of the NAPL mass is situated in the upper ±5 to ±10 feet of the soil as shown on geologic cross-sections presented as Figure 1-4. Within this depth interval, NAPL is present in zones or layers which are either saturated with NAPL or where the NAPL occurs at lower degrees of saturation in the form of grain coatings and blebs. The zones and layers containing NAPL within this interval are often separated by layers where no visible impacts are discernable. At depths below approximately 10 feet bgs, NAPL was encountered less frequently, and where present, occurs in very thin layers or lenses or as blebs or globules separated by intervals of soil where no visible impacts are discernable. Lenses, thin layers, or blebs of NAPL were locally encountered at depths greater than 20 feet bgs in a narrow area between borings SB-128 and SB-115 and at one location in the northern portion of the Central/Core Area, in soil boring SB-122 (refer to Figures 1-3 and 1-4). The deepest NAPL encountered in the soil were NAPL blebs at a depth of 22.4 feet bgs in boring SB-132 (refer to Figures 1-3 and 1-4).

NAPL was encountered in the northwest corner of the Central/Core Area within the upper approximately seven feet of soil at a few closely spaced borings (i.e., MW-2X, SB-108A, and SB-111). At MW-2X and SB-108A, NAPL was observed as tarry globules, black and hardened tar, and as grain coatings within the upper five feet of soil. At SB-111, NAPL was only encountered as a 0.2 foot thick layer at a depth interval of 7.1 to 7.3 feet bgs (refer to Figures 1-3 and 1-4).

Soil Quality

Analyses of subsurface soil samples obtained during the investigation activities indicate that elevated BTEX and PAH concentrations [i.e., concentrations in excess of the NYSDEC's Soil Cleanup Objectives (SCOs) for unrestricted use] in the soil are associated with intervals where NAPL was encountered (refer to Figure 1-4). Concentrations of BTEX and PAH compounds in soil samples collected from intervals that are not impacted by NAPL are typically non-detect, or if detected, are below the SCO for unrestricted use. In surface soil (i.e., 0- to 2-inches bgs), concentrations of PAHs were above SCOs for unrestricted use in only five of 30 sample locations; these five samples were located in the Central/Core Area.

Groundwater Quality

Some dissolved phase BTEX and PAH compounds have been detected in groundwater at concentrations above the New York State Class GA Groundwater Quality Criteria [i.e., the 6 NYCRR Part 703 Standards and guidance values from the Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1] at well locations within the Central/Core Area (i.e., MW-5 and MW-6). On occasion, traces of NAPL have been identified in these wells. The dissolved phase compounds are attributable to contributions from the NAPL in the subsurface. Downgradient of the Central/Core Area, concentrations of dissolved phase compounds in groundwater decrease to below the Class GA groundwater quality criteria, or to non-detect levels, before reaching the Patchogue River. This trend indicates that the BTEX and PAH compounds are undergoing natural attenuation and are not impacting the Patchogue River. Groundwater monitoring is currently being conducted on a quarterly basis at the Site.

Patchogue River Sediment and Surface Water

The Patchogue River is located east of the Site. Sediments in the river were probed and sampled upstream, adjacent to, and downstream of the Site. The concentration levels of the PAH compounds detected in the sediment, and the distribution of these concentrations and of locally observed sheens produced when the sediment was probed through the area investigated (upstream and downstream) are indicative of sediments impacted by urban runoff of petroleum substances and substances derived from the combustion of petroleum. They are not indicative of a localized MGP source such as the Site. This is further supported by data from the Site. Data from the RI and groundwater monitoring events conducted at the Site indicates that there are no substantial impacts from the Site in the soil or groundwater adjacent to the river. The RI determined that sediments will not impact ecological or human health receptors and, therefore, are not an environmental medium of concern and will not require remedial activities. Further evaluation activities were performed with regard to the sediments during the PDI that was performed as part of the FFS. This additional evaluation determined that no indications of a subsurface migration pathway for MGP impacts from the Site to the river have been identified based on soil borings adjacent to the river, analytical results from groundwater samples obtained from monitoring wells adjacent to the river, observations from the sediment probing activities, and the distribution of PAHs concentrations measured in sediment samples. Surface water sampling revealed no exceedances of applicable NYSDEC Ambient Water Quality Standards and Guidance Values (adjacent to the Site, the Patchogue River is designated as a Class C Surface Water). Based on the above, neither the former MGP operations that were conducted on-Site nor the resulting impacted materials currently situated in the subsurface at the Site appear to have had an impact on the sediments or surface water in the Patchogue River.

Soil Vapor

Sub-slab soil vapor, indoor air and ambient air samples were collected on-Site and off-Site during the RI. Volatile organic compounds (VOCs) were detected in the indoor air sample. MGP-related constituents were not detected at concentrations above indoor air screening criteria. Based on the fact that no MGP-related constituents were detected in the indoor air sample, soil vapor was not deemed to be a media of concern with regard to the remediation of the Site.

1.5 Record of Decision

In compliance with the Order on Consent and as per the results of the RI, National Grid retained BC to conduct a Focused Feasibility Study (FFS) to evaluate on and off-site remedial actions to mitigate, to the extent practicable, all health and environmental hazards and potential hazards associated with disposal of hazardous materials at the Site. The results of the evaluation are documented in a report entitled "Focused Feasibility Study, Patchogue Former Manufactured Gas Plant (MGP) Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" dated May 2011. Based on the results of the feasibility study process, a remedial alternative was selected by the NYSDEC and presented for public consideration in a Proposed Remedial Action Plan (PRAP) dated February 2011. The NYSDEC presented the PRAP, including the selected remedial alternative, to the interested public in a meeting on March 10, 2011. After the public meeting and receiving public comment, a ROD was prepared by the NYSDEC which documents the elements of the selected remedy.

The ROD describes the remedy for the Site that was chosen by the NYSDEC in accordance with the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. The following subsections discuss the remedial action objectives (RAOs) and the remedy selected for the Site by the NYSDEC.

1.5.1 Remedial Action Objectives

The RAOs prepared for the Patchogue Former MGP Site, as documented in the ROD, are as follows.

Public Health Protection

Groundwater

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with contaminated groundwater.

Soil

- Prevent ingestion/direct contact with contaminated soil.

Soil Vapor

- Address exposures to the public related to soil vapor intrusion into buildings.

Environmental Protection

Groundwater

- Remove the source of ground or surface water contamination.
- Restore the groundwater aquifer to meet ambient groundwater quality criteria, to the extent feasible.

Soil

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

NAPL

- Remove/treat free product/NAPL identified at the Site to the extent technically practicable.
- Eliminate through removal, treatment and/or containment the free product/NAPL as source of contamination to other environmental media.

Soil Vapor

- Eliminate, to the extent practicable, the impact of contaminants in soil or groundwater to soil vapor.

1.5.2 Summary of the Selected Remedy

Based on the results of the evaluation detailed in the FFS as well the public's input into the PRAP, as documented in the ROD, the NYSDEC selected a remedy for the Patchogue Former MGP Site. The components of the remedy, as presented in the ROD, are described below:

1. **Remedial Design Program:** A remedial design program will be implemented to provide the details necessary for the design, construction, operation, maintenance, and monitoring of the remedial program. Green remediation principals and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31, Green Remediation. The major green remediation components are as follows:
   - Considering the environmental impacts of treatment technologies and remedy stewardship over the long-term;
   - Reducing direct and indirect greenhouse gas and other emissions;
   - Increasing energy efficiency and minimizing use of non-renewable energy ;
   - Conserving and efficiently managing resources and materials;
   - Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
   - Maximizing habitat value and creating habitat, when possible;
   - Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
   - Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.
2. **On-Site Excavation:** On-site excavation of the following:
   - any existing former MGP structures, debris, and major obstructions, including highly impacted soils in the immediate vicinity of these structures, to allow for excavation and/or treatment of underlying soils and installation of a soil cover; and
   - on-site fill materials to a depth of at least two feet below ground surface (bgs) over the entire Central/Core Area (beyond the limits of the ISS area) to allow for installation of a two-foot thick soil cover. The on-site excavations will be backfilled with stockpiled soils and/or imported soil, the top two-feet of which will meet the 6NYCRR 375-6.7(d) restricted-residential criteria for backfill.
3. **Off-Site Excavation:** Off-site excavation (immediately to the east of the main MGP site), to a depth of approximately nine feet bgs to remove visible MGP-related source material and petroleum impacted soils. A demarcation layer will be placed at the bottom of the off-site excavation and the area will be backfilled entirely with material that meets 6NYCRR 375-6.7(d) residential criteria for backfill.
4. **In-Situ Solidification (ISS) of Soil:** In-situ solidification (ISS) of impacted soil will include all areas of MGP-related source material and associated soil, with the deepest targeted treatment depth being 23 feet below grade (bgs.) The soil will be mixed in place with cement and/or other hardening materials to form an impermeable, solid mass to prevent migration of MGP-related contaminants.

The area to be solidified will extend laterally beyond the limits of contamination to encapsulate the impacts. The method of ISS will be determined during the remedial design. Solidified soils will be covered by a sufficient layer of soil to protect them from freeze-thaw cycles. The top two feet of this cover will be soil that meets the restricted-residential requirements for cover material set forth in 6 NYCRR Part 375-6.7(d) which will be placed over a demarcation layer. The ISS treatment process increases the volume of the soil so an additional volume of material sufficient to account for this expansion will be required to be excavated and removed. The materials to be excavated to account for the frost protection layer and volume expansion will target source areas that are accessible and not otherwise excavated. Impacted soil and any excess stabilized soil will be transported to an approved off-site disposal facility. Excavated materials that are not considered source material (e.g. visible MGP tar-impacts) may be stockpiled and evaluated for reuse as backfill on-site. All excavated soils, not suitable for reuse, will be transported and disposed off-site at an approved landfill or treatment facility.

5. **Odor/Dust Control:** On-site material handling (dewatering and/or blending operations) will be performed under a temporary fabric structure, as necessary, to control vapor, odor and dust emissions. Odor suppression materials such as foam will be available on-site at all times. Excavated soils will either be directly loaded into transport trucks, if waste characterization has been performed, or staged on-site for waste characterization. A Community Air Monitoring Plan (CAMP) will be implemented which will include real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area during all ground-intrusive activities at the Site.
6. **Soil Cover:** Installation of a site cover to allow for restricted-residential use of the Site. The Site will be restored to its existing grade. The cover will consist either of structures, such as buildings, pavement, and sidewalks comprising the site development, or a soil cover in areas where the upper two feet of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). The soil cover will consist of a minimum of two feet of soil meeting the requirements for cover material set forth in 6 NYCRR Part 375-6.7(d). The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to support vegetation.
7. **Institutional Controls:** Imposition of an institutional control in the form of an environmental easement for the controlled property that:
   a. requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
   b. allows the use and development of the controlled property for restricted residential, commercial and industrial uses or as defined by Part 375-1.8(g), though land use is subject to local zoning laws;
   c. restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDEC, the New York State Department of Health (NYSDOH) or the Suffolk County Department of Health Services (SCDHS);
   d. prohibits agriculture or vegetable gardens on the controlled property; and
   e. requires compliance with the NYSDEC approved Site Management Plan.
8. **Site Management Plan:** A Site Management Plan is required which includes the following:
   a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the Site and details the steps and media-specific requirements necessary to allow the following institutional and/or engineering controls to remain in place and effective:
      - Institutional Controls: The Environmental Easement discussed in Paragraph 7 above.

- Engineering Controls: The ISS area discussed in Paragraph 4 and the site cover discussed in Paragraph 6 above.

A copy of the Site Management Plan will be provided to the appropriate property owners. This plan will include, but may not be limited to:

i. an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
ii. descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
iii. a provision to evaluate the potential for soil vapor intrusion should the on-site building become occupied or should any buildings be developed on the site and to implement actions (e.g., mitigation or monitoring) recommended to address exposures related to soil vapor intrusion;
iv. provisions for the management and inspection of the identified engineering controls;
v. maintaining site access controls and NYSDEC notification; and
vi. the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

b. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan will include, but may not be limited to:
   i. monitoring of groundwater to assess the performance and effectiveness of the remedy; and
   ii. a schedule of monitoring and frequency of submittals to the NYSDEC.

1.6 Standards, Criteria, and Guidance

Standards, Criteria, and Guidance (SCGs) are promulgated requirements and non-promulgated guidance, which guide site activities during investigation and remediation. SCGs include chemical-specific, action-specific, and location-specific SCGs. SCGs that are considered potentially applicable to remediation activities at the Patchogue Former MGP Site are summarized below.

Chemical-Specific SCGs

Chemical-specific SCGs that are applicable to the Patchogue Former MGP Site include:

- NYS Soil Cleanup Objectives (6 NYCRR Part 375);
- CP-51/"Soil Cleanup Guidance" (NYSDEC, October 2010); and,
- Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) Limits (40 CFR 261 and 6 NYCRR Part 371).

The December 2009 RIR, the May 2011 FFS and the March 2011 ROD included a comparison of analytical data for various Site media (including soil, groundwater, indoor air, Patchogue River sediment and surface water) to the applicable chemical-specific SCGs. In accordance with the March 2011 ROD, no MGP-related impacts have resulted in exceedances of chemical-specific SCGs in the Patchogue River Creek sediments or surface water and thus no remediation activities are required for these media.

Action-Specific SCGs

Action-specific SCGs that are considered potentially applicable to the proposed remedial actions at the Patchogue Former MGP Site include:

- General health and safety requirements, including Occupational Safety and Health Administration (OSHA) regulations;
- NYSDOH Generic Community Air Monitoring Plan (CAMP), which identifies air monitoring requirements for in work areas when certain activities are in progress at contaminated sites;

- Resource Conservation Recovery Act (RCRA) Land Disposal Restrictions (LDRs), which govern the land disposal of hazardous wastes;
- RCRA and United States and New York State Department of Transportation (USDOT and NYSDOT) regulations for the transportation and management of hazardous materials;
- NYSDEC Department of Environmental Remediation document entitled "Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment" (DER-4); and

Location-Specific SCGs

Location-specific SCGs that are considered potentially applicable to the Patchogue Former MGP Site include:

- Local permits from Suffolk County and the Village of Patchogue.

1.7 Remedial Design Work Plan Organization

This RDWP is comprised of nine sections and was organized in accordance with Section 5.2(b) of DER-10 "Remedial Design". The organization and content of the report are as follows:

- **Section 1 - Introduction** - This section provides a description of the location of the Site, the historical operations performed on the Site, the results of the remedial investigations conducted at the Site and a summary of the remedy selected to address the known contamination.
- **Section 2 – Remedial Design Approach** - This section summarizes the proposed approach to the design of the remedy to be implemented at the Site and also provides preliminary concepts of the construction aspects of its implementation.
- **Section 3 – Pre-Remedial Design Activities** - This section describes the implementation of pre-remedial design activities to obtain supplemental information in support of the design of the selected remedy.
- **Section 4 – Identification of Property Access and Federal and State Permits Required for Remediation** - This section identifies the access agreements and permits that will be necessary to implement the pre-remedial design activities as well as construct the remedy described in the ROD and this RDWP.
- **Section 5 – Health and Safety Plan** - This section summarizes the contents of the Health and Safety Plan (HASP, included in Appendix B) and the health and safety measures to be taken in order to ensure worker safety during the implementation of the pre-remedial design activities as well as the implementation of the remedy.
- **Section 6 – Post-Construction Maintenance and Monitoring Plan** - This section presents a discussion of the plans to be developed to detail the methods to be utilized to monitor and maintain the engineering controls to be installed at the Site and to monitor the Site upon completion of the construction of the proposed remedy.
- **Section 7 – Comprehensive Remedial Design Schedule** - This section presents the significant milestones associated with the remedial design tasks from preparation of this RDWP through mobilization for implementing the remedy.
- **Section 8 – References** – This section documents the references utilized to generate the RDWP.

Section 2

Remedial Design Approach

This section presents the proposed approach to the remedial design process that will be implemented at the Patchogue Former MGP Site. The design process is divided into three distinct phases, (i.e., Pre-Remedial Design; Remedial Design [50%, 95% and the Final (100%) Remedial Design Report (RDR)] and the implementation of the remedy. These phases are detailed in the following subsections of this RDWP.

2.1 Pre-Remedial Design Activities

Pre-remedial design activities will be conducted in order to gather supplementary information for the design of the selected remedy. The pre-design investigation activities to be conducted include:

- A permeability/compatibility study to optimize the design of the grout mixture and identify the grout mixture that will achieve the design permeability and strength without degrading in the presence of Site conditions;
- Groundwater modeling to assess the effects of implementation of the ISS on groundwater flow and groundwater elevation and, if necessary, to facilitate development of an approach to address an increase in water table elevation that may result from ISS implementation;
- A geotechnical investigation to acquire data in support of the design of the shoring system to be utilized to support the off-site excavation activities as well as the implementation of the ISS activities; and
- The performance of a subsurface obstruction survey to identify potential utilities and other potential impediments to the implementation of ISS as well as the excavation shoring system.

The Pre-Remedial Design Investigation activities are detailed in Section 3.0 of this RDWP.

2.2 Remedial Design Approach

The design for the selected remedy for the Patchogue Former MGP Site will be based on the results of the pre-design investigation activities described above and detailed in Section 3.0 of this RDWP, established standards and guidelines as well as professional experience in the remediation of MGP sites. The components of the selected remedy are described in the ROD as well as Section 1.6 of this RDWP. The following subsections describe the proposed general approach and steps in the design.

2.2.1 Remedial Design Report (50% Design)

The initial design submittal to the NYSDEC will be a Draft 50% Remedial Design Report (RDR). This design submittal will contain draft versions of the remedial construction approach, engineering drawings, and technical specifications. At the 50% design stage, several aspects of the design package will be conceptual in nature (e.g., shoring/sheeting system, work sequencing, etc.) and will require input from National Grid's Remediation Contractor(s). Key aspects of the design will be presented in greater detail in subsequent submittals. National Grid proposes to meet with the NYSDEC to discuss the components of the 50% Remedial Design Report during the review period.

The Draft 50% RDR will provide the basis for the performance of the remedy at the Site. The 50% RDR will include the following:

- A description of the design criteria and objectives for construction at the Patchogue Former MGP Site;
- The results of permeability/treatability/compatibility study tests to design the appropriate grout mixture to be utilized for ISS;
- The results of geotechnical soil testing in support of the design of the shoring/sheeting systems associated with the proposed excavation activities;
- The results of the pre-remedial design activities; and
- Preliminary drawings for the construction activities.

National Grid will schedule a meeting with the NYSDEC during the review period to discuss the 50% design.

2.2.2 Remediation Contractor Procurement

The Draft 50% RDR will be utilized to procure a Remediation Contractor(s). Once the selected Remediation Contractor(s) is procured, the balance of the remedial design will be completed. In conjunction with National Grid's Remediation Contractor, National Grid's Design Engineer will formulate the final design plans for the construction of the remedy.

2.2.3 Remedial Design Report (95% Design)

Once the design of the remedy is completed, a 95% version of the RDR will be submitted to the NYSDEC for review and approval. The 95% RDR will contain the final elements of the remedy design including engineering drawings and Site Operations Plans.

The Draft 95% RDR will include the following:

- The draft final engineering plans, documents, drawings and specifications;
- A draft outline of the Operations, Maintenance and Monitoring (OM&M) Plan for activities to be performed after the completion of the remedial construction activities;
- An estimate of construction costs for the implementation of the remedial construction activities;
- A draft schedule for completion of the remedial construction activities, OM&M and post-construction monitoring; and
- Design submittals prepared in conjunction with the Remedial Contractor(s) for the implementation of the remedy (i.e., Site Operations Plans, etc.).

Community officials and public stakeholders will be consulted during the development of the remedial design for input on community related issues in order to minimize potential disruptions to local businesses.

2.2.4 Final Remedial Design Report (100% Design)

The Final 100% RDR will be prepared after receipt of NYSDEC comments on their review of the 95% RDR. After the comments are addressed, the submittal will be considered complete, finalized and will be resubmitted to the NYSDEC. The Final 100% RDR will be signed and sealed/stamped by a professional engineer(s) licensed in the State of New York.

Commencement of the construction activities will proceed in accordance with the approved schedule after receipt of NYSDEC approval of the remedial design as the selected Remediation Contractor(s) will have already been procured.

2.3 Remedial Technologies

The following subsections of this report discuss the remedial technologies identified for implementing the selected remedy as described in the March 2011 ROD and Section 1.5.2 of this RDWP.

2.3.1 In-Situ Solidification

In-situ solidification (ISS) involves the mixing of impacted soils with a binding reagent (e.g., cement-based grout, bentonite, slag, mixtures of all three, etc.) to change the physical properties of the impacted soil to the form of a solidified mass. The desired changes to the impacted soil include:

- Decrease in the hydraulic conductivity of impacted soil (limits contact with groundwater);
- Encapsulation of the chemical constituents in the impacted soil thereby decreasing leachability; and
- Mixing of constituents throughout the solidified mass to percent volumes below their saturation point thereby eliminating the potential for mobile (i.e., free) NAPL.

ISS can be performed using a variety of technologies. For shallow zone applications (e.g., depth of approximately 0 to 30 feet bgs) such as at the Patchogue Former MGP Site, solidification agent injection and mixing is generally achieved using a method termed shallow-zone soil mixing (SSM). SSM utilizes large diameter augers (e.g., 6 to 12-foot diameter) to mix the soils to the targeted depths in a vertical column. Solidification agents are injected into the soils through ports in the auger shafts/flights during the process and mixed into the soil. To achieve continuous coverage, the columns are overlapped. Other soil mixing methods include mixing with excavator buckets, excavator mounted mixing/injection tools such as rakes and rotary mixing tools. The method of ISS to be employed at the Site will be determined during the design phase of the project.

In accordance with the March 2011 ROD, impacted soils to be subject to ISS will include all areas of MGP-related NAPL/tar and associated soil, with the deepest targeted treatment depth being 23 feet bgs. The approximate limits of the area subject to ISS, and the targeted depth of remediation, is depicted on Figure 2-1. The ISS volume is approximately 6,800 cubic yards. The area to be solidified will extend laterally beyond the limits of contamination to provide an additional measure of protection.

The ISS treatment process will increase the volume of the soil due to the injection of the binding reagent. Therefore, an additional volume of material sufficient to account for this expansion will be required to be excavated and removed from the Site. The intent of removing the materials will be to accommodate the welling and maintain the solidified mass below the frost line to avoid potential detrimental effects on freeze-thaw action. The materials to be excavated to account for the frost protection layer and volume expansion will target source areas that are accessible and not otherwise excavated. Impacted soil and any excess stabilized soil will be transported to an approved off-site disposal facility. Excavated materials that are not considered source material (e.g., those with no visible MGP tar-impacts) may be stockpiled and evaluated for reuse as backfill on-site. All excavated soils, not suitable for reuse, will be transported and disposed off-site at an approved landfill or treatment facility.

2.3.2 Excavation and Shoring

Excavation activities to be performed as part of the remedy will generally be conducted in three areas:

- Excavation of contaminant source materials to an average depth of nine feet bgs on the adjacent property to the east of the Site. The estimate of soil to be excavated is approximately 800 cubic yards;
- On-site fill materials to a depth of at least two feet bgs over the entire Central/Core Area (beyond the limits of the ISS area; approximately 1,800 cubic yards) to allow for installation of a two-foot thick soil cover; and

- Excavation of uppermost solidified soils to allow the area to be covered by a layer of soil to protect them from freeze-thaw cycles and establish the surface cover (approximately 1,700 cubic yards).

The areas subject to excavation activities are depicted on Figure 2-1.

In addition, excavation activities may be required if existing former MGP structures, debris, and major obstructions are encountered to facilitate implementation of the remedy. If encountered, the structures will be removed along with any highly impacted soils in the vicinity to allow for excavation and/or treatment of underlying soils and installation of a soil cover.

To facilitate excavation activities and provide a safe working environment, a shoring system will need to be designed to support the walls of the off-site excavation areas. The shoring system design will be based upon a review of existing Site constraints. The results of the geotechnical investigation, as described in Section 3.5 of this RDWP, will be evaluated and the preliminary design of a proposed shoring system to support the excavation walls and to mitigate adverse impacts (e.g., structural instability, settlement, movement, etc.) to adjacent facilities will be prepared. The final design of the proposed excavation shoring system will be undertaken with the assistance of the selected Remediation Contractor(s).

2.3.3 Engineering Control (Site Cover)

Engineering Controls will be implemented as part of the selected remedy to protect human health and the environment from MGP-related constituents that will remain in the subsurface at the Patchogue Former MGP Site. Engineering Controls are intended to eliminate contact with MGP-related constituents, and mitigate potential migration of these constituents from the Site. The Engineering Controls include construction of a cap over the portions of the Central/Core Area, outside of the limits of the ISS area, which were subject to former filling activities.

A Site cover will be installed to support future restricted-residential use of the Site. The on-site soil cover will be constructed over the limits of the ISS area as well as those portions of the Central/Core Area subject to historic filling activities. The two-foot thick soil cover will be constructed of materials meeting the 6NYCRR 375-6.7(d) restricted-residential criteria for backfill.

Site grading will be performed to facilitate drainage of stormwater and reduce infiltration. To the extent practical, the design for the Site cover will be coordinated with future development plans.

2.3.4 Groundwater Monitoring Program

A groundwater monitoring program will be conducted to determine the degree of contaminant reduction in the groundwater associated with the ISS, the source removal and natural attenuation processes. Initially groundwater monitoring will be conducted on at least an annual basis. The frequency and duration will be evaluated over time and increased, as necessary. Groundwater monitoring will continue until it has been demonstrated that the remedy has successfully achieved its objectives.

2.3.5 Institutional Controls and Site Management Plan

Various Institutional Controls will be evaluated during the remedial design process to augment the Engineering Controls by non-physical means and may include administrative measures, such as restrictions on groundwater use and future construction on the former MGP site. The Institutional Controls are intended to prevent exposure to constituents remaining on the site, and prevent actions that would interfere with the effectiveness of the remedial program or with the effectiveness and/or integrity of operation, maintenance, or monitoring activities. As detailed in the ROD, the Institutional Controls to be implemented at the Site consist of the development of a Site Management Plan and the establishment of an environmental easement on the Site.

A Site Management Plan (SMP) will be developed to identify the long-term monitoring, inspection, and maintenance activities for the institutional and engineering controls. Refer to Section 6 for additional details on the SMP and institutional controls, including periodic certification.

The environmental easement will require: (a) limiting the use and development of the property to restricted-residential, which will also permit commercial and industrial use; (b) compliance with the approved Site Management Plan; (c) prohibiting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH; and (d) National Grid to complete and submit to the NYSDEC a periodic certification of institutional and engineering controls.

2.3.6 Materials Management

Approved Backfill Materials: On-Site

The on-site excavations will be backfilled with either excavated materials that are not considered source material (e.g., with no visual MGP tar-impacts) that were stockpiled and evaluated for reuse and/or imported soil. The top two-feet of all soil backfill to be used to cover on-site excavations will meet the 6NYCRR 375-6.7(d) restricted-residential criteria for backfill. The two-feet of soil backfill will be placed over a demarcation liner.

Approved Backfill Materials: Off-Site

Off-site excavation (immediately to the east of the Site) will be backfilled entirely with material that meets 6NYCRR 375-6.7(d) residential criteria for backfill. The backfill will be placed over a demarcation liner between the native soils and the backfill materials. The area will be surfaced with an asphalt pavement system.

Remediation-Derived Wastes

Remediation-derived wastes will be properly managed, characterized and treated on-site or disposed of at off-site disposal facilities permitted and licensed to accept the various types of wastes. Anticipated waste streams include impacted soils, concrete and other construction debris, excess grout/impacted soil mixtures generated from the ISS processes, personal protective equipment and debris.

Excess grout/soil mixture generated from the ISS processes as well as visually impacted soils generated from the off-site excavation activities and the excavation activities conducted to facilitate installation of the soil cap will be collected, placed into trucks at their place or origin and managed, as necessary, within a temporary fabric structure to be constructed on the concrete pad in the Northern Area of the Site. These materials will be allowed to stabilize (ISS materials) or be further amended/stabilized (excavated impacted soils) to promote their handling characteristics.

Soil

During the soil removal activities, soil will be inspected and visibly impacted soil will be segregated from visibly un-impacted excavated material. Visibly impacted soil will be stockpiled in an on-site staging area(s) to facilitate handling, stabilization (via gravity dewatering or mixing with dryer soils or conditioning agents), consolidation, and characterization. Waste characterization (analyses and sampling frequency) will be conducted in conformance with applicable regulatory requirements (e.g., RCRA regulations) and requirements of the potential permitted off-site facility(ies). Other physical characteristics of the material will be observed and documented including physical appearance, odor, and organic vapor emissions, as measured with a photoionization detector (PID). Permitted treatment/disposal facilities on National Grid's list of approved facilities will be selected upon receipt of the waste characterization results and in accordance with applicable rules and regulations. After receiving acceptance from the treatment/disposal facility, the waste material will be loaded and

transported off-site to the facility. Waste tracking forms (manifests or bills of lading) will be used to document the shipment of the waste material from the Site to the treatment/disposal facility. In addition disposal certificates or weight tickets will be obtained from the facility.

Excavated soil that is not visibly impacted will be staged separately for use as backfill in accordance with Sections 3.2.1 and 3.2.2.

Liquids

Liquids recovered during remedial action will be staged separately in on-site holding tanks (e.g., frac tanks). Recovered liquids may include water collected from staging area sumps, liquids removed from structures, decontamination fluids, and NAPL. NAPL recovered in concentrated forms may be containerized separately (e.g., in New York State Department of Transportation (NYSDOT)-approved drums) for separate characterization and management. Waste characterization (analyses and sampling frequency) will be conducted in conformance with applicable regulatory requirements (e.g., RCRA regulations) and requirements of the potential permitted off-site facility(ies). Other physical characteristics of the liquid will be observed and documented including physical appearance and odor. Permitted treatment/disposal facilities on National Grid's list of approved facilities will be selected upon receipt of the waste characterization results and in accordance with applicable rules and regulations. After receiving acceptance from the treatment/disposal facility, the waste liquids will be pumped into haulers and transported off-site to the facility. Waste tracking forms (manifests or bills of lading) will be used to document the shipment of the waste liquids from the Site to the treatment/disposal facility. In addition, disposal certificates or weight tickets will be obtained from the facility.

An alternate means of managing water recovered during remedial action (e.g., from dewatering, decontamination, staging area sumps, etc.) may be through the use of a temporary on-site treatment system. As discussed previously, dewatering is not anticipated to be substantial, since the excavation component will be performed through the water table without dewatering. The potential need for a temporary on-site water treatment system will be further evaluated during remedial design and may ultimately be based on input from the selected Remediation Contractor. Treated water would then be discharged to either the Publicly Owned Treatment Works (POTW) or discharged to surface water under a State Pollutant Discharge Elimination System (SPDES) permit.

Debris

During implementation, former structures or foundations may be encountered which require removal in order to complete the remedial action. The foundations and structures (following removal of the contents of structures, as necessary) will be demolished, as necessary, to facilitate removal. Based on visual observations, and in consultation with the NYSDEC, masonry structures will be crushed for re-use as fill underneath the site cover.

Masonry debris not re-used on-site and other debris will be staged separately and characterized, as necessary, in accordance with applicable rules and regulations. Alternatively, waste characterization results from media in contact with the debris may be utilized if it is determined to be a conservative representation of the debris. A permitted treatment/disposal facility(ies) on National Grid's list of approved facilities will be selected upon receipt of the waste characterization results and in accordance with applicable rules and regulations. After receiving acceptance from the treatment/disposal facility, the waste material will be loaded and transported off-site to the facility. Waste tracking forms (manifests or bills of lading) will be used to document the shipment of the waste material from the Site to the treatment/disposal facility. In addition, disposal certificates or weight tickets will be obtained from the facility.

2.3.7 Air Monitoring

During implementation of the pre-design and remedial activities, a Community Air Monitoring Program (CAMP) will be implemented. The CAMP will conform to the guidelines presented by the New York State Department of Health in Appendix 1A of the New York State Department of Conservation DER-10 Technical Guidance for Site Investigation and Remediation. During the completion of pre-design activities, CAMP monitoring will be conducted during periods of intrusive site work. Monitoring will consist, at a minimum, of PIDs and dust meters at a minimum of two locations on the Site (i.e., upwind and downwind). Monitoring will be conducted in accordance with the above referenced DER-10 guidelines. The specific requirements and protocols for CAMP monitoring at the Site will be detailed in the CAMP to be submitted as part of the remedial design.

Based on the results of the CAMP conducted during the performance of the pre-remedial design activities, the CAMP described in Appendix A, may be supplemented by alternative air monitoring technologies and processes. The preparation of the final CAMP will be conducted during the design phase of the project. Once finalized, the CAMP will be incorporated into the remedial design packages to be submitted to, and approved by, the NYSDEC. During remedial activities, it is anticipated that air monitoring will be conducted using a combination of real time (continuous) air monitoring at fixed locations (24 hours per day/7 days per week) and walk-around perimeter and work zone monitoring using hand held instruments.

2.3.8 Odor Control/Vapor Management

Odor control and vapor management technologies and processes will be evaluated to mitigate or eliminate potential odors during ISS and excavation activities. The selected processes / technologies will be incorporated into the remedial design packages to be submitted to, and approved by, the NYSDEC.

Per the requirements of the ROD, management (i.e., dewatering, amending to improve handling characteristics) of materials resulting from excavation operations will be performed under a temporary fabric structure, as necessary, to control vapor, odor, and dust emissions.

Section 3

Pre-Remedial Design Activities

The following sections detail the pre-remedial design activities to be performed at the Site. The purpose of the pre-remedial design activities is to obtain supplemental site information necessary for the completion of the design of the remedy selected in the ROD.

3.1 Property Access Activities

PDI activities described below are planned for both on and off site properties. Upon approval of the RDWP, efforts will be made to establish access agreements with the owners of the off site properties to conduct the proposed activities.

3.2 Utility Clearance

Prior to conducting any ground intrusive activities described below, the locations for these activities would be marked in the field. Dig Safely New York would be contacted to obtain utility clearance. Additionally, the Village of Patchogue and Suffolk County would be contacted to obtain clearance for utilities that they maintain (e.g., sewer and water). Available information regarding the location of utilities from National Grid and the off-site property owners would also be reviewed.

3.3 Groundwater Flow Modeling Study

To assess the potential of the implementation of the planned ISS to adversely affect local hydrogeological conditions, a groundwater flow modeling study will be performed as part of the design process. This study is described in Section 3.3.1. Additional field data collection is proposed to support development and calibration of the groundwater flow model. These field activities are described in Section 3.3.2.

3.3.1 Groundwater Flow Modeling

The objectives of this groundwater flow modeling task are to:

- Develop a groundwater flow model calibrated to the Site groundwater level data for use as a baseline condition;
- Use the model to simulate the groundwater flow and groundwater levels following implementation of the remedial alternative; and
- Evaluate the influences of ISS in terms of the change of groundwater flow and groundwater levels relative to the baseline condition.

The model is intended as an analytical tool to evaluate the changes of groundwater flow and groundwater levels from the implementation of the remedial alternative (“what if?” scenarios) relative to the baseline condition and, if necessary, to facilitate development of an approach to address an increase in water table elevation that may result from ISS implementation.

The conceptual model used to develop the groundwater flow model will be based on the hydrogeologic conditions described in Section 1.3 and anticipated conditions following remedy implementation (i.e., ISS to targeted depths of up to 23 feet bgs). Site data, including in situ hydraulic conductivity test (slug test) results, observations/descriptions from soil borings, groundwater elevation data from monitoring

wells and piezometers, and surface water elevations from the Patchogue River will be used to construct the model. The model will also incorporate publically-available regional data, as appropriate. Also, as described in Section 3.3.2, additional field data will be collected to support the development of the model.

The "Modular Three Dimensional Finite Difference Groundwater Flow Model" (MODFLOW) will be used to perform the groundwater flow simulation. This modeling code was developed by the United States Geological Survey (USGS) in the early 1980's based on theoretical flow behavior defined by Darcy's Law. MODFLOW is well proven and accepted by industry and by regulatory agencies for application to porous media flow systems, and remains today as the de facto standard code for groundwater modeling.

If after developing the model and simulating pre-remedial groundwater flow conditions, the degree of uncertainty in the results requires further refinement of the conceptual model, additional data collection may be proposed aimed at reducing this uncertainty to acceptable levels. Such additional data collection may include additional soil borings to refine subsurface conditions, piezometer installation to provide additional groundwater level data and hydraulic conductivity data, and/or pumping tests to assess hydraulic properties of the subsurface.

Results of the modeling exercise will be included with design submittals. The results will describe the model area, construction of the model (e.g., boundary conditions, aquifer properties, etc.), model calibration, sensitivity analyses, and the results of the simulation of baseline conditions and the remedial alternatives.

3.3.2 Field Activities to Support Groundwater Flow Modeling Study

As described in Section 1.3, the stratigraphic units encountered at the Site, from shallowest to deepest, include fill, alluvial deposits and glacial outwash deposits (i.e., the upper glacial aquifer). The hydraulic properties may vary between these units and to some degree within these units. Thus, additional data will be collected to assess hydraulic properties of the units and thus facilitating their simulation in the groundwater flow model. The evaluation will include: (1) conducting in situ hydraulic conductivity tests (slug tests) on wells and piezometers screened in discrete stratigraphic units; and (2) measuring water levels at well/piezometer couplets where the wells/piezometers are screened in different stratigraphic units (i.e., fill and outwash) at the same location to assess hydraulic head difference between the units (i.e., vertical hydraulic gradient).

Several existing wells are screened discretely in the glacial outwash. None are screened discretely in the fill or alluvial deposits. Accordingly, couplets of temporary piezometers will be installed at several locations at the Site. Each couplet will include one piezometer screened in the fill and one piezometer screened in the outwash. This will permit slug testing to estimate the horizontal hydraulic conductivity of the individual units as well as water level measurements to assess hydraulic head differences between units. Existing outwash wells will be used as part of the couplet where subsurface conditions permit. As the alluvial deposits are relatively thin and variable, they will not be targeted for piezometer installation. Rather, the alluvial deposits will be assessed by their soil descriptions, their areal distribution and the vertical hydraulic gradient across them as measured by hydraulic head differences between the units above and below (i.e., fill and outwash units).

Provided below is a detailed description of the field activities to be conducted in support of the groundwater flow modeling study.

Install and Develop Temporary Piezometers

Seven temporary piezometers will be installed at four locations (four clusters) to facilitate the collection of water level measurements and hydraulic conductivity estimates in the fill and the outwash. At one of the four proposed cluster locations, existing well MW-9D is screened discretely in the outwash and thus

only one piezometer, screened in the fill, will need to be installed here to provide a piezometer couplet. At the other three locations, two piezometers will be installed; one with a screen interval set in the fill, and one with a screen interval set in the outwash. These locations will be positioned proximal to previously drilled borings SB-115, SB-121, and SB-128. The approximate locations of the proposed piezometers are depicted on Figure 3-1.

The soil borings advanced for the purposes of installing the piezometers will be drilled using hollow-stem augers and sampled with a two foot long, two-inch inside diameter (I.D.) split- spoon sampler from ground surface to the target depth indicated in Table 3-1. The soil samples will be described in the field to characterize soil type, including grain size, texture, and apparent moisture content. Soil samples will be logged in accordance with the Burmister Soil Classification System and classified using the Unified Soil Classification System (USCS). The soil descriptions will be used as the basis for determining the presence and thickness of the targeted unit as well as for determining the depth and length of the piezometer screen and filter pack interval.

The piezometers will be constructed of two-inch diameter, Schedule 40 PVC casing with 0.020-inch slot PVC screens. The casing and screen will be lowered into the borehole such that the screen is positioned within the targeted depth interval.

In the case that a soil boring is drilled to a depth below the targeted unit, the borehole will be plugged-back to seal off the interval below the targeted unit prior to installation of the screen and casing. Bentonite will be used to plug-back the borehole. Before the screen and casing are placed in the borehole, a one-inch thick layer of filter pack sand will be placed above the bentonite. The screen intervals for the piezometers intended to monitor the glacial outwash unit will be set sufficiently deep so that the filter pack will not extend upward into the overlying units (e.g., alluvial deposits or fill).

Once the screen and casing are in place, the annular space between the screen and the borehole will be filled with filter pack material sized appropriately for the screen slot size. The filter pack material will be added until it extends above the top of the screen. If possible, the filter pack will be installed to extend at least two feet above the top of the screen.

A bentonite seal will be placed in the annular space above the filter pack. If the bentonite annular seal is to be installed at a depth below the water table, pellets or chips of bentonite, or bentonite slurry, will be used to construct the seal. If the bentonite seal is to be positioned above the water table, bentonite slurry will be used to construct the seal. The bentonite slurry will be prepared by mixing water and powdered bentonite at a ratio of approximately 30 gallons of water to 25 to 30 pounds of bentonite. The bentonite slurry would be placed in the annular space using a side-discharging tremie pipe. If bentonite pellets or chips are appropriate, they can be placed in the annular space and allowed to settle in place via gravity settling and to hydrate for at least one hour before grout is placed above the bentonite (see below). Where possible, the bentonite seal will be a minimum of 24-inches thick, except in those cases where a screen may be in too close a proximity to the ground surface to allow for this thickness; in these instances, the piezometer construction will be modified to provide a functional seal at the ground surface.

The annular space above the bentonite seal will be filled with cement-bentonite grout to a depth within a foot or so below ground surface at a position appropriate for subsequent installation of the surface protective cover or casing. The grout will be placed from the bottom of the annular space using the tremie method.

An above-grade surface protective casing or a flush-mounted protective cover (as appropriate for the location) will be installed to cover the top of the piezometer casing. The cover or casing will be set in place with concrete such that surface water drains away from the piezometer.

A mark or notch will be placed at the top of the PVC casing to serve as the reference point for measurements of the water level in piezometer. An expansion plug (plumbers plug) with a vent hole will be used to cap the top of the PVC casing.

After a minimum period of 24 hours has passed following piezometer installation to allow for the cement-bentonite grout to set, the piezometers will be developed. Piezometer development will be conducted using one or a combination of techniques including surging, bailing, and pumping. The piezometers will be developed until the water produced from the well is visibly clear and free of sediment or until there is no further decrease in turbidity after removal of approximately 10 well volumes of water. Water and sediment produced from development will be containerized pending characterization and off-site disposal.

Each of the temporary piezometer locations will be surveyed. The survey will include location coordinates, ground surface elevation, and top of casing elevation (i.e., a water level reference point elevation). Coordinates will be referenced to the State Plane coordinate system for New York using the North American Datum of 1983 (NAD 1983) in units of feet. Elevations will be referenced to the North American Vertical Datum of 1988 (NAVD88) in units of feet. The survey will be performed by a New York State licensed surveyor.

Water Level Measurements

After the temporary piezometers are installed and developed and water levels in the piezometers have returned to static conditions following development, the depth to water will be measured in each well and piezometer at the Site. Measurements will be made from the surveyed reference point using this point as the zero depth reference. Measurements from all of the wells will be made within a period of approximately three hours or less. Measurements will be made using an electronic water level meter, and measured to the nearest 0.01 foot. At a minimum, two rounds of water level measurements will be conducted, separated in time by at least two weeks.

Slug Test Monitoring Wells and Temporary Piezometers

In-situ hydraulic conductivity tests (i.e., slug tests) will be performed on the following piezometers and monitoring wells at the Site:

- Seven temporary piezometers (to be installed, as described above)
- MW-1
- MW-2S
- MW-2D
- MW-4D
- MW-7D
- MW-8D
- MW-9D

The water-bearing zone beneath the Site is unconfined. Accordingly, rising head slug tests will be conducted. The rising head slug tests will be performed according to the procedures describe below:

- Prior to inserting equipment into the piezometer or well to conduct a slug test, the static water level will be measured to the nearest 0.01 foot with a manually-operated electronic water-level meter.
- A pressure transducer equipped with a data logger for recording water levels will be installed in the well/piezometer. The transducer will be positioned at a depth below where the slug (see below) will be lowered to. Depth to water measurements will be made with the transducer and manually with an electronic water level meter to confirm that the water level in the well is at static conditions, and that the transducer is functioning.

- A weighted slug of known volume, or a bailer, will be inserted into the well below the water level. The volume of the slug or bailer will be such that it equates to between 0.3 and 1.5 feet of water column in the well. The water level will be measured with the transducer and with the electronic water level meter until the water level returns to static following the introduction of a slug.
- The slug will be rapidly removed from the well, and simultaneously with its removal, automatic measurement and logging of water level data will be initiated. The data logger will be set to record data on a logarithmic schedule so that measurements are recorded more frequently in the earlier part of the test, when the water level is changing at the fastest rate.
- Water level measurements with the data logger will continue until the water level has returned to static levels, or have recovered by approximately 90 percent. If the water level has not reached this degree of recovery within one hour, the test may be terminated at the discretion of the field geologist.

Following completion of the test, the data will be downloaded from the data logger and stored in the electronic project files. The change in water level versus time data will be evaluated analyzed using analytical techniques appropriate for unconfined aquifers (e.g., Hvorslev [1951], Bouwer and Rice [1976, 1989], etc.) to estimate horizontal hydraulic conductivity for the unit adjacent to each well and piezometer.

Decommission Temporary Piezometers

Following completion of the Groundwater Flow Modeling Study, the temporary piezometers will be decommissioned. Because these piezometers will not have crossed continuous confining layers, they will be decommissioned by grouting in place in accordance with "Groundwater Monitoring Well Decommissioning Procedures" (NYSDEC, August 2009). To decommission the piezometer, a tremie pipe will be lowered to the bottom of the piezometer and cement-bentonite grout pumped through the tremie pipe so that the piezometer is grouted from the bottom to the top. Water displaced from the piezometer during decommissioning will be contained for proper disposal. The grout level will be monitored, and if it settles substantially, additional grout will be added to raise the grout level. Following completion of the grouting, the above-grade protective casing or flush-mounted protective cover will be removed, along with any portion of the PVC casing that is above grade. The area where the protective cover/casing was removed will be backfilled with clean soil to grade.

3.4 In-Situ Solidification

Pre-remedial design investigation activities will be conducted to support the design of ISS component of the remedy. This testing will include bench-scale testing as described in the following sections.

3.4.1 In-Situ Solidification Treatability/Compatibility Study

In-Situ Solidification (ISS) is part of the selected remedy for the Site. In order to develop a cementitous mixture (i.e., grout mixture) that will achieve the desired permeability and strength characteristics to meet the RAOs establish in the ROD while maintaining its integrity in the subsurface environment as the Site, a Treatability/Compatibility Study (i.e., Study) will be conducted. The Study will be performed in accordance with the United States Environmental Protection Agency's (USEPA's) guidance document entitled "Guidance for Conducting Treatability Studies under CERCLA" and dated November 1992. The soil treatability data will be used to prepare cost estimates and design specifications with regard to the full-scale ISS treatment.

3.4.1.1 Test Criteria

The first criterion is related to decreasing the mass loading of the contaminants of concern (COCs) on the water-bearing zone at the Site. This will result in a reduction of the dissolved-phase COC concentrations in the groundwater with the goal of achieving the applicable groundwater quality criteria. The mass loading on the groundwater is a largely the result of groundwater flow through the impacted soils and the concentration of the COCs in that flow. The intent of the ISS is to achieve the desired decrease in mass loading by decreasing the groundwater flow rate through the impacted soils. This will be accomplished through reducing the hydraulic conductivity of the impacted soils by mixing them with the cementitous grout resulting in a solidified mass.

The second criterion is related to the effect on the subsurface geotechnical conditions at the Site after the completion of the remedy. The strength of the solidified mass must be sufficient to support future uses of the Site after implementation of the selected remedy.

The final criterion is that the design mixture must be compatible with the subsurface conditions at the Site including maintaining its integrity when mixed with the impacted media. As such, the Study will be designed to verify that the recommended mixture will be chemically compatible with Site contaminants (VOCs, SVOCs, coal tar, NAPL), the Site groundwater and the water used during construction.

3.4.1.2 Study Overview

The proposed Treatability Study will include:

- Collection of samples of site soils and impacted media from the proposed ISS area;
- Performance of a laboratory study; and
- Summarizing the results in a report.

The elements of the Study are outlined in the subsequent sections. The Study will result in the identification of at least one mixture that would achieve the RAOs and could be applied within the subsurface conditions at the Site. However, if additional analysis is needed to finalize the design, the Study detailed below may have to be expanded.

Sample Collection

Three distinct soil types were identified at the Site during previous investigation activities: fill, alluvial deposits, and outwash deposits (see Section 1.3). In all three strata, locations were identified where MGP NAPL and/or tar was observed. The alluvial deposits are generally thin and variable in composition. For the purposes of this Study, the alluvial deposits and underlying outwash deposits have been grouped together as “native” deposits.

The result of the implementation of the ISS will depend on the amount of contaminant mass in the soil and the soil type. As impacts were noted in all three site strata, a conservative approach to develop the Study procedures was taken and samples that include materials from all three strata will be collected for the use in the Study. These samples will be obtained from areas where significant MGP-related impacts were noted. Using this approach, an ISS mixture will be developed that will be effective over the entire range of Site soils and to address the most significant MGP-related impacts.

A review of boring logs and geological cross-sections depicting subsurface conditions at the Site, as presented in the May 2011 FFS, was performed to identify locations for the collection of samples to be used in the Study. As described above, it was noted that two distinguishable soil types generally are present: fill and native deposits. As indicated previously, the native deposits consist of alluvium and

outwash; however, the distinction between the two is difficult to establish, as both often display similar characteristics (see Section 1.3). Based on that, it is not deemed necessary to obtain separate samples of the alluvium and outwash. Two treatability study samples will be collected; one representative of the fill and one representative of native deposits.

Samples of site soils and impacted media to be used in the Study will be collected immediately adjacent to existing boring locations PASB-29 and SB-118. The locations of the proposed soil borings to be utilized to collect these samples are noted on Figure 3-2. Visual observations of the subsurface conditions at these boring locations PASB-29 and SB-118 identified the presence of significant MGP-related impacts in the fill and alluvial/outwash deposits, respectively. The depth intervals for the MGP impacts are approximately 0 to 5.0 feet bgs at PASB-29, and 5.0 to 20.0 bgs at SB-118. Samples for the Study will be collected from these respective depth intervals.

Samples will be collected using three-inch diameter split-spoons. Multiple borings will be required to be drilled to obtain the volume of material required for the Study (anticipated to be approximately five to 15 gallons from each location). A three-inch diameter, two foot long split spoon will collect up to approximately one-half gallon of material if the sample recovery is 100 percent.

Soil samples from each split-spoon will be described in the field to characterize soil type, including grain size, texture, sedimentary structures/features, and apparent moisture content. The soil samples will be logged in accordance with the Burmister soil classification system, and classified using the Unified Soil Classification system (USCS). Each sample will also be field screened for MGP-related impacts, or other impacts, based on appearance, odor and/or organic vapor concentrations measured with a photoionization detector (PID); in particular, the nature, distribution of degree of saturation of NAPL will be described, where encountered.

The samples from the depth interval targeted for treatability samples will be collected in large pre-cleaned containers made of glass or polyethylene. The size of the containers will be selected based on the size of the coolers that the samples will be shipped in to the laboratory. The jars will be labeled to identify the following: sample identification name/number; sample location name (i.e., soil boring number); depth interval of sample; date and time of sample collection; site name; and name of sampler. Once filled, the sample container will be closed and cooled to approximately 4°C.

A chain-of-custody (COC) form will be used to document the sample collection, sample handling, and custody of the samples. The COC form will accompany the samples from the time of collection to the receipt of the sample at the laboratory. If samples are split either in the field or at the laboratory for shipment to an additional laboratory or laboratories, COC forms will be completed and accompany the split samples, and be maintained at the receiving laboratory,

The sample containers will be shipped to the laboratory in clean coolers. The samples in the coolers will be shipped with ice or ice packs to maintain a temperature of approximately 4°C. Appropriate clean packing material will be used in the cooler to cushion the samples and reduce the potential for breakage. The COC form will be placed in the cooler with the samples. Once the coolers are filled, they will be closed and a custody seal, signed by the samplers, will placed on the cooler such that the opening of the cooler would require the seal to be broken. Shipment of the samples will comply with the appropriate transport and shipping regulations.

Laboratory Study Methods

Untreated soils, as well as potential mixtures of site soil with cementitous grout containing varying amount of other additives will be tested for various parameters, such as soil physical characteristics, strength, swell, hydraulic conductivity, and compatibility with Site conditions and contaminants. Following is the lists of tests/methods that will be utilized during the treatability study. Different subsets of the tests will be performed at different stages of the study, as outlined in the subsequent sections.

Analysis	Method
pH	EPA Method 9045C
Moisture Content	ASTM D2216
Bulk Density (w/dry density)	ASTM D 2937
Atterberg Limits	ASTM D 4318
Unconfined Compressive Strength	ASTM D 2216
Pocket Penetrometer	NA
Loss on Ignition	NA
Hydraulic Conductivity (falling head)	ASTM D 5084
Volumetric Expansion	NA
Immersion Test	NA

Sample Receipt and Untreated Material Characterization

Samples of subsurface soils and impacted media from the two sampling locations will be received at the laboratory, appropriately logged in and placed into secure storage. Materials from each of the two samples will be homogenized using stainless steel mixing instruments and gently mixed with low-energy mixing techniques to ensure a uniform material prior to treatability testing. Any large or agglomerated particles will be broken into more manageable sizes. For bench-scale testing, all particles larger than 0.5 inches in diameter will be removed from the untreated samples.

After homogenization, representative aliquots of the untreated soils from each of the two sampling locations will be prepared for characterization testing. Potential off-gassing from the samples will be managed using standard laboratory health and safety procedures including proper handling of samples by trained personnel, the use of exhaust hoods, etc. Characterization testing to be performed on the untreated soils will include:

Analysis	Method
pH	EPA Method 9045C
Moisture Content	ASTM D2216
Loss on Ignition	NA
Bulk Density (w/dry density)	ASTM D 2937
Sieve Analysis (w/hydrometer)	ASTM D 422
Atterberg Limits	ASTM D 4318

These analyses will provide a baseline for the evaluation of the study results.

Solidification Treatment

Process Overview

Testing will be conducted on the MGP-impacted soil using a phased approach: preliminary evaluation, optimization evaluation, and repeatability evaluation.

Once the baseline characterization of the untreated soil is complete, preliminary screening mixtures will be developed in order to evaluate a range of solidification reagents and/or addition rates. After the preliminary evaluation has been completed, additional mixtures will be developed to further optimize and evaluate treatment designs identified during the previous phase. Mixtures selected following the optimization phase will be re-developed for use in the repeatability evaluation. Upon completion of each phase, the candidate mixture designs will be subjected to analytical characterization analyses.

Frequently, initial mix design is performed with random soil samples and samples of water from the source anticipated to be used during construction. These initial mixes are then checked for chemical compatibility by re-analyzing using NAPL and/or site groundwater to permeate the aliquots. Because the soil samples used during this Study would have been collected from areas representative of the significantly impacted areas, they will be sufficient to verify the chemical compatibility, and the second-stage verification will not be required.

Preliminary Evaluation

Based on the results of characterization of the untreated soil mixtures, the types of reagents as well as their addition and rates that have been shown to be effective at improving the physical properties of hydraulic conductivity and UCS for similar materials will be identified. Preliminarily, likely reagents will include, but will not be limited to:

- Portland cement,
- Bentonite,
- Organoclay,
- Ground granulated blast furnace slag.

Water from a local source, as anticipated to be used during construction, will be utilized to develop the mixtures. It is anticipated that a total of 16 mixtures of the untreated soil material will be developed in an effort to evaluate a range of reagents and addition rates (eight mixtures for each of the two soil types: fill and native deposits).

Each mixture will be developed by placing an aliquot of untreated soil into a blending chamber. Reagent(s) will be added to the untreated soil and blended at a rate of approximately 30 to 40 rotations per minute (rpm) until visually homogeneous, for approximately 60 to 90 seconds. Immediately following mixture development, unit weight of each mixture will be measured and the mixtures will be placed into cylindrical molds for curing. Each mixture will be allowed to cure for a period of seven days in a humid environment maintained at a temperature of 18 to 24°C. Upon completion of the curing period, each mixture will be analyzed for the following:

Analysis	Method
pH	EPA Method 9045C
Pocket Penetrometer	NA
Unconfined Compressive Strength	ASTM D 2216
Hydraulic Conductivity (falling head)	ASTM D 5084

Pocket penetrometer readings will be conducted on each mixture at three, five, and seven days of curing. Unconfined Compressive Strength (UCS) testing in accordance with ASTM Method D2166 will be conducted after seven and 28 days of curing, while hydraulic conductivity testing will be performed after a 28-day curing time (ASTM D 5084).

Optimization

Based on the results of preliminary solidification treatment evaluations, treatment designs will be identified for further optimization and evaluation. Each design will represent one set of ingredients. It is anticipated that two types of mixtures (i.e., two types of ingredients) will be selected for further study. Each of the two types of mixtures will be refined into six sub-types by varying the addition rates of the admixtures. Each of the six sub-mixtures will be applied to each of the two soil types (fill and native deposits) for a total of 24 aliquots (2 types of mixture * 6 addition rates = 12 submixtures total, each applied to both soil types results in 24 aliquots). Treatment and testing will be in direct accordance with

protocols used during the preliminary evaluation. In addition, the volumetric expansion test will be applied to aliquots after seven and 28 days of curing. The immersion test will be applied to aliquots after 28 days of curing.

Analysis	Method
pH	EPA Method 9045C
Pocket Penetrometer	NA
Unconfined Compressive Strength	ASTM D 2216
Hydraulic Conductivity (falling head)	ASTM D 5084
Volumetric Expansion	NA
Immersion Test	NA

Repeatability Evaluation

The results of the preliminary evaluation and optimization phases will be reviewed and up to three mixture designs will be selected for the evaluation of repeatability of the results. The mixtures will be analyzed in accordance with the procedures used during the optimization evaluation (pH, pocket penetrometer, UCS, hydraulic conductivity, immersion and volumetric expansion).

Analysis	Method
pH	EPA Method 9045C
Pocket Penetrometer	NA
Unconfined Compressive Strength	ASTM D 2216
Hydraulic Conductivity (falling head)	ASTM D 5084
Volumetric Expansion	NA
Immersion Test	NA

3.4.1.3 Reporting

Throughout the duration of the project, the selected testing laboratory will provide interim updates as data are received. A data usability review will be conducted on the analytical results and a Data Usability Summary Report (DUSR) prepared. The testing laboratory will prepare a Treatability Study Laboratory Report presenting the results of all testing and detailed descriptions of all protocols used during performance of the Study.

Following the completion of the laboratory study, a Treatability Study Report will be prepared. Study results will be summarized in the report and incorporated into the remedial design. The structure of the Treatability Study Report will be as follows:

- Introduction;
- Treatability Study Overview;
- Sample Collection;
- Untreated Waste Receipt;
- Untreated Soil Characterization;
- Solidification Treatment;
- Preliminary Evaluations;
- Optimization Evaluations;
- Repeatability Evaluations;
- Discussion of Results;

- Recommendations and Conclusions;
- Tables;
- Figures;
- Attachments;
- Chains-of-Custody;
- Boring Logs; and
- Laboratory Report.

3.5 Supplemental Geotechnical Investigation

A supplemental geotechnical investigation will be conducted to acquire geotechnical data through the installation of soil borings, the collection of soil samples and the performance of various field and laboratory testing to facilitate the design and installation of the ISS work and the excavation shoring systems to support the off-site excavation activities (depth of nine feet bgs).

The Supplemental Geotechnical Investigation will include the drilling and sampling of three soil borings along the limits of the off-site excavation area. These limits correspond with the location of the proposed shoring system that will be required to facilitate the off-site excavation. The approximate locations of the three soil borings are depicted on Figure 3-3. The borings will be installed utilizing either hollow-stem auger or mud-rotary drilling methodologies.

Soil samples will be collected from the borings and analyzed for geotechnical parameters, and the Standard Penetration Testing (SPT) pursuant to ASTM D1586 will be conducted as part of sample collection.

3.5.1 Soil Borings

A total of six soil borings will be drilled and sampled at two areas of the Site: the perimeter of the off-site excavation area (three borings) and within the ISS area (three borings).

Excavation Areas

In order to evaluate the subsurface conditions along the alignment of the proposed sheeting/shoring system to be utilized to support the integrity of the excavation sidewalls, three soil borings will be installed. The three borings will be spaced along the limit of the proposed shoring system to allow for variations in the composition of the soils comprising the subsurface. The borings will be installed to a depth of approximately 30 feet bgs.

ISS Area

Three soil borings will be installed in the area of the proposed ISS to evaluate the subsurface conditions in support of the selected installation method. The borings will be installed to a depth corresponding with the deepest anticipated ISS treatment (23 feet bgs).

3.5.1.1 Collection of Soil Samples

Continuous SPT sampling will be performed in all of the borings to be drilled along the horizontal alignment of the shoring system as well as within the ISS Area.

3.5.1.2 Sample Analysis (Geotechnical)

Representative samples of the soils obtained from the borings drilled along the anticipated alignment of the shoring system as well as within the ISS Area will undergo laboratory testing for grain size distribution and direct shear tests. The direct shear tests will determine the internal friction angle of the soils, which is a vital component of the design of the excavation support systems.

Inferred field relative density will be calculated based on the SPT to be performed as part of the test borings.

In addition, representative soil samples, as determined in the field, obtained from the borings will be analyzed at a laboratory for the following parameters:

- Grain Size;
- Moisture Content;
- Liquid Limit; and
- Plastic Limit.

3.5.1.3 Site Restoration

Upon completion of drilling, the boreholes will be filled with a cement-bentonite grout mixture to pre-disturbance grade using the tremie method.

3.6 Subsurface Obstruction Survey

3.6.1 Objective of Subsurface Obstruction Survey

A subsurface obstruction survey will be performed to identify potential utilities and other obstructions (i.e., former structures, foundations, etc.) along and within the excavation and ISS Areas. The identification of utilities/obstructions will allow for the preparation of contingencies to remove and/or relocate potential obstructions to implementation of the remedy selected for the Site. Further, the performance of the subsurface obstruction survey will confirm the locations as well as the presence/absence of potential subsurface structures, piping and utilities identified on existing site drawings.

3.6.2 Subsurface Obstruction Survey Scope of Work

The Scope of Work for the Subsurface Obstruction Survey will consist of the procurement of a Contractor to perform magnetometer, ground-penetrating radar (GPR) and/or other potential subsurface obstruction identification methods. The Subsurface Obstruction Survey will serve to identify the locations of potential obstructions to the implementation of ISS as well as the earth support system associated with the off-site excavation to be performed as part of the remedy. Once identified, the subsurface obstructions will be mapped and depending on the type, depth and extent of the obstruction, either removed, relocated or incorporated into the barrier and/or earth support system.

3.7 Air Monitoring

A Community Air Monitoring Plan (CAMP) has been established for the identified pre-remedial design and design activities. A copy of the CAMP is provided in Appendix A. The CAMP, in conjunction with the air monitoring requirements of the Health and Safety Plan (HASP), will:

- Establish background levels of target compounds in ambient air prior to initiation of remedial construction;
- Monitor and document perimeter ambient air levels of target compounds during the implementation of the remedy;
- Provide an early-warning system to prevent the potential exposure to elevated concentrations in off-site areas by responding aggressively to exceedances of short-term action levels, and to prevent concentrations at the perimeter of the Site that would potentially result in a long-term exposure above acceptable risk levels;

- Evaluate ongoing effectiveness of, and need for additional vapor and/or dust suppression controls and/or alteration of work activities, to reduce airborne compounds to below acceptable risk levels; and,
- Use real-time perimeter monitoring results in conjunction with confirmatory air sampling.

Based on the results of the monitoring conducted during the performance of the pre-remedial design activities, the CAMP may be supplemented by alternative air monitoring technologies and processes prior to implementing the remedy. The preparation of the final CAMP will be conducted during the design phase of the project. Once finalized, the CAMP will be incorporated into the remedial design packages to be submitted to, and approved by, the NYSDEC.

3.8 Management of Pre-Remedial Design Derived Wastes

All wastes derived from the implementation of the pre-remedial design tasks will be managed, characterized and disposed of at a properly permitted off-site disposal facility. Waste streams will include, but are not limited to, the following:

- Soil cuttings from the Supplemental Geotechnical Investigation, sampling for the treatability study and the piezometer installation;
- Groundwater generated from the development of the piezometers as well as the performance of the slug tests; and
- Personal protective equipment worn by site workers in accordance with the Health and Safety Plan.

Waste will be containerized and stored on site, pending off-site disposal, in New York State Department of Transportation (NYDOT)-specification 55-gallon drums, roll-off containers, frac tanks or other suitable containers.

Section 4

Identification of Property Access and Permits Required for Remediation

This section of the RDWP describes the property access agreements as well as the federal, state and local permits required for the implementation of both the pre-remedial design activities and the final remedy. As part of the remedial design process, National Grid will work with local utilities, adjacent property owners and others to identify and protect their facilities.

4.1 Property Access Agreements

Parcels of land owned by private entities are located within the areas subject to the remedy and/or activities associated with remedy implementation. Therefore, site access agreements will need to be negotiated prior to implementation of the pre-design activities or remedy implementation.

4.2 Federal, State, and Local Permits

Remedial activities at the Patchogue Former MGP Site are being performed under an Order on Consent, Index Number D1-0001-99-05 (the Order) signed by KeySpan Corporation (a predecessor company of National Grid) and the NYSDEC. In accordance with 6 NYCRR 375-1, NYSDEC-issued permits are not required for the pre-design activities or remedy implementation. Rather, the remedial measures are evaluated and implemented based on the substantive elements of the applicable and relevant and appropriate state environmental laws and regulations. No federal or state permits are anticipated to be required for either the pre-design or design activities. As per 6 NYCRR 375-1.7c, no permits, consents, approvals or other authorizations are required under any local zoning, land use or other regulatory program. However, consultation with local officials and other stakeholders will occur prior to completion of the final design.

An exemption of the obligation to obtain a permit and other authorizations may be provided if all of the criteria below apply to the remedial program being implemented.

1. The activity is on the Site;
2. The activity satisfies all substantive technical requirements applicable to like activity conducted pursuant to the State or local permit as determined by DEC;
3. The activity is a component of the remedial program; and
4. The activity is being conducted pursuant to an oversight document.

A list of permits which meet the criteria above and are typically exempted by the DEC for remedial activities is included as Appendix 1C in DER-10. In accordance with DER-10, exemptions from the following potentially applicable permit programs are anticipated:

- Air Pollution Control– State Permits;
- Coastal Erosion Permit;
- Hazardous Waste Permit;
- Solid Waste Permit;
- Protection of Waters Permit;
- Operation of Solid Waste Management Facilities;
- Operation of Hazardous Waste Management Facilities; and
- State Pollution Discharge Elimination Systems (SPDES).

Since wetlands have not been identified at the Site, the following permits will not be required:

- Wetlands Permit (Freshwater)
- Wetlands Permits (Tidal)

Also, since the Patchogue River is not identified as a wild and scenic river, a Wild Scenic and Recreational Rivers Permit will not be required.

Compliance with the substantive requirements of applicable permit programs will still be necessary, including:

- Proper waste packaging, labeling transportation and disposal;
- Air monitoring;
- Erosion controls; and
- Waste characterization, handling, transportation and disposal.

Other Federal and State permits which may be required to complete the investigation and/or remediation are not exempted. The US Army Corps of Engineers (USACE) regulates land up to the ordinary high water line (freshwater) and the mean high tide (tidal areas) through Section 10 of the Rivers and Harbors Acts of 1890. Section 10 regulates excavation, filling and other activities that modify the navigable waters of the United States. Under Section 404, the USACE regulates the discharge of fill onto other areas (including highest tide and some upland areas) and permits are required for these activities. Therefore, federal permitting programs that require permits in these regulated areas may be applicable since excavation, filling and regrading work will be conducted adjacent to the Patchogue River.

In summary, the permits and authorizations that will likely be required include:

- USACE Nationwide Permit 38 or USACE letter of authorization if disturbance is considered low impact;
- City of Patchogue construction permits; and
- Executed access agreements with the property owner.

Section 5

Health and Safety Plan (HASP)

A Health and Safety Plan (HASP) has been prepared to address worker health and safety for all investigative activities to be performed at the Patchogue Former MGP Site including the pre-design activities. The full version of the Health and Safety Plan, entitled "Health and Safety Plan for Pre-Design Investigation and Quarterly Groundwater Sampling at Patchogue Former MGP Site, 234 West Main Street, Village of Patchogue, Suffolk County, NY 11772" dated December 2010 (Revision 1) and prepared by Brown and Caldwell Associates, is included as Appendix B to this RDWP. The Health and Safety Plan has been prepared to address worker safety issues and well as community impacts based on projected activities to be performed at the Patchogue Former MGP Site. The Health and Safety Plan includes:

- Roles and responsibilities of project team members;
- A history of the Site and a description of the Site activities;
- A discussion of the potential chemical, biological and physical hazards at the Site;
- Activity Hazard Analyses (AHAs) for the various work tasks;
- A discussion of the requirements and use of Personal Protective Equipment (PPE);
- Air monitoring requirements;
- Establishment of work zones;
- Medical surveillance procedures and protocols;
- An Emergency Response Plan; and
- Requirements for records keeping and tracking.

Section 6

Post-Construction Maintenance and Monitoring Plans

This section identifies the requirements of the Site Management Plan (SMP) and describes the institutional controls to be implemented at the Site, including the scope of surveys required to support the development of the institutional controls.

6.1 Site Management Plan

A site-specific Site Management Plan (SMP) will be prepared in accordance with DER-10 and submitted with the Final Engineering Report (FER). In accordance with the March 2011 ROD, the SMP will identify the procedures and requirements for the following institutional and engineering controls:

1. Management of the final cover system to restrict excavations below the soil cover, pavement or buildings. Excavated soil will be tested, properly handled to protect the health and safety of workers and the nearby community, and will be properly managed in a manner acceptable to the NYSDEC;
2. Monitoring of groundwater; and
3. Identification of all use restrictions on the Site.

The SMP will include an institutional and engineering control (IEC) plan, monitoring plan, and operation and maintenance plan, as required for the Site remedy.

6.2 Institutional Controls

Institutional controls will be established in the form of an environmental easement that will require:

1. Limiting the use and development of the property to restricted residential use which will also permit commercial and industrial use;
2. Compliance with the approved Site Management Plan;
3. Prohibiting the use of groundwater as source of potable or process water, without necessary water quality treatment as determined by the New York State Department of Health; and
4. National Grid to complete and submit to the Department a periodic certification of institutional and engineering controls.

After remedial actions are completed, the environmental easement will be prepared and submitted to NYSDEC. In order for the environmental easement to be executed by NYSDEC, the following information will also be obtained and submitted to NYSDEC, assuming that some of the required information can be obtained from the adjacent property owner:

1. A title report, current within six months;
2. A written commitment from a New York State-licensed title insurance company indicating that it will issue the necessary title insurance policy, naming the state as an insured party, upon the recording of the environmental easement;

3. A metes and bounds description of the Site differentiating areas of varying restrictions, if any, required by the remedial program;
4. A survey of the Site, in a form approved by NYSDEC and prepared by a New York State licensed surveyor with current registration or an American Land Title Association (ALTA) standard survey. The survey will:
   a. show the limits of the area of the site subject to the environmental easement;
   b. delineate any areas within the Site subject to the easement, with differing use or other restrictions; and
   c. be presented so as to allow the metes and bounds description to be matched to the survey;
5. If requested by NYSDEC, a survey endorsement current to within three months;
6. The property owner's agreement to establish and maintain the easement in a form which is expressly made enforceable by the state set out in such form as to be recordable pursuant to Real Property Law Section 291; and
7. Other relevant documentation as specified by NYSDEC.

6.3 Certification of Institutional and Engineering Controls

National Grid will provide periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer licensed in the State of New York or such other expert acceptable to the NYSDEC, until the NYSDEC notifies National Grid in writing that this certification is no longer needed. This submittal will:

1. Contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with NYSDEC approved modifications;
2. Allow the NYSDEC access to the Site; and
3. State that nothing has occurred that will impair the ability of the institutional or engineering control to protect the public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the NYSDEC.

In accordance with DER-10, the initial periodic review will be conducted no more than 18 months after issuance of the certificate of completion or closure letter. Thereafter, periodic reviews will be annually, unless a different certification period is approved by the NYSDEC.

Section 7

Comprehensive Remedial Design Schedule

The Comprehensive Remedial Design Schedule for the Patchogue Former MGP Site is summarized below. This schedule tracks the significant milestones associated with the remedial design tasks from preparation of this RDWP through mobilization to implement the remedy.

Milestone	Milestone Date
Remedial Design Work Plan (RDWP)	
Submit Draft RDWP to NYSDEC	August 30, 2011
NYSDEC Review of Draft RDWP	August 31, 2011 – December 21, 2011
NYSDEC Approval of RDWP	December 22, 2011
Pre-Remedial Design Investigation	
Conduct Field Portion of PDI	March 19, 2012 to April 6, 2012
Laboratory Analysis of Samples (Geotechnical and Environmental)	April 9, 2012 to May 31, 2012
Treatability Study	April 9, 2012 – July 10, 2012
50% Remedial Design Report (50% RDR)	
Submit 50% RDR to NYSDEC	September 28, 2012
NYSDEC Review of 50% RDR	October 1, 2012 – October 26, 2012
Submit Response to Comments (RTC) to NYSDEC	November 28, 2012
NYSDEC Approval of RTC	January 2, 2013
Contractor Procurement	
National Grid Procures Remedial Contractor	November 12, 2012 to February 26, 2013
95% Remedial Design Report (95% RDR)	
Submit 95% RDR to NYSDEC	July 29, 2013
NYSDEC Review of 95% RDR	July 30, 2013 – August 26, 2013
100 % Remedial Design Report (100% RDR)	
Submit Draft 100% RDR to NYSDEC	October 17, 2013
NYSDEC Review of Draft 100% RDR	October 18, 2013 – November 14, 2013
Finalize 100% RDR Based on NYSDEC Comments	November 15, 2013 – December 3, 2013
NYSDEC Review of Final 100% RDR	December 4, 2013 – December 17, 2013
NYSDEC Approval of 100% RDR	December 18, 2013
Remedy Implementation	
Mobilize to Implement Remedy	January 22, 2014

The milestone dates noted in the table above may be affected by several factors during the design phase of the project including regulatory reviews extending beyond the assumed timeframes, acquisition of permits and the establishment of access agreements.

References

KeySpan, 2002. "Preliminary Site Assessment Report Order on Consent D1-0001-99-05, NYSDEC Site No. 1-52-182 Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York", March.

NYSDEC, 2010. "Division of Environmental Remediation, DER-10, Technical Guidance for Site Investigation and Remediation", May.

NYSDEC, 1999. "Order on Consent D1-001-99-05," September 30.

NYSDEC, 1990. TAGM #4030 (Selection of Remedial Actions at Inactive Hazardous Waste Sites), May 15.

TetraTech EC, Inc., 2009. "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York", December.

6 NYCRR Part 375, Environmental Remediation Programs

NYSDEC, 1998, "Division of Water Technical and Operational Guidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" June

NYSDEC, 2011. "Proposed Remedial Action Plan, K-Patchogue MGP, Patchogue, Suffolk County, Site No. 152182", February.

NYSDEC, 2011. "Record of Decision, K-Patchogue MGP, Patchogue, Suffolk County, Site No. 152182", March 31.

Brown and Caldwell Associates, 2011. "Focused Feasibility Study, Patchogue Former Manufactured Gas Plant (MGP) Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York", May.

Bruxton, H.T., and Smolensky, D.A., 1999, "Simulation of the Effects of Development of the Groundwater Flow System or Long Island, New York: U.S. Geological Survey Water-Resources Investigations Report 98-4069", 57 p.

Cedegren, H, 1977. "Seepage, Drainage and Flow Nets". John Wiley & Sons, Inc., New York, 534 p.

USEPA, 1992. "Guidance for Conducting Treatability Studies under CERCLA", November.

Tables

TABLE 3-1
PROPOSED TEMPORARY PIEZOMETERS
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

Proposed Piezometer	Nearest Soil Boring	Unit Targeted for Screen	Estimated Depth of Screen Interval (ft., BGS) [1, 2]
PZ-1A	SB-115	Fill	4 to 9
PZ-1B	SB-115	Glacial Outwash	14 to 19
PZ-2A	SB-121	Fill	3 to 5
PZ-2B	SB-121	Glacial Outwash	10 to 15
PZ-3A	SB-128	Fill	3 to 6
PZ-3B	SB-128	Glacial Outwash	13 to 18
PZ-4A	PASB-45(MW-9S/D)	Fill	3 to 5

Notes:
(1) BGS-Below ground surface
(2) Estimated screen depths are based on nearest soil boring. Actual screen interval to be based on position of fill or outwash at specific location as determined by a soil boring conducted prior to piezometer installation.

Figures

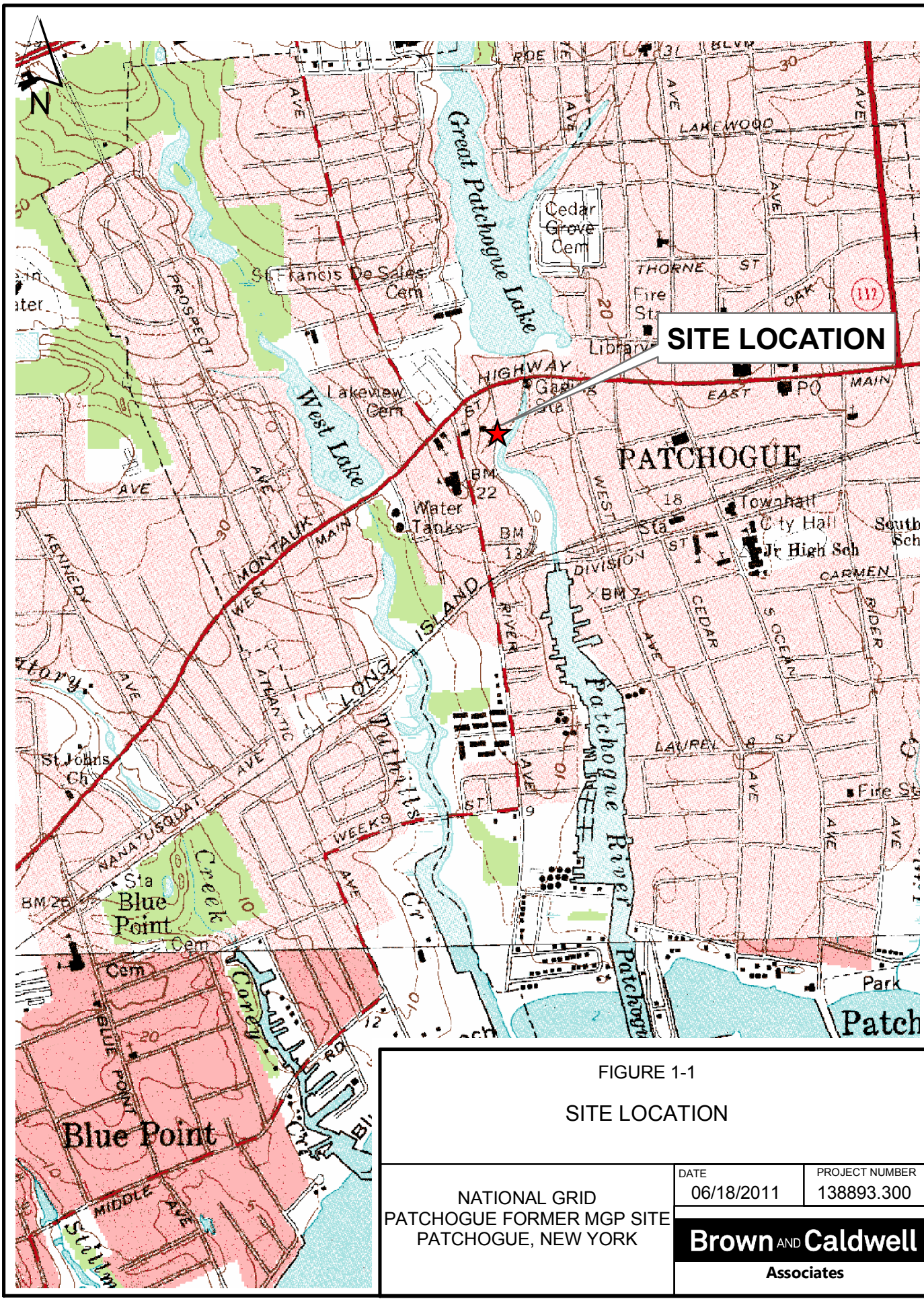


FIGURE 1-1

SITE LOCATION

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

DATE	PROJECT NUMBER
06/18/2011	138893.300

Brown AND Caldwell
Associates

P:\GIS\National_Grid\Patchogue\Patchogue_Site_Location.mxd

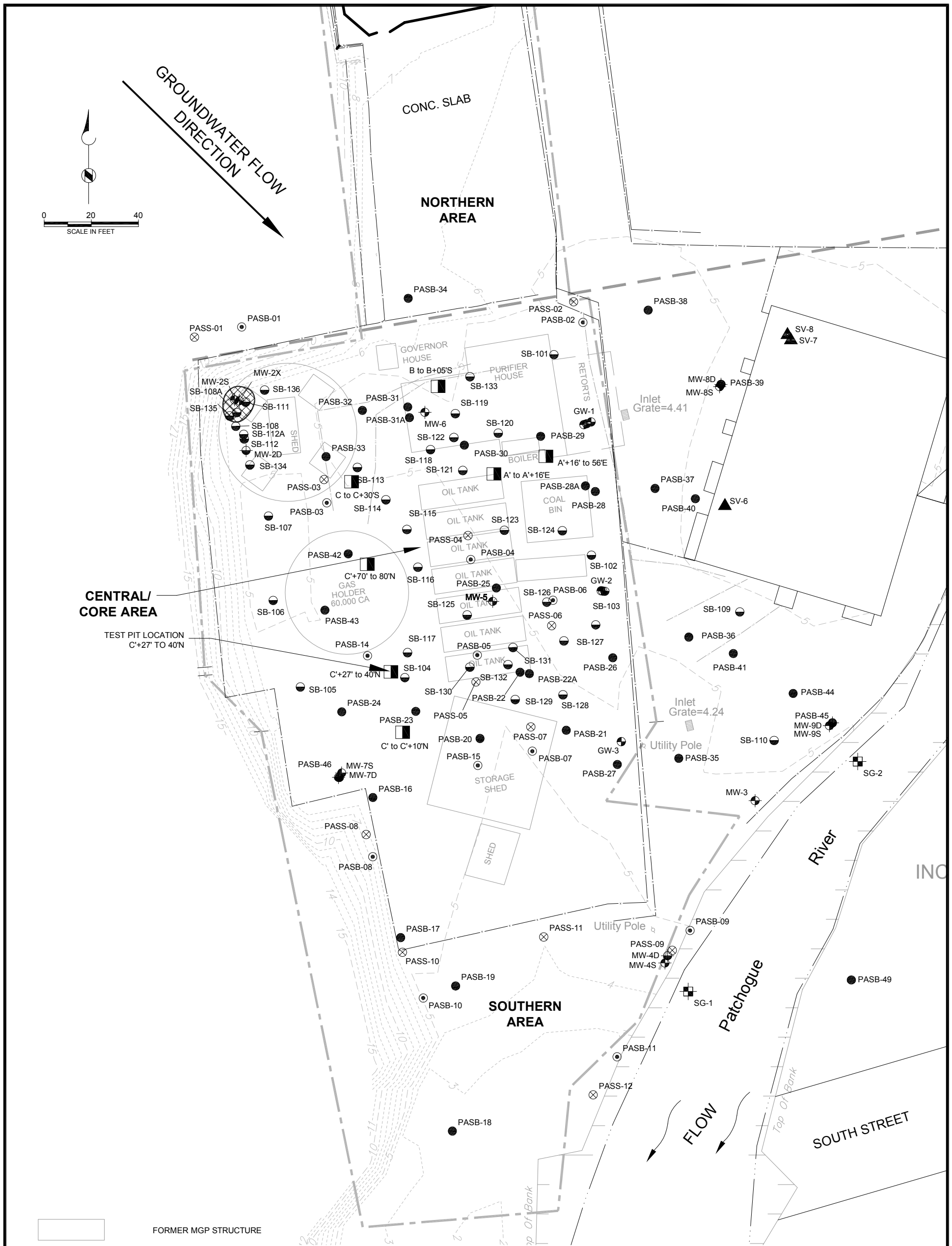


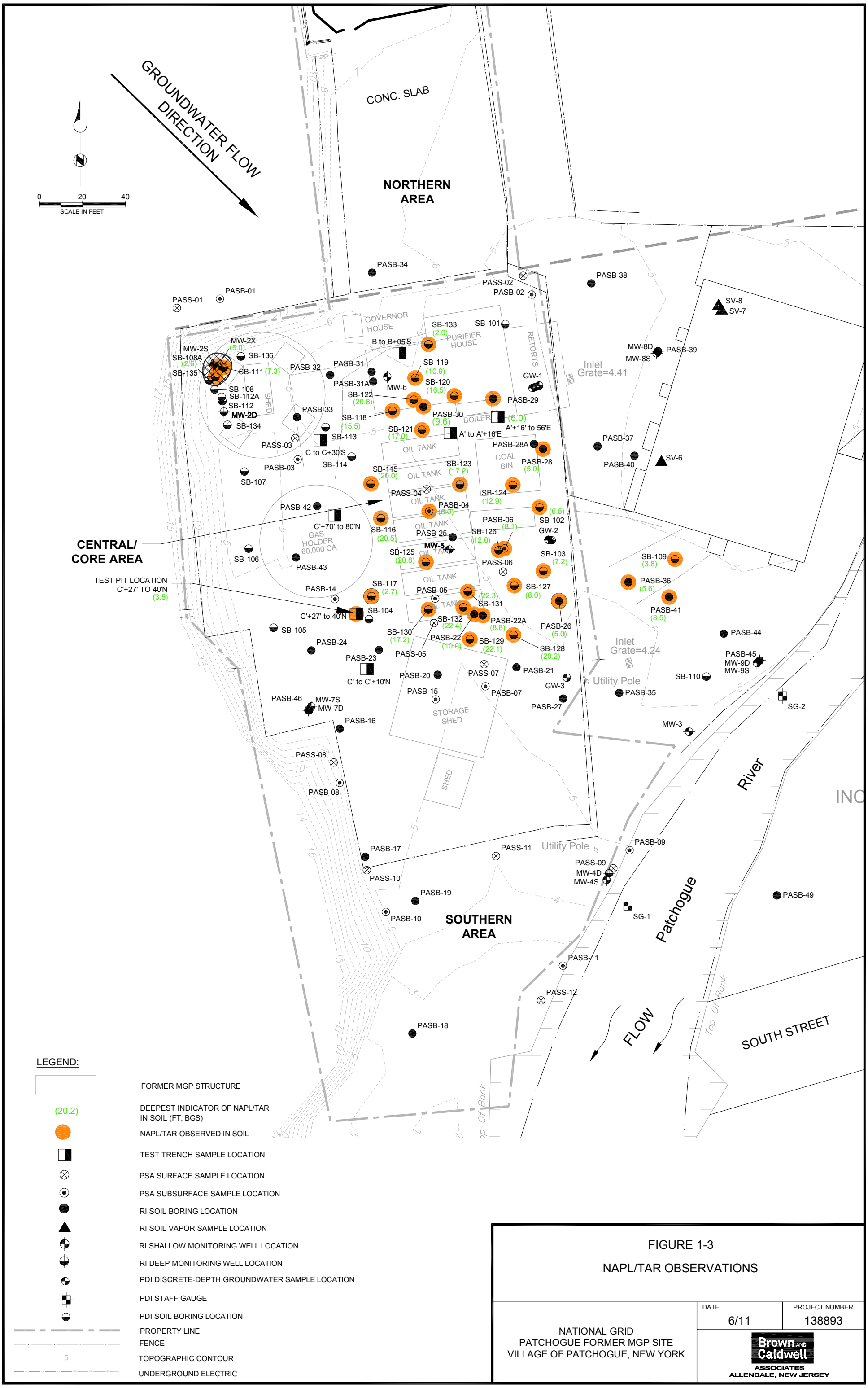
FIGURE 1-2
SITE PLAN

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

DATE	PROJECT NUMBER
6/11	138893

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893_REMEDIAL DESIGN WORK PLAN\FIG-1-2 (SITE PLAN).DWG 06/23/2011 11:42:33AM By:rjames XREFS: Layout: 11X17 - Alt 2



LEGEND:

- FORMER MGP STRUCTURE
- (20.2) DEEPEST INDICATOR OF NAPL/TAR IN SOIL (FT, BGS)
- NAPL/TAR OBSERVED IN SOIL
- TEST TRENCH SAMPLE LOCATION
- PSA SURFACE SAMPLE LOCATION
- PSA SUBSURFACE SAMPLE LOCATION
- RI SOIL BORING LOCATION
- RI SOIL VAPOR SAMPLE LOCATION
- RI SHALLOW MONITORING WELL LOCATION
- RI DEEP MONITORING WELL LOCATION
- PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION
- PDI STAFF GAUGE
- PDI SOIL BORING LOCATION
- PROPERTY LINE
- FENCE
- 5 TOPOGRAPHIC CONTOUR
- UNDERGROUND ELECTRIC

FIGURE 1-3

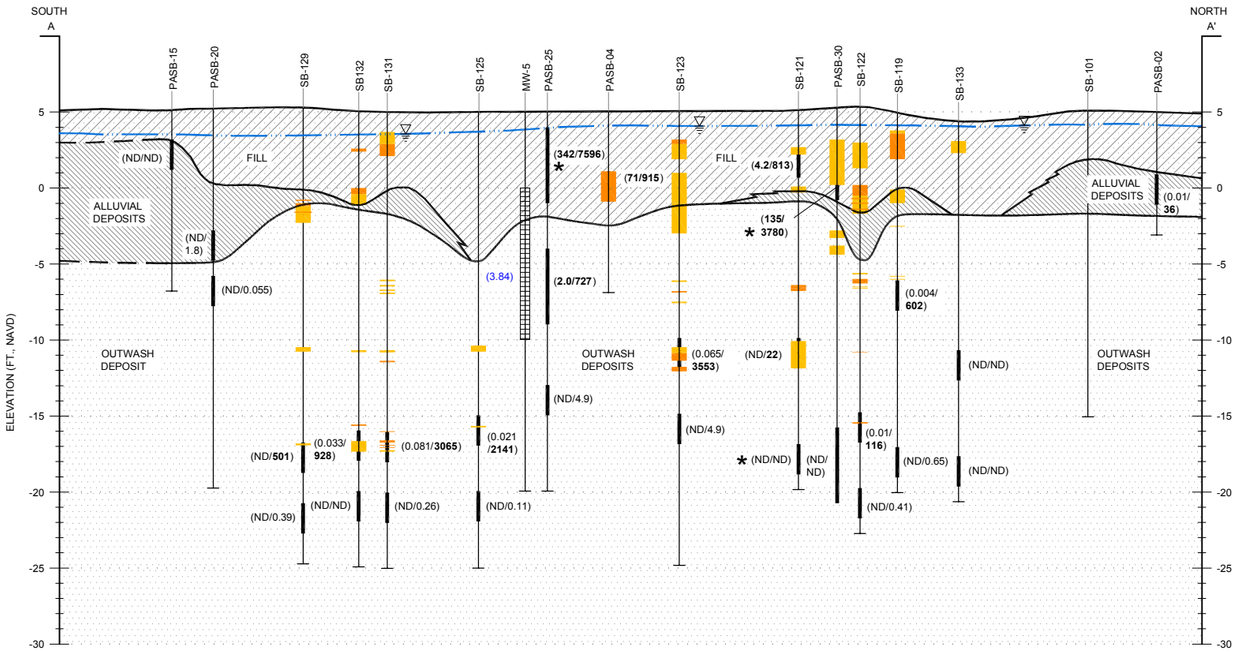
NAPL/TAR OBSERVATIONS

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

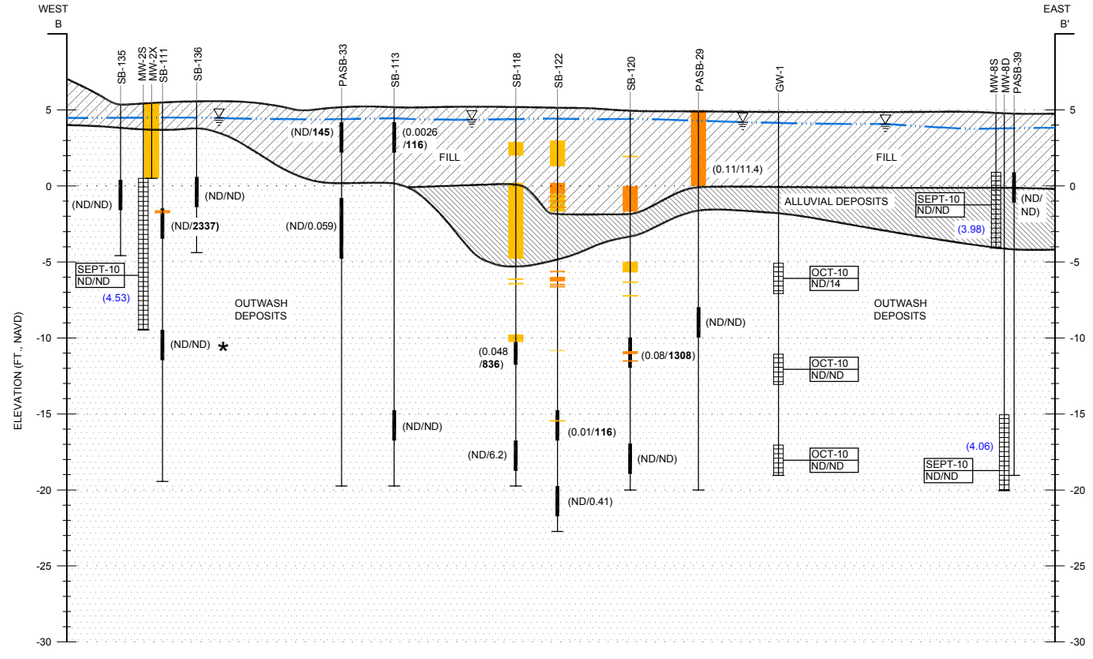
DATE	PROJECT NUMBER
6/11	138893

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

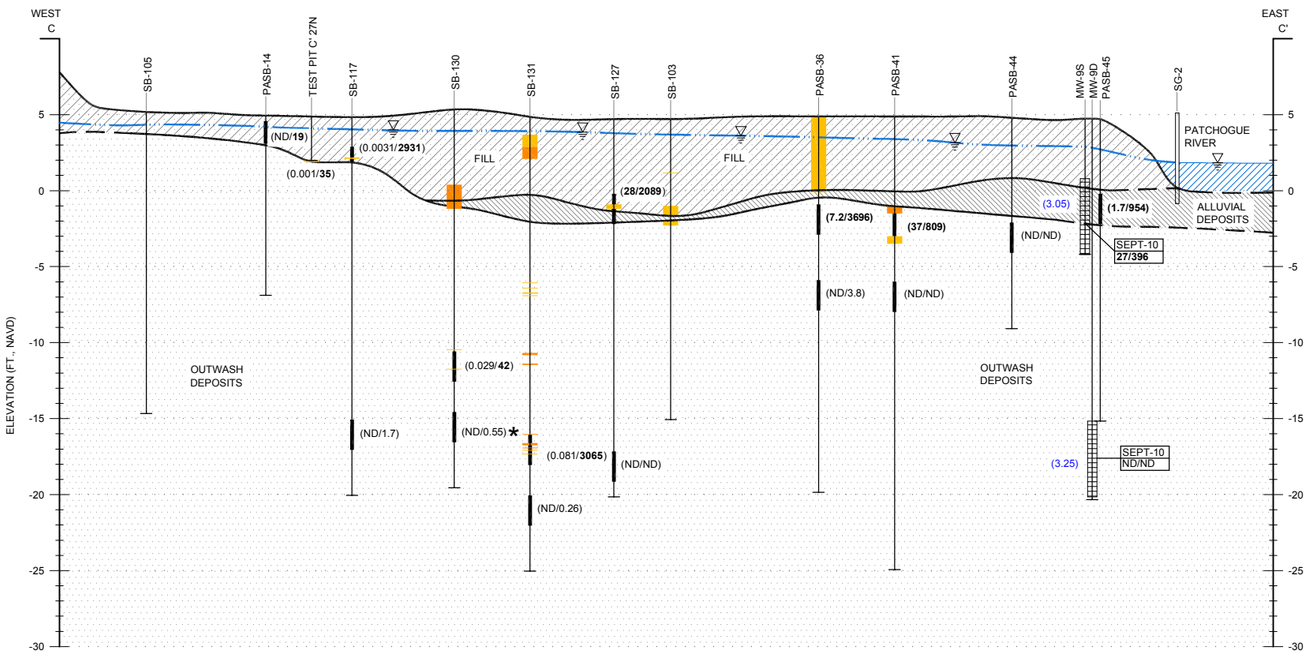
P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893_REMEDIAL DESIGN WORK PLAN\FIG-1-3 (NAPL-TAR).DWG 06/23/2011 11:49:27AM By:rjames XREFS: Layout: 11X17 - Alt 2



CROSS SECTION A-A'

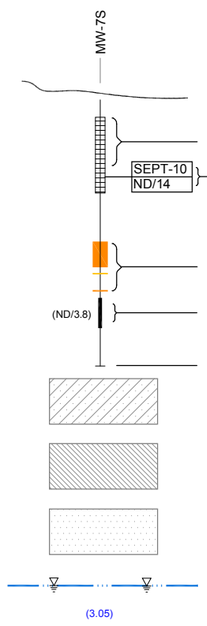


CROSS SECTION B-B'



CROSS SECTION C-C'

LEGEND:



MONITORING WELL / SOIL BORING IDENTIFICATION AND APPROXIMATE LOCATION

GENERALIZED GROUND SURFACE

WELL SCREEN INTERVAL

TOTAL BTEX/TOTAL PAHS IN GROUNDWATER. VALUES REPORTED IN MICROGRAMS PER LITER (ug/L) BOLD VALUE INDICATES ONE OR MORE CONSTITUENT CONCENTRATIONS ABOVE CLASS GA CRITERIA.

INTERVAL/DISCRETE DEPTH WHERE NAPL/TAR OBSERVED IN SOIL. COLOR OF SYMBOL INDICATES DEGREE OF SATURATION. (DARK ORANGE -= HIGH, LIGHT ORANGE = LOW)

TOTAL BTEX/TOTAL PAH (mg/kg) CONCENTRATION WITHIN SAMPLE INTERVAL. BOLD VALUE INDICATES ONE OR MORE CONSTITUENT CONCENTRATIONS ABOVE PART 375 UNRESTRICTED SOIL CLEANUP OBJECTIVES.

TOTAL DEPTH OF BOREHOLE

FILL

ALLUVIAL DEPOSITS

OUTWASH DEPOSITS

WATER TABLE (9/8/2010)

GROUNDWATER ELEVATION (FT., NAVD)

ABBREVIATIONS:

BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE ISOMERS
PAH	POLYCYCLIC AROMATIC HYDROCARBONS
ND	NOT DETECTED
*	HIGHEST TOTAL BTEX OR TOTAL PAH VALUE LISTED FROM ORIGINAL AND DUPLICATE SAMPLE

0 5 10
SCALE IN FEET
VERTICAL

0 40 80
SCALE IN FEET
HORIZONTAL

FIGURE 1-4
GEOLOGICAL CROSS SECTIONS

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

DATE: 6/11
PROJECT NUMBER: 138893.305

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893_REMEDIAL DESIGN WORK PLAN\FIG-1-4 (GEOLOGICAL CROSS SECTIONS).DWG 06/23/2011 11:50:54AM By:rjames XREFS: Basemap Layout: Layout1

GROUNDWATER FLOW DIRECTION

0 20 40
SCALE IN FEET

CONC. SLAB

NORTHERN AREA

CENTRAL/ CORE AREA

SOUTHERN AREA

TEST PIT LOCATION C'+27' TO 40'N (3.5)

PASB-34 PASB-01 PASS-01 PASS-02 PASB-02 PASB-38

GOVERNOR HOUSE B to B+05'S SB-133 (2.0) SB-101 PURIFIER HOUSE RETORTS

MW-2X (5.0) MW-2S SB-108A (2.6) SB-135 SB-136 SB-111 (7.3) PASB-32 PASB-31 PASB-31A MW-6 SB-119 (10) SB-120 (16.5) SB-122 (20.8) SB-108 SB-112A SB-112 MW-2D SB-134 SHED PASB-33 SB-118 (15.5) PASB-30 (9.6) PASB-29 GW-1

BOILER (6.0) A'+16' to 56'E A' to A'+16'E

SB-121 (17.0) SB-113 PASS-03 C to C+30'S SB-114 OIL TANK PASB-28A COAL BIN PASB-28 (5.0) PASB-03 SB-107 SB-115 (20.0) SB-123 (17.2) PASS-04 OIL TANK PASB-04 (6.9) SB-124 (12.9) (6.5) SB-102 GW-2 PASB-42 C'+70' to 80'N SB-116 (20.5) PASB-25 PASB-06 (8.1) SB-126 (12.0) GAS HOLDER 60,000 CA MW-5 SB-125 (20.8) PASS-06 SB-103 (7.2) SB-106 PASB-43 OIL TANK SB-109 (3.8) PASB-36 (5.6) PASB-41 (8.5) SB-127 (6.0) PASB-14 SB-117 (2.7) PASB-05 (22.3) SB-131 SB-104 C'+27' to 40'N SB-132 (22.4) PASB-22A (8.8) PASB-26 (5.0) SB-105 SB-130 (17.2) PASB-22 (10.0) SB-129 (22.1) SB-128 (20.2) PASB-24 PASS-05 PASB-23 C' to C'+10'N PASB-20 PASS-07 PASB-21 GW-3 PASB-15 PASB-07 PASB-46 MW-7S MW-7D STORAGE SHED PASB-27 PASB-16 SHED PASS-08 PASB-08 PASB-17 PASS-11 PASS-10 PASB-19 PASB-10

PASB-44 PASB-45 MW-9D MW-9S SB-110 PASB-35 SG-2 MW-3

Inlet Grate=4.41 Inlet Grate=4.24 Utility Pole Utility Pole

PASB-37 PASB-40 SV-6 SV-8 SV-7 MW-8D MW-8S PASB-39

PASB-09 PASS-09 MW-4D MW-4S SG-1 PASB-49

River Patchogue

PASB-11 PASS-12 PASB-18

FLOW

Top Of Bank Top Of Bank

SOUTH STREET

INC

LEGEND:

- APPROXIMATE LIMITS OF SURFICIAL SCRAPING AND ENVIRONMENTAL SOIL CAP
- APPROXIMATE LIMITS OF EXCAVATION TO A DEPTH 9 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH OF 4 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH OF 7 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 8 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 13 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 21 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 23 FT.
- FORMER MGP STRUCTURE
- (20.2) DEEPEST INDICATOR OF NAPL/TAR IN SOIL (FT, BGS)
- NAPL/TAR OBSERVED IN SOIL
- TEST TRENCH SAMPLE LOCATION
- PSA SURFACE SAMPLE LOCATION
- PSA SUBSURFACE SAMPLE LOCATION
- RI SOIL BORING LOCATION
- RI SOIL VAPOR SAMPLE LOCATION
- RI SHALLOW MONITORING WELL LOCATION
- RI DEEP MONITORING WELL LOCATION
- PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION
- PDI STAFF GAUGE
- PDI SOIL BORING LOCATION
- PROPERTY LINE
- FENCE
- 5 TOPOGRAPHIC CONTOUR
- UNDERGROUND ELECTRIC

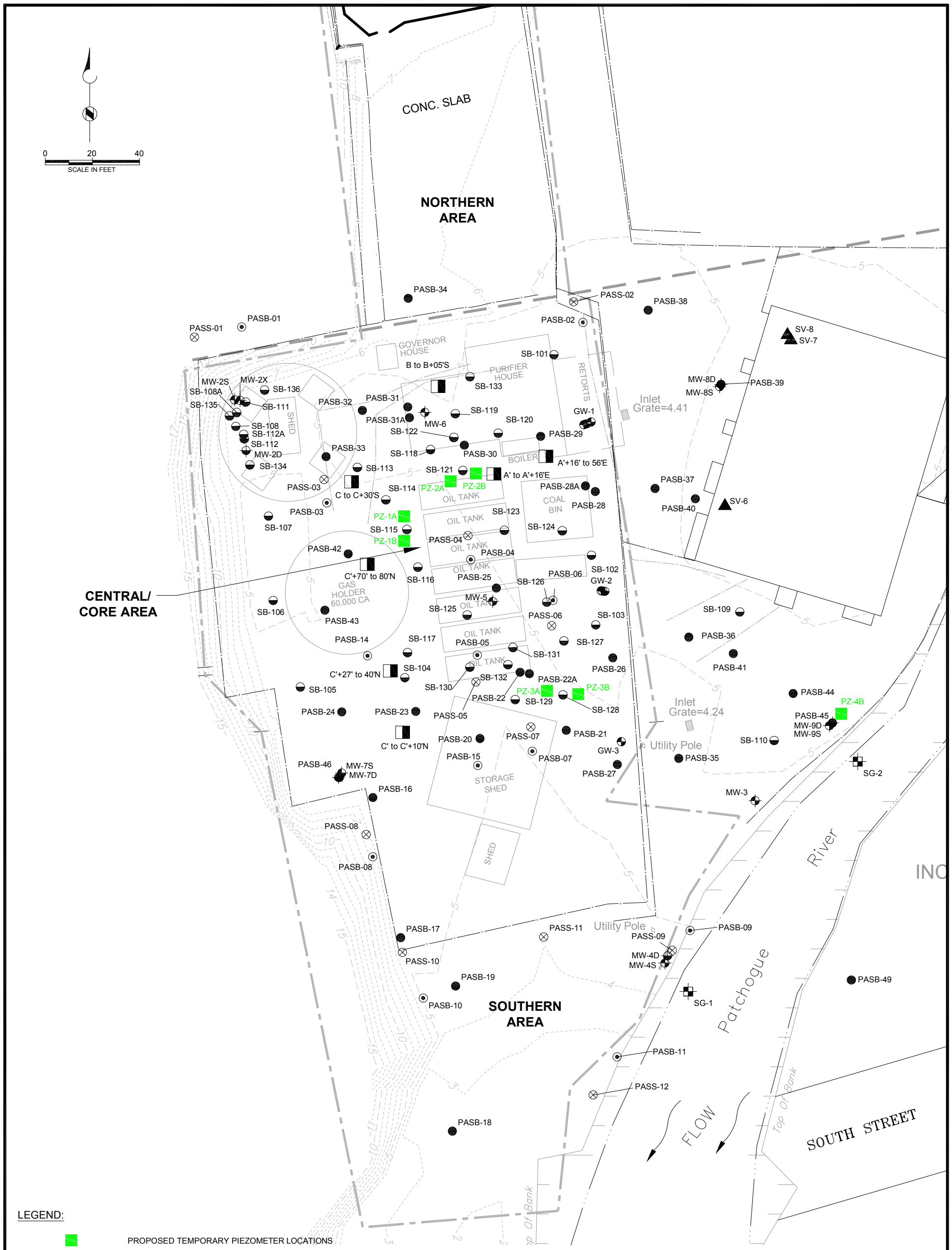
FIGURE 2-1
REMEDIAL ACTION PLAN

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

DATE	PROJECT NUMBER
6/11	138893

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893_REMEDIAL DESIGN WORK PLAN\FIG-2-1 (REMEDIAL ACTION PLAN).DWG 06/23/2011 06:46:24PM By:rjames XREFS: Layout: 11X17 - Alt 2



LEGEND:

- PROPOSED TEMPORARY PIEZOMETER LOCATIONS
- TEST TRENCH SAMPLE LOCATION
- PSA SURFACE SAMPLE LOCATION
- PSA SUBSURFACE SAMPLE LOCATION
- RI SOIL BORING LOCATION
- RI SOIL VAPOR SAMPLE LOCATION
- RI SHALLOW MONITORING WELL LOCATION
- RI DEEP MONITORING WELL LOCATION
- PDI STAFF GAUGE
- PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION
- PDI SOIL BORING LOCATION
- PROPERTY LINE
- FENCE
- TOPOGRAPHIC CONTOUR
- UNDERGROUND ELECTRIC

FIGURE 3-1

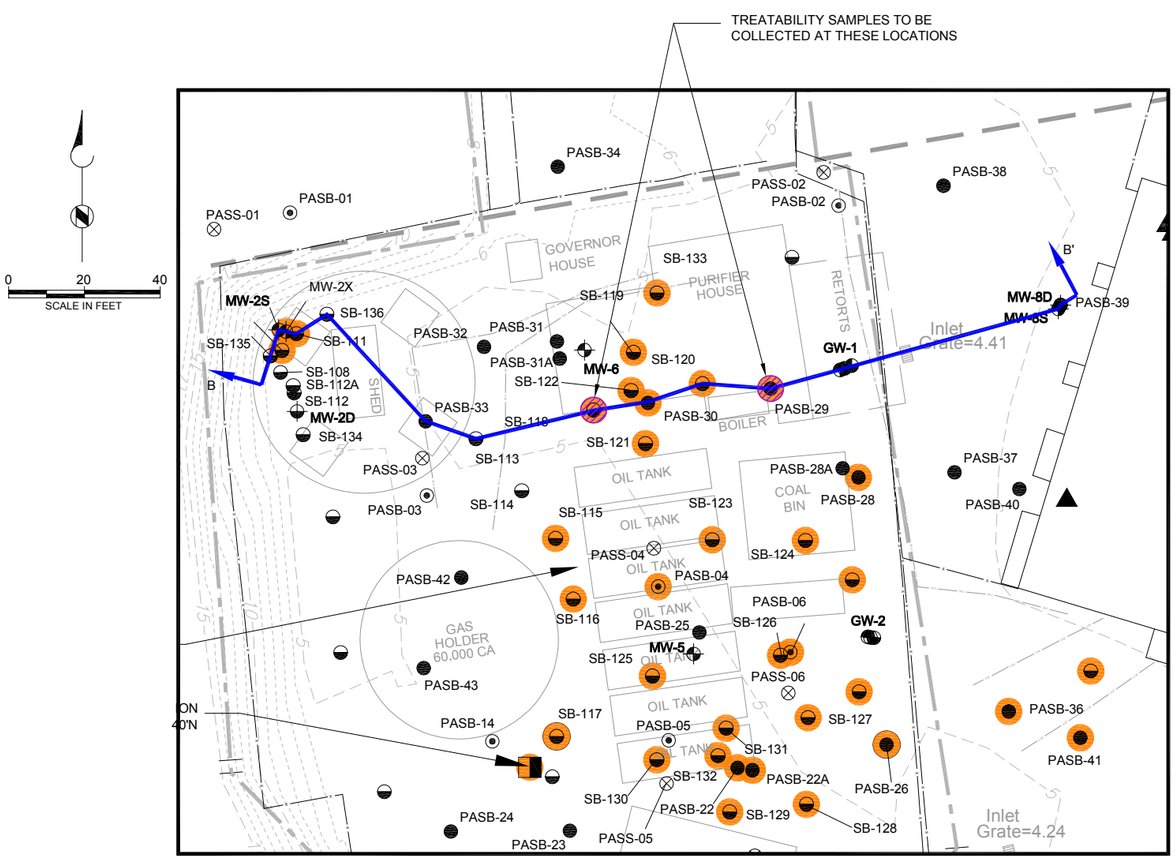
PROPOSED TEMPORARY PIEZOMETER LOCATIONS

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

DATE	PROJECT NUMBER
6/11	138893

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893_REMEDIAL DESIGN WORK PLAN\FIG-3-1 (PLANNED TEMPORARY PIEZOMETERS).DWG 06/23/2011 11:52:48AM By:rjames XREFS: Layout: 11X17 - Alt 2



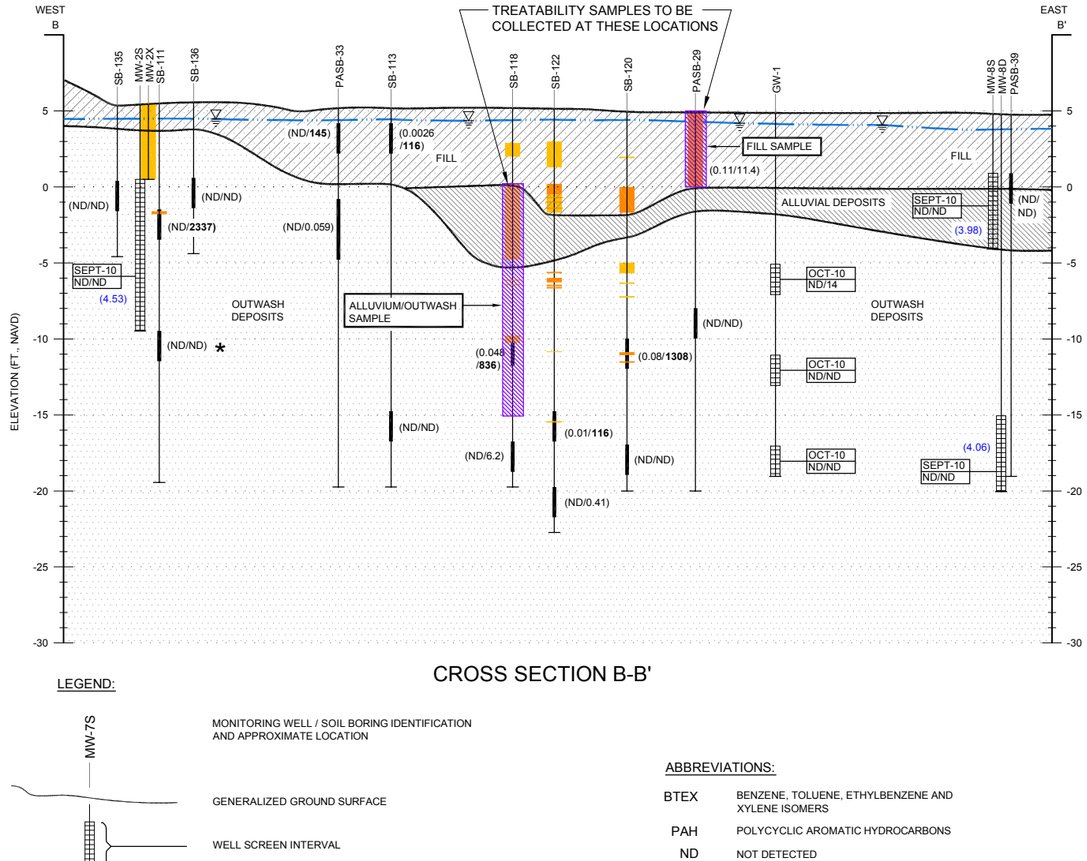
PLAN VIEW

LEGEND:

- NAPL/TAR OBSERVED IN SOIL
- TEST TRENCH SAMPLE LOCATION
- PSA SURFACE SAMPLE LOCATION
- PSA SUBSURFACE SAMPLE LOCATION
- RI SOIL BORING LOCATION
- RI SOIL VAPOR SAMPLE LOCATION
- RI SHALLOW MONITORING WELL LOCATION
- RI DEEP MONITORING WELL LOCATION
- PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION
- PDI STAFF GAUGE
- PDI SOIL BORING LOCATION
- PROPERTY LINE
- FENCE
- 5 TOPOGRAPHIC CONTOUR
- UNDERGROUND ELECTRIC

SOURCE:

FOCUSED FEASIBILITY STUDY
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE,
BROWN AND CALDWELL, MAY 2011
FIGURES 3-1 AND 3-3.



CROSS SECTION B-B'

LEGEND:

- MW-7S — MONITORING WELL / SOIL BORING IDENTIFICATION AND APPROXIMATE LOCATION
- GENERALIZED GROUND SURFACE
- WELL SCREEN INTERVAL
- SEPT-10 / ND/14 — TOTAL BTEX/TOTAL PAHS IN GROUNDWATER. VALUES REPORTED IN MICROGRAMS PER LITER (ug/L) BOLD VALUE INDICATES ONE OR MORE CONSTITUENT CONCENTRATIONS ABOVE CLASS GA CRITERIA.
- INTERVAL/DISCRETE DEPTH WHERE NAPL/TAR OBSERVED IN SOIL. COLOR OF SYMBOL INDICATES DEGREE OF SATURATION. (DARK ORANGE -= HIGH, LIGHT ORANGE = LOW)
- (ND/3.8) — TOTAL BTEX/TOTAL PAH (mg/kg) CONCENTRATION WITHIN SAMPLE INTERVAL. BOLD VALUE INDICATES ONE OR MORE CONSTITUENT CONCENTRATIONS ABOVE PART 375 UNRESTRICTED SOIL CLEANUP OBJECTIVES.
- TS SAMPLE TO BE COLLECTED
- TOTAL DEPTH OF BOREHOLE
- FILL
- ALLUVIAL DEPOSITS
- OUTWASH DEPOSITS
- WATER TABLE (9/8/2010)
- (3.05) — GROUNDWATER ELEVATION (FT., NAVD)

ABBREVIATIONS:

BTEX	BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE ISOMERS
PAH	POLYCYCLIC AROMATIC HYDROCARBONS
ND	NOT DETECTED
*	HIGHEST TOTAL BTEX OR TOTAL PAH VALUE LISTED FROM ORIGINAL AND DUPLICATE SAMPLE

SOURCE:

FIGURE 3-2 AND 3-3 OF THE MAY 2011 FOCUSED FEASIBILITY STUDY.

0 5 10
SCALE IN FEET
VERTICAL

0 40 80
SCALE IN FEET
HORIZONTAL

FIGURE 3-2

PROPOSED LOCATIONS OF ISS TREATABILITY STUDY SAMPLES

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

DATE	PROJECT NUMBER
6/11	138893.305

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893_REMEDIAL DESIGN WORK PLAN\FIG-3-2 (LOCATION OF ISS TREATABILITY STUDY SAMPLE).DWG 06/23/2011 11:53:54AM By:rjames XREFS: Basemap
Figure 7 - ALT 3 Layout: Layout1

GROUNDWATER FLOW DIRECTION

0 20 40
SCALE IN FEET

NORTHERN AREA

CENTRAL/ CORE AREA

SOUTHERN AREA

TEST PIT LOCATION C'+27' TO 40'N

CONC. SLAB

GOVERNOR HOUSE

PURIFIER HOUSE

RETORTS

BOILER

COAL BIN

OIL TANK

GAS HOLDER 60,000 CA

SHED

STORAGE SHED

Inlet Grate=4.41

Inlet Grate=4.24

Utility Pole

PASB-01 PASB-02 PASB-03 PASB-04 PASB-05 PASB-06 PASB-07 PASB-08 PASB-09 PASB-10 PASB-11 PASB-14 PASB-15 PASB-16 PASB-17 PASB-18 PASB-19 PASB-20 PASB-21 PASB-22 PASB-22A PASB-23 PASB-24 PASB-25 PASB-26 PASB-27 PASB-28 PASB-28A PASB-29 PASB-30 PASB-31 PASB-31A PASB-32 PASB-33 PASB-34 PASB-35 PASB-36 PASB-37 PASB-38 PASB-39 PASB-40 PASB-41 PASB-42 PASB-43 PASB-44 PASB-45 PASB-46 PASB-49

PASS-01 PASS-02 PASS-03 PASS-04 PASS-05 PASS-06 PASS-07 PASS-08 PASS-09 PASS-10 PASS-11 PASS-12

SB-101 SB-102 SB-103 SB-104 SB-105 SB-106 SB-107 SB-108 SB-108A SB-109 SB-110 SB-111 SB-112 SB-112A SB-113 SB-114 SB-115 SB-116 SB-117 SB-118 SB-119 SB-120 SB-121 SB-122 SB-123 SB-124 SB-125 SB-126 SB-127 SB-128 SB-129 SB-130 SB-131 SB-132 SB-133 SB-134 SB-135 SB-136

MW-2D MW-2S MW-2X MW-3 MW-4D MW-4S MW-5 MW-6 MW-7D MW-7S MW-8D MW-8S MW-9D MW-9S

GW-1 GW-2 GW-3

GI-1 GI-2 GI-3 GI-4 GI-5 GI-6

SG-1 SG-2

SV-6 SV-7 SV-8

A' to A'+16'E

A'+16' to 56'E

B to B+05'S

C to C+30'S

C'+70' to 80'N

C'+27' to 40'N

C' to C'+10'N

River

Patchogue

FLOW

Top Of Bank

SOUTH STREET

INC

LEGEND:

- APPROXIMATE LIMITS OF SURFICIAL SCRAPING AND ENVIRONMENTAL SOIL CAP
- APPROXIMATE LIMITS OF EXCAVATION TO A DEPTH 9 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH OF 4 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH OF 7 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 8 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 13 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 21 FT.
- APPROXIMATE LIMITS OF ISS TO A DEPTH 23 FT.
- FORMER MGP STRUCTURE
- PROPOSED GEOTECHNICAL SOIL BORING LOCATION
- TEST TRENCH SAMPLE LOCATION
- PSA SURFACE SAMPLE LOCATION
- PSA SUBSURFACE SAMPLE LOCATION
- RI SOIL BORING LOCATION
- RI SOIL VAPOR SAMPLE LOCATION
- RI SHALLOW MONITORING WELL LOCATION
- RI DEEP MONITORING WELL LOCATION
- PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION
- PDI STAFF GAUGE
- PDI SOIL BORING LOCATION
- PROPERTY LINE
- FENCE
- TOPOGRAPHIC CONTOUR
- UNDERGROUND ELECTRIC

FIGURE 3-3

PROPOSED LOCATIONS OF GEOTECHNICAL INVESTIGATION SOIL BORINGS

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

DATE 6/11

PROJECT NUMBER 138893.400

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893_REMEDIAL DESIGN WORK PLAN\FIG-3-3 (PROPOSED LOCATIONS OF GEOTECHNICAL ISB).DWG 06/23/2011 11:55:54AM By:rjames XREFS: Layout: 11X17 - Alt 2

Appendix A: Community Air Monitoring Plan

Appendix A

Community Air Monitoring Plan

This Community Air Monitoring Plan has been designed to conform to the guidelines presented by the New York State Department of Health in Appendix 1A of the New York State Department of Conservation, DER-10, Technical Guidance for Site Investigation and Remediation. Real-time air monitoring for volatile compounds at the perimeter of the exclusion zone will be conducted. Monitoring for odors will also be conducted and odor suppressant foams and water sprays will be readily available to address dust and odor emissions. The following procedures will be implemented during field activities as appropriate:

- Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the exclusion zone on a continuous basis. If 15-minute average total organic vapor levels exceed five (5) ppm (or five ppm above background as determined at an upwind location), ground intrusive activities will be temporarily halted and monitoring continued until total organic vapor levels drop below the action level. If the organic vapor level is above 25 ppm at the perimeter of the exclusion area, activities must be shut down. Monitoring will continue and the Project Manager or designee will be consulted regarding a proper course of action. All 15-minute average readings must be recorded and will be available for NYSDEC and NYSDOH review.
- Particulates may become a concern during intrusive site activities (i.e., grading, excavating or other movement or disturbance of site soils). PM10 particulate levels will be continuously monitored downwind at the perimeter of the exclusion zone with a portable real-time PM10 particulate monitor that will have an alarm set at 100 µg/m^3. If downwind particulate levels integrated over a period of 15 minutes exceed 100 µg/m^3, then particulate levels upwind of the exclusion zone will be measured. If the downwind particulate level is more than 100 µg/m^3 greater than the upwind particulate level, dust suppression techniques (e.g. spraying water, covering exposed soils with poly sheeting) will be employed. If after implementation of dust suppression techniques, the downwind PM10 particulate level exceeds the upwind PM10 particulate level by greater than 150 µg/m^3, activities will be halted and the Project Manager will be consulted. All readings will be recorded and be available for NYSDEC and NYSDOH review. These action levels can be modified if particulates are better characterized and identified.

Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds five (5) ppm above background levels at the perimeter of the exclusion zone, ground intrusive activities will cease and monitoring continued. If the organic vapor levels decrease below five (5) ppm (above background), excavating activities may resume. If the organic vapor levels are greater than 5 ppm, but less than 5 ppm over background at the perimeter of the work area, activities may resume provided:

- The organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest residence or commercial structure, whichever is less, is below 5 ppm over background, and,
- More frequent intervals of monitoring, as directed by the Site Manager in consultation with the Project Manager, are conducted.

If the organic vapor level is above 5 ppm over background at the perimeter of the exclusion zone, work activities will halt and vapor control contingencies will be implemented. Exposed soils will be covered with poly sheeting or a biodegradable, surfactant-based foam concentrate, will then be sprayed onto the excavated soils to control the fugitive vapors. When work shutdown occurs, downwind air monitoring will be implemented to ensure that vapor emissions do not impact the nearest residential or commercial structure.

If organic vapor levels greater than 5 ppm over background are identified 200 feet downwind from the exclusion zone, or half the distance to the nearest residential or commercial property line, whichever is less, all work must cease. Following cessation of work activities and implementation of odor control contingencies, if organic vapor levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then air quality must be monitored within 20 feet of the perimeter of the nearest residential/commercial structure (the "20 foot zone").

If organic vapor levels approach 5 ppm above background within the "20 foot zone" for a period of more than 30 minutes, or organic vapor levels greater than 10 ppm above background for any time period occur within the "20 foot zone", then the following steps will be taken:

- Frequent air monitoring will be conducted at 30-minute intervals within the 20-foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site Manager.

Appendix B: Health and Safety Plan

Health and Safety Plan for Pre-Design Investigation

And Quarterly Groundwater Sampling

at

Patchogue Former MGP Site

234 West Main Street

Village of Patchogue, Suffolk County, NY 11772

June 2011

Revision 3

BC Project Number: 138893.303

Prepared by:

BROWN AND CALDWELL

110 Commerce Drive

Allendale, New Jersey 07401

Prepared for:

NATIONAL GRID

175 East Old Country Road

Hicksville, NY 11801

Approval Page

For

Health and Safety Plan for Pre-Design Investigation

and Quarterly Groundwater Sampling

at

Patchogue Former MGP Site

234 West Main Street

Village of Patchogue, Suffolk County, NY 11772

Revision 2

This Health and Safety Plan (HASP) has been prepared and reviewed by the following Brown and Caldwell (BC) personnel for use at: Patchogue Former MGP Site (BC Project Number: 138893.303).

	Name	Signature	Title	Date
Prepared By:	Catherine E. Trent, P.E.	Catherine E. Trent	HS Specialist/Senior Engineer	6/29/11
Reviewed By:	Brett Schwartz		Site Safety Officer	
Reviewed By:	Keith Bogatch		Project Manager	6/29/11
Reviewed By:	Patricia Petrino	Patricia Petrino	PDI Task Manager	6/29/11
Reviewed By:	Jim Bucha, CIH, CSP		Director of Health and Safety	6/29/11
Effective Dates:	June 2011	through	May 2012	

THE AMERICAN BOARD OF INDUSTRIAL HYGIENE INCORPORATED CERTIFICATION NUMBER 6738 CP EXPIRES 6-1-2012 PENNSYLVANIA - 1960 JAMES A. BUCHA, CIH

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LIST OF APPENDICES

CRITICAL PROJECT INFORMATION

This HASP was developed consistent with requirements in National Grid's generic HASP, entitled "Generic Environmental Health and Safety Plan for Site Investigations at Non-Owned Former MGP Sites" (Foster Wheeler, November 2002), referred herein to as the "Generic HASP".

Primary Known Compounds of Concern:

Compounds of Concern as identified in "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York" (Tetra Tech EC, Inc, December 2009) are as follows:

Contaminants/ Materials of Concern
BTEX
PAHs
Cyanide
NAPL/Tar
Purifier Waste

Minimum Level of Personal Protective Equipment: ☒ Level D ☐ Level C

Note: Upgrade to Level C is allowed on this project with the exception of Cyanide. If cyanide is measured via colorimetric tube, or direct-reading instrument, to be above 2.5 ppm, then work stoppage will occur.

Additional PPE:

Level D includes work shirt and long pants, hardhat, steel toes, and safety glasses. Additional PPE that may be required is as follows (see Section 4 for additional PPE information):

- High-visibility traffic safety vest
- Safety goggles with side shields
- Plastic face shield or splash-proof goggles for use during heavy equipment decontamination
- Overboots
- 11-mil Nitrile gloves for sampling activities
- Ear plugs on an as needed basis
- Full-body Tyvek suits to prevent exposure to ticks, chiggers and other insects
- Full face air purifying respirators with organic vapor/HEPA filter cartridges if upgrade to Level C is required.

SEE SECTION 10 FOR SITE EMERGENCY CONTINGENCY PROCEDURES

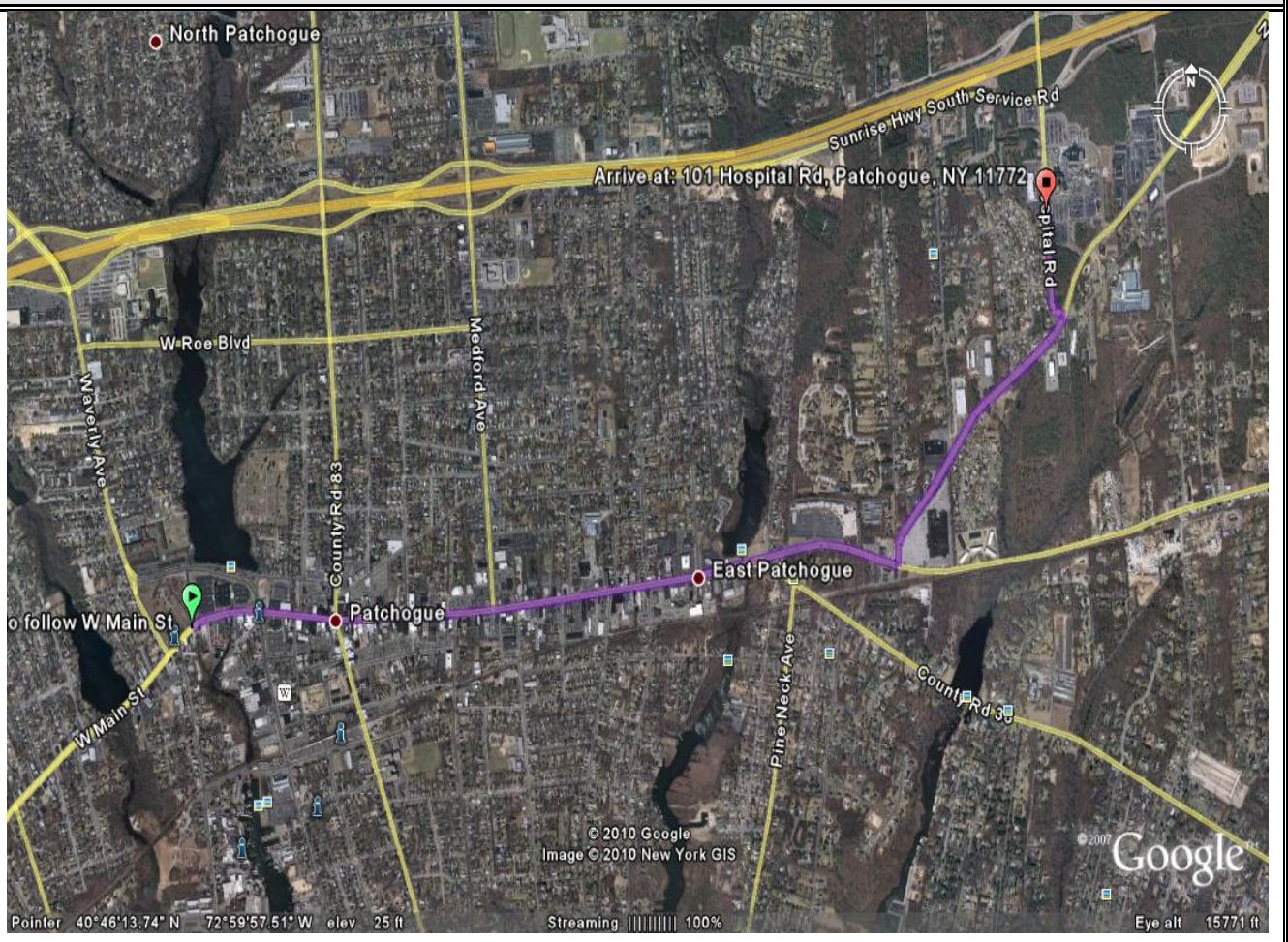
Do not endanger your own life. Survey the situation before taking any action.

New Jersey BC Office Telephone	**110 Commerce Drive Allendale, NJ 07401 Phone: 201-574-4700**
Site Location Address	**234 West Main Street Patchogue, New York 11772**

EMERGENCY PHONE NUMBERS: In the event of emergency, contact the Project Manager and/or Regional Safety Unit Manager.

Emergency Services (Ambulance, Fire, Police)	**911**
Poison Control	**(800) 876-4766 or (800) 222-1222**
Hospital Name	**Brookhaven Memorial Hospital 101 Hospital Road, Patchogue,**
Hospital Phone Number	**Phone: (631) 654-7100**
BC Project Manager (PM): Keith Bogatch	**Office: 201-574-4765 Cell: 201-739-2320**
BC PDI Task Manager: Patricia Petrino	**Office: 201-574-4761 Cell: 862-377-9645**
BC Field Operations Leader: Jim Marolda	**Office: 201-574-4713 Cell: 201-841-1625**
BC Site Safety Officer (SSO): Brett Schwartz	**Office: 201-574-4727 Cell: 551-579-3901**
BC Director of Health and Safety Jim Bucha, CIH, CSP	**Office: (916) 853-5308 Cell: (916) 216-6374**
BC Regional Safety Unit Manager (RSUM): Lydia Crabtree, CSP	**Office: 615-250-1236 Cell: 615-202-1311**
Corporate Risk Management	**Property Loss Blythe Buetzow: (925) 210-2470 Injury Angela Hale: (925) 210-2218**
Client Contact: Sarah Aldridge	**Office: 516-545-2568 Cell: 860-334-0554**
Subcontractors:	
Drilling Company: Zebra Environmental Corp. David Vines	**Office: 516-596-6300**

HOSPITAL LOCATION MAP



HOSPITAL DIRECTIONS:

1. Head northeast on County Road 85/ West Main Street toward West Ave
2. go 2 miles
3. Turn left at East Patchogue Yaphank Road/ Sills Road
4. go 0.7 mi
5. Turn left at Hospital Road
6. go 0.3 mi
7. Destination will be on the right

HOSPITAL INFORMATION:

Brookhaven Memorial Hospital and Medical Center
101 Hospital Road
Patchogue,

Phone: (631) 654-7100

Est. Travel Distance: 3 miles
Est. Travel Time: 7 minutes

EMERGENCY FIRST AID PROCEDURES

THE RESPONDER SHOULD HAVE APPROPRIATE TRAINING TO ADMINISTER FIRST AID OR CPR

1. Survey the situation. Do not endanger your own life. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME. ENSURE ALL PROTOCOLS ARE FOLLOWED INCLUDING THAT A STANDBY PERSON IS PRESENT. IF APPLICABLE, REVIEW MSDSs TO EVALUATE RESPONSE ACTIONS FOR CHEMICAL EXPOSURES.
2. Call 911 (if available) or the fire department **IMMEDIATELY**. Explain the physical injury, chemical exposure, fire, or release.
3. Decontaminate the victim if it can be done without delaying life-saving procedures or causing further injury to the victim.
4. If the victim's condition appears to be non-critical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by the SSO or designated personnel: let the doctor assume the responsibility for determining the severity and extent of the injury. If the condition is obviously serious, contact emergency medical services (EMS) for transport or appropriate actions.

Notify the PM and Regional Safety Unit Manager immediately and complete the appropriate accident/incident investigation reports as soon as possible.

STOP BLEEDING AND CPR GUIDELINES	
To Stop Bleeding	**CPR**
1. Give medical statement by indicating you are trained in 1st Aid. 2. Assure: airway, breathing and circulation. 3. Use **DIRECT PRESSURE** over the wound with clean dressing or your hand (use non-permeable gloves). Direct pressure will control most bleeding. 4. Bleeding from an artery or several injury sites may require **DIRECT PRESSURE** on a **PRESSURE POINT**. Use pressure points for 30 -60 seconds to help control severe bleeding. 5. Continue primary care and seek medical aid as needed.	1. Give medical statement by indicating you are trained in CPR. 2. Arousal: Check for consciousness. 3. Call out for help, either call 911 yourself or instruct someone else to do so. It is very important to call for emergency assistance prior to initiating CPR. 4. Open airway with chin-lift. 5. Look, listen and feel for breathing. 6. If breathing is absent, give 2 slow, full rescue breaths. 7. Look, listen and feel for breathing. 8. If breathing is absent, initiate CPR; 30 compressions for each two breaths. 9. If an automated external defibrillator (AED) is available, use it in accordance with the AED instructions.

REVISION HISTORY

Revision No.	Revision Date	Reason	Editor
0	May 2010	New Project	N. Lordan/ J. Bucha
1	December 2010	Addition of Quarterly GW Sampling to SOW	C. Trent/ J. Bucha
2	June 2011	Addition of Hollow Stem Augers to SOW	C. Trent/ J. Bucha
3	August 2011	NG near-miss incident report	C. Trent/ J. Bucha
4			
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1. INTRODUCTION

Brown and Caldwell (BC) has prepared this Health and Safety Plan (HASP) for use during the Pre-Design Investigation activities to be conducted at the Patchogue Former MGP Site located at West Main Street, Patchogue, Suffolk County, NY 11772 ("the Site"). Activities conducted under BC's direction at the Site will be in compliance with applicable Occupational Safety and Health Administration (OSHA) regulations, particularly those in Title 29 of the Code of Federal Regulations, Part 1910.120 (29 CFR 1910.120), and other applicable federal, state, and local laws, regulations, and statutes. A copy of this HASP will be kept on site during scheduled field activities.

This HASP addresses the identified hazards associated with planned field activities at the Site. It presents the minimum health and safety requirements for establishing and maintaining a safe working environment during the course of work. In the event of conflicting requirements, the procedures or practices that provide the highest degree of personnel protection will be implemented. If scheduled activities change or if site conditions encountered during the course of the work are found to differ substantially from those anticipated, the Regional Safety Unit Manager and Project Manager will be informed immediately upon discovery, and appropriate changes will be made to this HASP.

BC's health and safety programs and procedures, including medical monitoring, respiratory protection, injury and illness prevention, hazard communication, and personal protective equipment (PPE), are documented in the BC Health & Safety Manual. The Health & Safety Manual is readily accessible to BC employees via the BC Pipeline. These health and safety procedures are incorporated herein by reference, and BC employees will adhere to the procedures specified in the manual.

BC's HASP has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's HASP may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's HASP does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's HASP to identify all hazards that may be present at the Site.

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards

that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own HASP for this project or other health and safety program documents for review.

1.1 Site Description and History

The Site description and history below is as presented in the Final Remedial Investigation Report, Patchogue Former MGP Site (Tetra Tech EC, Inc., December 2009).

1.1.1 Drilling

During all drilling activities, the operator must ensure that the appropriate level of protection and appropriate safety procedures are utilized. The operator will verify that equipment "kill switches" are functioning properly at the start of each day's use. Hard hats, steel-toed boots, and ear and eye protection will be required at all times when working around drill rigs. The proximity of underground and overhead utilities must be identified before any drilling is attempted. The rig may not be moved with the mast in the upright position.

Workers can effectively manage hazards associated with working around heavy equipment if a constant awareness of these hazards is maintained. These hazards include the risk of becoming physically entangled in rotating machinery, slipping and falling, impact injury to eyes, head and body, and injury from machinery operations. Never work or walk on piles of well casings. Make sure all high-pressure lines and hoses have whip checks attached. Constant visual or verbal contact with the equipment operator will facilitate such awareness. In addition, when a drill rig is in operation, the equipment operator must maintain contact with the drill rig controls with both hands. The equipment operator may not attempt to help the assistant or assume the tasks of the assistant while also operating the drill rig.

1.1.2 Site History

The following is a brief summary of operations conducted at the site from 1904 until present based on the available records:

- 1904: Earliest records of site use for coal gasification
- 1904 – 1926: Site owned and operated by Patchogue Gas Company
- 1914: Site converted into a high pressure gas distribution facility
- 1915 – 1918: Site used to store and distribute high pressure gas produced off-site
- 1922 – 1925: Site used to produce emergency water gas
- 1926: Eight gas aboveground storage tanks (ASTs) installed on-site
- 1976: Long Island Lighting Company sold the site and MGP and gas distribution operations eased. Site sold to third party.
- 1976 – 2006: Site used as a refrigeration-scrap storage yard
- 2005: Site re-acquired by KeySpan

- 2006: KeySpan demolished a warehouse and detached garage
- Present: Inactive and vacated site with concrete slabs remaining at the ground surface.

1.1.3 Site Description

The Patchogue Former MGP Site is located at 234 West Main Street south of Main Street, east of River Avenue, and adjacent to Patchogue River in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York. The site is approximately 3.6 acres with a maximum length (north-south) of approximately 680 feet and a maximum width (east-west) of 180 feet. The average elevation of the site is 10 feet above mean sea level (msl) and the site has a relatively flat topography. The site is located along the Patchogue River just south of where the river exits Patchogue Lake. An overflow pond is also located south/southwest of the site. The site is currently vacant and the southern area of the property is overgrown with brush and trees. Two concrete slabs are located adjacent to one another in the northern area of the site and are approximately 240 feet by 60 feet in combination. The site is secured by locked perimeter fencing, and private properties border the site.

The site is bordered to the east by the Patchogue River and small industrial properties. The surrounding area is primarily used for commercial and residential purposes. A commercial/industrial area is located north of the site and a residential area lies south of the site. Above All Store Fronts and the Patchogue River border the site to the east, while Costanza Marine Contractors is situated to the west. The River Avenue Elementary School is located approximately one-tenth of a mile southwest and upgradient of the site, with residential homes between the site and the school. The Village of Patchogue's waste water treatment plant (WWTP) is located upstream of the site on the eastern side of the Patchogue River.

1.2 Scope of Work

Soil Borings

Pre-design investigation activities are to be performed, via the implementation of the soil boring program, to collect information from the MGP impacted areas identified near the center of the Site and the off-site petroleum impacted areas on the adjacent property (to the east). Initially, soil borings will be advanced and sampled at approximately eight to 10 locations. In addition, approximately two to four borings will be advanced on the adjacent property to the east of the Site to collect additional information regarding the petroleum impacts in this area.

The pre-design investigation activities being performed to confirm the previously recorded observations and to further assess the nature of the MGP and petroleum-related impacts. This assessment will include visible observations as recorded in the field using the standard National Grid "Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites". No analytical samples will be collected during the proposed field investigation.

The soil borings will be advanced using direct-push technology (e.g., GeoProbe®) and/or hollow stem augers. Samples from cores will be field screened for indications of MGP-related, or other, impacts based on appearance, odors or organic vapor concentration measurements using a properly

calibrated photoionization detector (PID). Upon completion, the soil borings will be backfilled with cement-bentonite grout.

If needed, additional borings may be advanced in an effort to collect information regarding the characteristics of the impacts. Locations of these potential additional borings will be field determined. The field screening methodology will be consistent with the approach described above.

Monitoring of Surface Water and Groundwater Levels

Continuous monitoring of water levels in the Patchogue River and monitoring wells located on the Site will be conducted to monitor water level fluctuations in the Patchogue River adjacent to the site and in groundwater beneath the site over time, as described under the description for Phase 302. This will be accomplished using In-Situ Level-TROLLS® installed in monitoring wells located near the river channel, wells located upland from river, and in a staff gauge (equipped with PVC stilling tube) that will be installed in the river. Manual water level measurements will be made in all monitoring wells and the staff gauge at the beginning and end of this monitoring period.

Results obtained from this water level monitoring effort are intended to provide data that will indicate whether the river is tidally influenced and, if applicable, assess the influence of river levels on groundwater levels.

Slug Tests

In-situ hydraulic conductivity tests (i.e., slug tests) will be performed on up to 6 of the existing site monitoring wells. Rising head slug tests will be conducted and the data generated will be input into AQTESOLV® software for hydraulic conductivity calculations.

The slug test results would be used to estimate time-of-travel of groundwater from the "source area" to the Patchogue River (as requested by the NYSDEC) and would also be used for estimating excavation dewatering rates/volumes in our evaluation of remedial alternatives.

Groundwater Monitoring and NAPL Gauging

Four (4) rounds of groundwater sampling, water level measurements, and NAPL gauging will be conducted as part of quarterly groundwater monitoring activities at the Site. Field activities for each groundwater monitoring event will be conducted by a two-person field crew from BC. Each groundwater monitoring event will be completed in approximately three (3) days. Depth to water measurements and NAPL gauging will be conducted prior to groundwater sampling. In the event that NAPL is detected in a monitoring well, a groundwater sample will not be collected from that well.

Groundwater samples will be collected according to the United States Environmental Protection Agency (USEPA) low-flow sampling protocol, 2010, and in accordance with procedures outlined in the Generic Field Sampling Plan for Site Investigations at Non-Owned Former MGP Sites (Foster Wheeler, November 2002) (referred to as "FSP").

2. KEY BC PROJECT PERSONNEL AND RESPONSIBILITES

Keith Bogatch is the Project Manager (PM). Patricia Petrino is the Pre-Design Investigation (PDI) Task Manager. Jim Bucha, CIH, CSP is the BC Director of Health and Safety. Lydia Crabtree, CSP is the Regional Safety Unit Manager (RSUM). Brett Schwartz has been designated as the BC Site Safety Officer (SSO) for this project. An onsite SSO will be designated from the field staff implementing the PDI or conducting the quarterly groundwater sampling. The BC project field staff have completed 40 hours of comprehensive health and safety training, which meets the requirements of 29 CFR 1910.120.

The responsibilities of key BC project personnel are presented below.

2.1 BC Project Manager

The PM is responsible for evaluating hazards anticipated at the Site and working with designated field staff and the RSUM to prepare this HASP to address the identified hazards. The PM is also responsible for the following.

- Informing project participants of safety and health hazards identified at the Site.
- Providing a copy of this HASP to BC project participants and a copy to each BC subcontractor prior to the start of field activities.
- Ensuring that the BC project team is adequately trained and perform safety briefings in accordance with this HASP.
- Providing the resources necessary for maintaining a safe and healthy work environment for BC personnel.
- Communicating project safety concerns to the RSUM for determining corrective actions.

2.2 BC Site Safety Officer

The SSO has on-Site responsibility for verifying that BC team members, including subcontractors, comply with the provisions of this HASP. The SSO has the authority to monitor and correct health and safety issues as noted on-Site. The SSO is responsible for the following.

- Reporting unforeseen or unsafe conditions or work practices at the Site to the PM or RSUM.
- Stopping operations that threaten the health and safety of BC field team or members of the surrounding community.
- Monitoring the safety performance of Site personnel to evaluate the effectiveness of health and safety procedures.
- Performing air monitoring, as necessary, as prescribed in this HASP.

- Documenting field team compliance with this HASP by completing the appropriate BC forms contained in the Appendices of this document.
- Conducting daily tailgate safety meetings and assuring that project personnel understand the requirements of this HASP (as documented by each BC field team member's signature on the Signature Page).
- Limiting access to BC work areas on the Site to BC field team members and authorized personnel.
- Enforcing the "buddy system" as appropriate for Site activities.
- Performing periodic inspections to evaluate safety practices at the Site.
- Identifying the location and route to nearby medical facility and emergency contact information and coordinating appropriate responses in the event of emergency.

2.3 BC Regional Safety Unit Manager

The RSUM is responsible for final review and modification of this HASP. Modifications to this HASP that result in less protective measures than those specified may not be employed by the PM or SSO without the approval of the RSUM. In addition, the RSUM has the following responsibilities.

- Developing and coordinating the overall BC health and safety program.
- Advising the PM and SSO on matters relating to health and safety on this project.
- Recommending appropriate safeguards and procedures.
- Modifying this HASP, if necessary, and approving changes in health and safety procedures at the Site.

2.4 BC Team Members

BC employees and subcontractors are responsible for familiarizing themselves with health and safety aspects of the project and for conducting their activities in a safe manner. This includes attending site briefings, communicating health and safety observations and concerns to the SSO, maintaining current medical and training status and maintaining and using proper tools, equipment and PPE. Proper work practices are part of ensuring a safe and healthful working environment. Safe work practices are essential and it is the responsibility of BC employees and team members to follow safe work practices when conducting scheduled activities. Safe work practices to be employed during the entire duration of fieldwork include, but are not limited to, the following.

- Following the provisions of this HASP, company health and safety procedures and regulatory requirements.
- Reviewing safety-related information from other parties (i.e., client or contractors) as it relates to BC's activities.

- Inspecting personal protective equipment (PPE) before on-site use, using only intact protective clothing and related gear, and changing suits, gloves, etc. if they are damaged or beyond their useful service life.
- Setting up, assembling, and checking out all equipment and tools for integrity and proper function before starting work activities.
- Assisting in and evaluating the effectiveness of Site procedures (including decontamination) for personnel, protective equipment, sampling equipment and containers, and heavy equipment and vehicles.
- Practicing the "buddy system" as appropriate for site activities.
- Not using faulty or suspect equipment.
- Not using hands to wipe sweat away from face, but rather using a clean towel or paper towels.
- Practicing contamination avoidance whenever possible.
- Not smoking, eating, drinking, or applying cosmetics while in chemically-affected areas of the site or before proper decontamination.
- Washing hands, face and arms before taking rest and lunch breaks and before leaving the site and the end of the workday.
- Checking in and out with the SSO upon arrival and departure from the site.
- Performing decontamination procedures as specified in this HASP.
- Notifying the SSO immediately if there is an incident that causes an injury, illness or property loss. Incidents that could have resulted in injury, illness or property loss (close call) will also be reported to the SSO.
- Not approaching or entering an area where a hazardous environment (i.e., oxygen deficiency, toxic or explosive) may exist without employing necessary engineering controls, proper PPE and appropriate support personnel.
- Using respirators correctly and as required for the Site; check the fit of the respirator with a negative or positive pressure test; Not wearing respirator with facial hair or other conditions that prevent a face-to-facepiece seal.
- Not entering confined spaces without appropriate evaluation, equipment, training and support personnel.

2.5 BC Subcontractors

Subcontractor personnel are expected to comply fully with subcontractor's HASP and to observe the minimum safety guidelines applicable to their activities which may be identified in the BC HASP. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

3. HAZARD ANALYSIS

Hazards at the Site may include physical hazards, chemical hazards or biological hazards. Each type of identified hazard is addressed in the following sections. Hazards that are the specialty of a subcontractor (i.e., operation of a drill rig or excavator) are not addressed in this HASP. Subcontractors are responsible for identifying potential hazards associated with their activities and implementing proper controls.

3.1 Chemical Hazards

Exposure pathways of concern for chemical compounds that may be present at the Site are inhalation of airborne contaminants, direct skin contact with contaminated materials, and incidental ingestion of affected media. Wearing protective equipment and following decontamination procedures listed in Section 7 can minimize dermal contact and incidental ingestion. To minimize inhalation hazards, dust or vapor control measures will be implemented, where necessary, and action levels will be observed during scheduled activities. Site-specific action levels and air monitoring requirements are presented in Section 5.

The table presented below provides a summary of the range of constituent concentrations measured in the various media (soil, groundwater) at the site based on the Remedial Investigation data.

Known or Suspected Chemicals in Site Media	Media	Known Concentration Range	
		Lowest	Highest
Benzene	Soil	Not detected (ND)	6.3 mg/kg
	Groundwater	ND	46 µg/l
Toluene	Soil	ND	22 J mg/kg
	Groundwater	ND	120 µg/l
Ethyl Benzene	Soil	ND	130 DJ mg/kg
	Groundwater	ND	390 DJ µg/l
Xylene, Total	Soil	ND	195 mg/kg
	Groundwater	ND	460 DJ µg/l
Total Polycyclic Aromatic Hydrocarbons (PAHs)	Soil	ND	16,410 mg/kg
	Groundwater	ND	2,041 µg/l
Cyanide, Total (Typically present at MGP sites as iron cyanide complexes)	Soil	ND	3.95 mg/kg
	Groundwater	ND	0.015 mg/l

Chemical descriptions of select chemicals of concern, including health effects and exposure limits, are presented in the following paragraphs. Each chemical description includes physical and odor recognition characteristics, the health effects associated with exposure, and exposure limits expressed as an 8-hour time-weighted average (TWA). Provided are federal OSHA (OSHA) permissible exposure limits (PELs; located in 29 CFR 1910.1000); California OSHA (Cal/OSHA) PELs (located in 8 CCR 5155); and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs).

For sites outside California, Cal/OSHA PELs are included as an additional reference.

3.1.1 Benzene

Benzene is a clear, volatile liquid. It is colorless, highly flammable, and toxic, with a characteristic odor. It is a severe eye and moderate skin irritant. Human effects by inhalation and ingestion include euphoria, changes in sleep and motor activity, nausea and vomiting, other blood effects, dermatitis, and fever. In industry, inhalation is the primary route of chronic benzene poisoning. If the liquid is aspirated into the lung it may cause pulmonary edema. Poisoning by skin contact has also been reported. Exposure to high concentrations (3,000 ppm) may result in acute poisoning, which is characterized by the narcotic action of benzene on the central nervous system. Chronic poisoning occurs most commonly through inhalation and dermal absorption. Benzene is a known human carcinogen that can cause leukemia.

- The OSHA PEL is listed as 1 ppm.
- The Cal/OSHA PEL is listed as 1 ppm.
- The TLV is listed as 0.5 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.1.2 Toluene

Toluene is a colorless liquid with a benzol-like odor. Human systemic effects of exposure to toluene include central nervous system changes, hallucinations or distorted perceptions, motor activity changes, psychophysiological changes, and bone marrow changes. It is a severe eye irritant and an experimental teratogen. Inhalation of high vapor concentrations may cause impairment of coordination and reaction time, headaches, nausea, eye irritation, loss of appetite, a bad taste in the mouth, and lassitude.

- The OSHA PEL is listed as 200 ppm.
- The Cal/OSHA PEL is listed as 50 ppm.
- The TLV is listed as 20 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.1.3 Ethylbenzene

Ethylbenzene is a clear, colorless liquid. It is mildly toxic by inhalation and skin contact. Inhalation can cause eye, sleep, and pulmonary changes. It is an eye and skin irritant at levels as low as 0.1% (1,000 ppm) of the vapor in air. At higher concentrations, it is extremely irritating at first, then can cause dizziness, irritation of the nose and throat, and a sense of constriction in the chest. Exposure to high concentrations of ethylbenzene vapor may result in irritation of the skin and mucous membranes, dizziness, irritation of the nose and throat, and a sense of constriction of the chest.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 100 ppm.
- The TLV is listed as 100 ppm.

3.1.4 Xylene

Xylene is a clear, colorless liquid. It exhibits the general chlorinated hydrocarbon central nervous system effects, olfactory (smell) changes, eye irritation and pulmonary changes. It is a severe skin irritant. There are three isomers: ortho, meta, and para. Exposure to high concentrations of xylene vapor may result in eye and skin irritation. Eye irritation may occur at concentrations of about 200 ppm.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 100 ppm.
- The TLV is listed as 100 ppm.

3.1.5 Polycyclic Aromatic Hydrocarbons (PAHs)

Tar from MGP sites and residues of gasoline and diesel fuels may contain polycyclic aromatic hydrocarbons (PAHs). Certain PAHs are known as human carcinogens. Routes of entry include inhalation, gastrointestinal and skin contact. They are not usually very volatile. Therefore, unless they are known to be present at significant concentrations, high odors of fuels are evident, or dust clouds are present, the primary method of protection is by avoiding skin contact. Components of tar from MGP sites include naphthalene, pyrene, phenanthrene, anthracene, chrysene, fluoranthene, and acenaphthene.

PAHs constitute a class of materials of which benzo[a]pyrene (BaP) is one of the most common and also the most hazardous. In general, PAHs can be formed in any hydrocarbon combustion process. The less efficient the combustion process, the higher the PAH emission factor is likely to be. The major sources are stationary sources, such as heat and power generation, refuse burning, industrial activity, such as coke ovens, and coal refuse heaps. PAHs may also be released from oil spills. Because of the large number of sources, people are exposed to very low levels of PAHs every day.

Certain PAHs, such as BaP, have been demonstrated to be carcinogenic at relatively high exposure levels in laboratory animals. BaP is a yellowish crystalline solid that consists of five benzene rings

joined together. It is highly soluble in fat tissue and has been shown to produce tumors in the stomachs of laboratory mice. In addition, skin cancers have been induced in a variety of animals at very low levels and unspecified lengths of application.

It is important to recognize the PAHs' ability to adhere to soil and other particulates. Therefore, good particulate emission controls and the use of air purifying respirators with particulate filters are required for protection against airborne PAH hazards.

- The OSHA PEL is listed as 0.2 mg/m3 (as coal tar pitch volatiles).
- The Cal/OSHA PEL is listed as 0.2 mg/m3 (as coal tar pitch volatiles).
- The TLV is listed as 0.2 mg/m3 (coal tar pitch volatiles, as benzene soluble aerosol).

3.1.6 Cyanide

The toxicity of cyanide compounds is quite variable. Iron cyanides, which are frequently encountered at MGP sites, have a low toxicity. Hydrogen cyanide is a chemical asphyxiant. It is released as a gas upon contact of the liquid with an acid compound. There are also both soluble and insoluble forms. Routes of entry include inhalation, skin absorption and ingestion. Symptoms of cyanide poisoning include weakness headaches, nausea vomiting and slow gasping respiration. The PEL for sodium and potassium cyanide is 5 mg/m3. These substances have very poor warning properties and therefore cannot be protected against by Air Purifying Respirators. Precautionary measures include worker training of symptoms, testing solutions for acidic conditions which may release CN vapors with litmus paper and checking with the emergency hospital for the capability of administering an antidote within 20 minutes from the onset of symptoms.

Hydrogen cyanide (HCN) is a colorless or pale blue liquid or gas (above 78° F) with a bitter, almond-like odor. It is a deadly human poison by all routes of exposure. Symptoms of mild exposure include cyanosis, headache, dizziness, unsteadyness of gait, a feeling of suffocation, and nausea. In cases of acute cyanide poisoning, death is extremely rapid (exposure to concentrations of 100 to 200 ppm for periods of up to 60 minutes can cause death).

HCN is a very dangerous fire hazard when exposed to heat, flame, or oxidizers. When heated to decomposition or in reaction with water, steam, or acid, it produces highly toxic fumes of CN.

- The OSHA PEL is listed as 10 ppm (11 mg/m3).
- The Cal/OSHA PEL is listed as 4.7 ppm (5 mg/m3).
- The TLV Ceiling Limit is listed as 4.7 ppm for hydrogen cyanide and 5 mg/m3 as a ceiling level for cyanide salts.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.2 Hazard Communication

In accordance with the Hazard Communication standard, material safety data sheets (MSDSs) will be maintained on site for chemical products used by BC personnel at the Site (i.e., spray paint, PVC

cement, etc.). Subcontractors will be responsible for maintaining MSDSs for chemical products they bring on Site. In addition, containers will be clearly labeled in English to indicate their contents and appropriate hazard warnings. Please note that labeling containers includes, but is not limited to, any waste, used PPE, and/or decontamination materials collected.

3.3 Opening Wells and Well Vaults

Direct-reading instrumentation specified in Section 5 will be used to monitor any work in a well vault at the site where VOCs are a concern. The well vault will be opened carefully with the BC employee staying upwind as much as possible and then left open for a minimum of three minutes to allow the vault to vent. If the well cap is then removed, allow another three minutes for the well head to vent before proceeding. Please note that if there are other established protocols that differ from 3 minutes, the more protective time increment will be followed. Personnel should stay upwind as much as possible while working in and around the vault.

When removing a well cap, personnel will remain upwind as much as possible and will carefully remove the cap by opening it away from them in order to reduce the likelihood of exposure to vapors. Personnel will wait a minimum of three minutes to allow the well to vent before proceeding.

3.4 Physical Hazards

The following physical hazards, as marked below, have been identified and may be encountered during scheduled field activities.

- ☒ Slips, Trips and Falls
- ☒ Heavy Equipment
- ☐ Excavations
- ☒ Noise
- ☒ Overhead Utilities
- ☐ Electrical Equipment
- ☐ Confined Spaces
- ☒ Sharp Objects/Cutting
- ☐ Elevated Platforms
- ☒ Traffic
- ☐ Arc Flash Protection
- ☐ Building Collapse
- ☒ Drowning Hazards – Wading Activities
- ☒ Housekeeping
- ☒ Materials and Equipment Handling - Lifting
- ☒ Drilling
- ☒ Underground Utilities
- ☒ Equipment Refueling
- ☐ Lockout/Tagout
- ☐ Fire
- ☒ Cutting Acetate Sleeves
- ☐ Ladder Use
- ☒ Driving
- ☐ Boating Safety
- ☐ Personal Safety – Urban Setting

Actions to be taken to protect against the hazards identified are provided in the sections below.

3.4.1 Slip, Trips, and Falls

Slipping hazards may exist due to uneven terrain, wet or slick surfaces, leaks or spills. Tripping hazards may be present from elevation changes, debris, poor housekeeping or tools and equipment. Some specific hazards may include: climbing/descending ladders, scaffolding, berms or curbing. Collectively, these types of injuries account for nearly 50 percent of all occupational injuries and accepted disabling claims. Prevention requires attention and alertness on the part of each worker, following and enforcing proper procedures, including good housekeeping practices, and wearing appropriate protective equipment.

3.4.2 Housekeeping

Personnel shall maintain a clean and orderly work environment. Make sure that all materials stored in tiers are stacked, racked, blocked, interlocked, or secured to prevent sliding, falling, collapse, or overturning. Keep aisles and passageways clear and in good repair to provide for free and safe movement of employees and material-handling equipment. Do not allow materials to accumulate to a degree that it creates a safety or fire hazard.

During construction activities, scrap and form lumber with protruding nails and other items shall be kept clear from work areas, passageways, and stairs. Combustible scrap and debris shall be removed at regular intervals. Safe means must be provided to facilitate removal of debris.

Containers must be provided for collecting and separating waste, used rags and other debris. Containers used for garbage and other oily flammable or hazardous waste such as caustics, acids, harmless dusts, etc., must be separated and equipped with covers. Garbage and other waste shall be disposed of at frequent and regular intervals.

3.4.3 Heavy Equipment

Equipment, including earth-moving equipment, drill rigs, or other heavy machinery, will be operated in compliance with the manufacturer's instructions, specifications, and limitations, as well as any applicable regulations. The operator is responsible for inspecting the equipment prior to use each work shift to verify that it is functioning properly and safely.

The following precautions should be observed whenever heavy equipment is in use.

- PPE, including steel-toed boots, safety glasses, high visibility vests, and hard hats must be worn.
- Personnel must be aware of the location and operation of heavy equipment and take precautions to avoid getting in the way of its operation. Workers must never assume that the equipment operator sees them; eye contact and hand signals should be used to inform the operator of the worker's intent.
- Personnel should not walk directly in back of, or to the side of, heavy equipment without the operator's knowledge. Workers should avoid entering the swing radius of equipment and be aware of potential pinch points.
- Nonessential personnel will be kept out of the work area.

3.4.4 Materials and Equipment Handling - Lifting

The movement and handling of equipment and materials on the Site pose a risk to workers in the form of muscle strains and minor injuries. These injuries can be avoided by using safe handling practices, proper lifting techniques, and proper personal safety equipment such as steel-toed boots and sturdy work gloves. Where practical, mechanical devices will be utilized to assist in the movement of equipment and materials. Workers will not attempt to move heavy objects by themselves without using appropriate mechanical aids such as drum dollies or hydraulic lift gates.

Proper lifting techniques include the following.

- Lift with the strength of your knees, not your back.
- Firmly plant your feet approximately shoulder-width apart.
- Turn your whole body, don't bent or twist at the waist.
- Be sure that the path is clear of obstructions or tripping hazards; avoid carrying objects that will obstruct your vision.
- Use caution when holding an object from the bottom to prevent crushing of the hands or fingers when lowering.

3.4.5 Excavations

A competent person who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them, will be present during excavation activities.

The atmosphere will be tested in excavations, before employees are permitted to enter and begin work, greater than 4 feet in depth or where oxygen deficiency or toxic or flammable gases are likely to be present. The atmosphere shall be ventilated and re-tested until flammable gas concentrations less than 5 percent of the lower explosive limit (LEL) and site-specific action levels are obtained. Worker entry will not be allowed if the oxygen concentration is less than 20 percent. In addition, a safe means of access and egress (i.e., a ladder, stairs or ramp) must be provided so that no more than 25 feet of lateral travel is required by employees.

Workers will not enter unstable excavations or excavations greater than 5 feet in depth without appropriate protective systems such as benching, sloping, or shoring. If shoring or shielding systems are not used, side slopes will not be steeper than 1½:1 without written confirmation from the competent person that slope is safe for the soil conditions. Excavations will be constructed in accordance with the OSHA Excavation Safety Standard (29CFR1926 Subpart P).

The competent person will inspect excavations daily. If there is evidence that a cave-in or slide is possible, work will cease until the necessary safeguards have been taken. Excavated material will be placed far enough from the edge of the excavation (a minimum of 2 feet) so that it does not fall

back into the opening or affect the integrity of the sidewall. At the end of each day's activities, open excavations will be clearly marked and secured to prevent nearby workers or unauthorized personnel from entering them. Remote sampling techniques will be the preferred method of sample collection in excavations.

3.4.6 Drilling

During all drilling activities, the operator must ensure that the appropriate level of protection and appropriate safety procedures are utilized. The operator will verify that equipment "kill switches" are functioning properly at the start of each day's use. Hard hats, steel-toed boots, and ear and eye protection will be required at all times when working around drill rigs. The proximity of underground and overhead utilities must be identified before any drilling is attempted. The rig may not be moved with the mast in the upright position.

Workers can effectively manage hazards associated with working around heavy equipment if a constant awareness of these hazards is maintained. These hazards include the risk of becoming physically entangled in rotating machinery, slipping and falling, impact injury to eyes, head and body, and injury from machinery operations. Never work or walk on piles of well casings. Make sure all high-pressure lines and hoses have whip checks attached. Constant visual or verbal contact with the equipment operator will facilitate such awareness.

3.4.7 Noise

Noise may result primarily from the operation of heavy equipment, process machinery or other mechanical equipment. Hearing protection with the appropriate noise reduction rating (NRR) shall be worn in areas with high noise levels. A good rule of thumb to determine if hearing protection is needed is the inability to have a conversation at arms length without raising voice levels. If loud noise is present or normal conversation becomes difficult, hearing protection in the form of ear plugs, or equivalent, will be required.

3.4.8 Underground Utilities

Reasonable efforts will be made to identify the location(s) of underground utilities (e.g., pipes, electrical conductors, fuel lines, and water and sewer lines) before intrusive soil work is performed. The state underground utility notification authority (New York Dig Safely) and the local municipality (Village of Patchogue) will be contacted prior to the start of intrusive field activities in accordance with local notification requirements. In areas not evaluated or serviced by the underground utility notification authority, and a reasonable potential for underground utilities exists, one or more of the following techniques will be employed to determine the location of subsurface structures.

- Contracting the services of a qualified private utility locator.
- Having a survey of the subject area conducted by staff trained in the use of subsurface utility locating equipment.
- Subsurface testing (i.e., hand digging or potholing) to the expected depth of probable utilities (not less than 5 feet).

If utilities cannot be located or if unlocated utilities are suspected to be present, subsurface activities (i.e., borings, excavation) should not be conducted before the location(s) or absence of underground utilities is confirmed.

Typical subsurface location marks are as follows:

- Red – electrical,
- Yellow – gas/oil/steam,
- Blue – water,
- Green – sanitary/storm drains/culverts,
- Orange – communications, and
- White – proposed excavation or boring.

Intrusive work should be limited to the area 3.3 feet (1 meter) on either side of the location marks. In some special cases such as fiber optics and high-pressure pipelines this area should be expanded to 16.5 feet (5 meters) on either side of the utility.

3.4.9 Overhead Utilities

If work is to be conducted in the vicinity of overhead electrical utilities, the owner of the overhead line will be contacted to determine the maximum voltage. Any overhead utility will be considered to be energized unless and until the person owning or operating such line verifies that the line is not energized, and the line is visibly grounded at the work site.

Workers will not perform work in proximity to energized high-voltage lines (including scaffolding, well drilling, pile driving, or hoisting equipment) until danger from accidental contact with high-voltage lines has been effectively guarded against.

Equipment with articulated upright booms or masts are not permitted to operate within 15 feet of an overhead utility line (less than 50kV) while the boom is in the upright position. For transmission lines in excess of 50kV, an additional distance of 4 inches for each 10 kV over 50kV will be used.

3.4.10 Equipment Refueling

Care shall be exercised while refueling generators, pumps, vehicles, and other equipment to prevent fire and spills. Personnel shall eliminate static electricity by grounding themselves (touching metal) prior to using refueling hoses and or containers of petroleum liquids. Items being refueled shall be grounded or be located on the ground and not on a trailer, work bench or inside a truck bed. Equipment that is hot must be allowed to cool prior to refueling. Spill response materials shall be available when conducting refueling operations.

3.4.11 Electrical Hazards

Electrical equipment to be used during field activities will be suitably grounded and insulated. Ground-fault circuit interrupters (GFCI), or equivalent, will be used with electrical equipment to

reduce the potential for serious electrical shock. Electrical equipment including batteries, generators, panels and extension cords shall be kept dry during use. Extension cords may not be used as a permanent means of providing power and will be removed from service if they are worn, frayed, or if the grounding prong is missing.

Extension cord precautions include the following.

- Be aware of exposed or bare wires, especially on metal grating. Warning*: Electrical contact with metal can cause fatal electrocution.*
- Prior to use, inspect cords for exposed or bare wires, worn or frayed cords, and incorrect splices. Splices are permitted, but there must be insulation equal to the cable, including flexibility.
- Cables and extension cords in passageways, steps or any area where there may be foot traffic should be secured so as to not create a tripping hazard. Overhead cables and extension cords shall be rigged to a height greater than 6 feet.
- Shield extension cords that must run across driveways or areas where vehicle traffic is present.
- Do not run cords across doorways or windows where they can be frayed or cut by a closed door or window.
- Do not run wires through wet or puddled areas.
- Flexible cord sets that are used on construction sites or in damp locations shall be of hard usage or extra hard usage type.

Observation of energized machinery will take place from a safe distance. Only qualified personnel will remove guards, hatch covers, or other security devices if necessary. Equipment lockout procedures and an appropriate facility work permit requirements will be followed. Lockout/tagout procedures will be conducted before activities begin on or near energized or mechanical equipment that may pose a hazard to site personnel. Workers conducting the operation will positively isolate the piece of equipment, lock/tag the energy source, and verify effectiveness of the isolation. Only employees who perform the lockout/tagout procedure may remove their own tags/locks. Employees shall complete lockout/tagout training before initiating this procedure.

Only qualified personnel will remove covers of electrical equipment to expose energized electrical parts. Entering electrical rooms/vaults or areas with live exposed electrical part by BC employees shall be permitted only when accompanied by a qualified personnel after notification and approval of the appropriate facility personnel.

3.4.12 Lockout/Tagout

Lockout/tagout (LO/TO) procedures in accordance with 29 CFR 1910.147 will be performed before activities begin on or near energized or mechanical equipment that may pose a hazard to site personnel. The purpose of the lockout/tagout (LO/TO) system is to safeguard exposure from machinery, energized electrical circuits, piping under pressure, or any type of energy source from

unexpected energization or start up that could at cause harm to an individual. Workers conducting the operation will positively isolate the piece of equipment, lock/tag the energy source, and verify effectiveness of the isolation. Only employees who perform the lockout/tagout procedure may remove their own tags/locks. Employees must be thoroughly trained before initiating this procedure.

Whenever multiple personnel (or multiple employers are working on the same worksite) are to be engaged in activities requiring LO/TO, employees/employers shall inform each other of their activities and coordinate their respective LO/TO procedures. Whenever a group lockout/tagout procedure must be performed, they shall utilize a procedure that affords the same level of protection as that provided by the implementation of a personal lockout or tagout device. Group LO/TO devices shall meet the requirements of 29 CFR 1910.145(f)(3).

Basic Lockout/Tagout Procedures

1. Each person will maintain their own lock, key, and lockout device so that no one else can remove the lock.
2. Always notify the operator when work is to be done.
3. Use your own lock to lock out electrical power. Attach a tag or sign to the power disconnect to indicate that maintenance work is in progress. Use the wording "Do Not Operate."
4. Bleed all pressure from pneumatic, hydraulic, or other fluid lines, or safely isolate them from the area where work is being done.
5. Drain contents of lines or tanks as needed. Lock valves open or closed to prevent buildup of pressure.
6. Ground electrical systems as needed.
7. Secure any device under tension or compression so as to prevent accidental movement. Move suspended parts that could drop or cycle to a safe position and block, clamp, or chain them in place.
8. Verify (test) that the mechanism had been isolated from the source of energy.
9. Ensure that all workers remove their individual locks after work is completed. The last worker should remove the locking devices.
10. Ensure that the last person double-checks that all is clear and safe before start-up.

Portable Equipment

Portable electrical equipment such as hand drills, computers, and power saws that use plug type connectors must be unplugged prior to any task that may expose the employee to energized portions of the equipment. Removal of the plug from the power source, such as the generator or wall socket, may be combined with a tagout system, particularly if the plug is at a distance from the equipment being repaired.

3.4.13 Confined Spaces

Entry into confined spaces will be conducted in strict accordance with 29 CFR 1910.146. Confined spaces will be evaluated prior to entry to determine if hazards are present that could pose a risk to entrants. Before workers may enter a permit-required confined space, a pre-entry checklist and entry permit must be completed by the PM or SSO, approved by the RSUM and, all requirements for entry must be met.

Confined spaces may be described as having, but not being limited to, the following characteristics:

- is large enough to permit an employee to enter and perform work; and
- has limited or restricted means of entry and exit; and
- is not equipped, designed, or intended for continuous human occupancy.

If there is any serious health and safety hazard present in the confined space is considered a permit-required confined space (permit space). A permit-space is a confined space that has one or more of the following characteristics:

- contains or has the potential to contain a hazardous atmosphere; or
- contains or has the potential to contain a material with the potential to engulf or entrap an employee; or
- is so configured that an employee may become trapped, disoriented, or asphyxiated by wall configurations or floors that taper to smaller cross sections; or
- contains any other established safety or health hazard (examples may include sources of energy, moving parts or thermal considerations).

All fluid, electrical, and steam lines and other sources of energy that could harm entrants must be completely isolated before entry. The following atmospheric conditions must be met before entry is permissible (air monitoring may be necessary to verify these conditions are met):

- flammable vapor or dust must be at a concentration less than 5 percent of the lower explosive limit (LEL); and
- oxygen must be at a concentration greater than 20 percent and less than 22 percent; and
- hydrogen sulfide concentration must be less than 5 parts per million (ppm); and
- toxic substances must be at a concentration less than their respective permissible exposure limits or specified action limits.

In addition, the following roles must be designated before entry into permit-required confined spaces is allowed: Entry Supervisor; Attendant; and Authorized Entrant(s). Confined space entry for each project also requires training for the project team on written operating procedures, including the use of the Confined Space Pre-Entry Checklist and Confined Space Entry Permit forms.

BC employees are ***not*** trained in rescue services. Such services are to be arranged locally, prior to entry operations, by the PM. Rescue services can typically be provided by the local fire department or contracted service provider.

3.4.14 Fire/Explosion

Site workers should have an increased awareness concerning fire and explosion hazards whenever working with or near flammable materials, especially when performing any activity that may generate sparks, flame, or other source of ignition. Intrinsically safe equipment is required when working in or near environments with the potential for an explosive or flammable atmosphere. The SSO will verify facility requirements for a "hot work" permit before activities that may serve as a source of ignition are conducted.

Flammable materials will be kept away from sources of ignition. In the event of fire, work will cease, the area will be evacuated, and the local fire response team will be notified immediately. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. A fully charged ABC dry chemical fire extinguisher will be readily available for use during all scheduled activities at the Site.

3.4.15 Sharp Objects/Cutting Utensils

Frequently field tasks require the cutting of items such as rope, packaging or containers. Care should be exercised in using knives and/or cutting implements while performing such cutting tasks. Personnel should cut down and away from their body and other personnel. The item being cut should be braced or secured from movement while cutting. When slicing open acetate liners, such as those utilized in direct push drilling, personnel should use a hook blade cutting implement designed for this task versus a straight blade knife.

3.4.16 Cutting Acetate Sample Sleeves

The cutting of acetate sleeves presents a potential hazard to sampling personnel. By following proper procedures, the risk associated with this activity can be effectively minimized. To remove the soil sample the acetate liner must be cut with a bladed tool or knife. Knives are more frequently the source of disabling injuries than any other hand tool. The principal hazard in the use of knives is the hand slipping from the handle onto the blade or the blade strikes another part of the body. To prevent this, the following safety procedures should be followed.

- Provide a safety blade holder with a retraction spring on a track where blade mounts. Use a hook type linoleum blade which has a reduced cutting edge. When the hook of the blade is cutting the acetate liner it keeps the blade extended. If the blade breaks or the operator's hand slips the blade automatically retractions into the handle of the safety blade holder.
- Replace blades when they become dull. If material becomes hard to cut the blade is dull.
- Wear leather cut-resistant (such as Kevlar) gloves.
- Wear safety glasses.

- The cutting stroke should be away from the body. If that is not possible, then the hands and body should be in the clear.
- Provide an angle iron device to place the liner in when cutting. This gives a holder for the liner.
- If you drop the knife just let it fall to the ground and DO NOT try to catch it.
- If you lay the knife down make sure the blade is retracted into the holder or the knife is placed in a protective holder.

3.4.17 Elevated Platforms

When working at heights that expose employees to falls greater than 6 feet, especially on sloping roofs and elevated platforms, the requirements of 29 CFR 1926.502 shall be observed. In such instances, a safety harness shall be worn and the lanyard secured at a level not lower than the employee's waist, limiting the free-fall distance to a maximum of 6 feet.

Elevated work platforms shall be constructed, used, and maintained in accordance with Subpart L of the OSHA Construction Safety Orders. Scaffolds and hoisting lines shall be inspected daily by a competent person to verify the integrity of the components. If a material is determined to be defective, it may not be used for any purpose and will be replaced immediately.

A standard railing shall consist of top rail, intermediate rail, toe board, and post. It shall have a vertical height of approximately 42 inches (±3 inches) from the top surface of the top rail to the floor, platform, runway, or ramp. The top rail shall have a smooth surface throughout. The intermediate rail shall be set half way between the top rail and the floor, platform, runway, or ramp.

A cover of standard strength and construction that is secured against accidental displacement shall guard floor holes, hatchways, or any other openings into which a person can walk. When the cover is not in place, the openings shall be guarded with a standard railing (equipped with a toe board) on all exposed sides. Any cover on floor openings shall be properly labeled or stenciled with letters at least one inch high or greater stating "OPENING – DO NOT REMOVE".

Personal Fall Protection Equipment

Full body harness is the only acceptable means of fall arrest for personnel working over surfaces greater than six feet in height. A Fall Arrest System consisting of safety harness and anchor lanyard must be worn by anyone working on elevated surfaces that lack "general" fall protection such as railings, etc.

Lanyards must be tied off at a point above the worker's head and to a firm structure or a portion thereof designed to hold a weight of 5,000 lbs. Only hooks with locking snaps that operate in "as new" condition will be used. These hooks are also referred to as "double action lanyard hooks".

When other possible means of fall protection (railings, etc.) are not available, individuals working at heights of less than 6 feet must tie-off if there is danger of impalement, especially if the impalement hazard cannot be mitigated in accordance with OSHA standards.

All workers must perform routine inspection of belts/harnesses and lanyards prior to their use. The employer shall conduct regular inspections (every three months) of all fall protection equipment. In addition, there shall be an inspection of all workers' personal tools and equipment prior to the employees using them on the job.

Lanyards are to be used for tie-off purposes only, and damaged belts, harnesses, and lanyards must be retired and discarded.

3.4.18 Ladder Use

Ladders are to be maintained in good condition at all times, with tight joints, hardware, and fittings securely attached, and moveable parts freely operating without binding or undo play. Defective ladders must be "tagged" out of service. Safety "feet" shall be kept in good condition. Ladders are to be visually inspected for possible signs of damage or defects daily, before each use.

Where possible, portable straight rung ladders shall be set up so that the horizontal distance from the top support to the foot of the ladder is ¼ of the working length of the ladder. The ladder shall be secured by tying it off to a firm point, or held in place by another worker while in use. If the ladder is used to gain access to a roof or platform, the side rails shall extend at least 3 feet beyond the point of support at the edge of the roof or platform.

Step ladders shall always be set up properly, so that they are in the "A" frame position, level and with all four feet on firm ground, and fully opened with the spreaders locked in place. Personnel are forbidden to stand on the top cap or on the last step of a step ladder, or to stand on the hinged back of a step ladder. A step ladder shall never be used at a straight ladder.

3.4.19 Traffic

Vehicular traffic presents opportunities for serious injury to persons or property. Traffic may consist of street traffic or motor vehicles operated by facility employees or visitors to the Site. Workers and other pedestrians are clearly at risk during periods of heavy traffic. Risk from motor vehicle operations may be minimized by good operating practices and alertness, and care on the part of workers and pedestrians.

Site personnel will wear high-visibility traffic safety vests whenever activities are conducted in areas of heavy traffic. Work vehicles will be arranged to be used as a barrier between site workers and nearby traffic. If required by local ordinances or site location, a traffic control plan will be developed implemented.

It is important to be conscious of all vehicular traffic that may be present during conduct of field operations. Use caution tape, barricades, or safety cones to denote the boundaries of the work area and to alert vehicle operators to the presence of operations which are non-routine to them. Be careful when exiting the work area and especially when walking out from between parked vehicles to avoid vehicular traffic.

Never turn your Back on Traffic. When working in or near a roadway, walk and work with your face to the oncoming traffic. If you must turn your back to traffic, have a coworker watch oncoming traffic for you.

Vehicle and Worksite Position. Whenever possible, place a vehicle between your worksite and oncoming traffic. Not only is the vehicle a large, visible warning sign, but if an oncoming car should fail to yield or deviate, the parked vehicle, rather than your body, would absorb the first impact of a crash. Turn the wheels so that if the vehicle were struck, it would swing away from the worksite. Even though the vehicle would protect you in a crash, it might be knocked several feet backward. Always leave some room between the rear of the vehicle and the work area.

Use of Signs and Cones to Direct Traffic. Traffic signs and cones are used to inform drivers and direct traffic away from and around you. Cones and signs are only effective if they give oncoming drivers enough time to react and make it clear how traffic should react.

Cone Positioning. The most common coning situation is setting a taper of cones that creates a visual barrier for oncoming motorists and gradually closes a lane.

The position of the taper depends on the road width, position and size of the work area, and also on the characteristics of the traffic.

3.4.20 Driving

A lot of driving is required to get to, from, and between project Sites. Safe vehicle maintenance and operation must be a priority. It requires knowledge of directions to (and conditions of) the Site in advance, careful exiting and merging into traffic, anticipating the unexpected, remaining alert to one's physical and mental condition, resisting distractions such as cell phone use, other car activities and contacting assistance when needed. Report all vehicle accidents/incidents to BC's Risk Manager.

3.4.21 Arc Flash Protection

An arc flash is a short circuit through the air when insulation or isolation between electrified conductors is breached or can no longer withstand the applied voltage, an arc flash occurs. Statistics show that there are 5 to 10 arc flash explosions a day near electrical equipment that result in hospitalization of a burn victim. An arc flash can be caused by common occurrences such as dropping tools, accidental contact with electrical systems, and build up of dirt or corrosion.

The temperature of an arc can reach more than 35,000 F as it creates a brilliant flash of light and a loud noise. Concentrated energy explodes outward from the electrical equipment, spreading hot gases, melting metal, causing death or severe burns, and creating pressure waves that can damage hearing or brain function and a flash that can damage eyesight. The fast-moving pressure wave also can send loose material such as pieces of equipment, metal tools, and other objects flying, injuring anyone standing nearby.

Regulations require the calculation of the "flash protection boundary" inside which qualified workers must be protected when working. This boundary is an imaginary sphere surrounding the

potential arc point, "within which a person could receive a second-degree burn if an electrical arc flash were to occur," according to the National Fire Protection Association (NFPA) 70E standard. Brown and Caldwell's Health and Safety Manual gives direction of when and where to establish this boundary.

BC's Electrical Safety/Arc Flash Policy provides information and instruction for BC employees who work on or near energized power circuits, electrical distribution equipment, electrical utilization equipment and those who inspect energized equipment, where a phase-to-ground or phase-to-phase short or fault occurrence may cause an Arc Flash event.

BC employees shall comply with BC Health and Safety Requirements Manual # 207 – Lockout/Tagout and treat electrical equipment and circuits as energized until:

1. Lock-Out / Tag-Out protection is in place and the equipment or circuit has been tested to verify "no voltage" present, by a trained and qualified electrical worker, or
2. The equipment or circuit has been physically isolated from every power source, tested, and clearly labeled.

For those BC employees involved with **energized electrical work** (i.e. design verification, equipment check-out, or start-up adjustments), the following ordered approach shall be used:

1. BC employees shall seek to have a trained and qualified electrical worker perform all energized electrical hands-on work (i.e. switching, metering, testing, etc.) while BC employees remain outside the flash protection boundary.
2. BC employees that closely supervise work within the flash protection boundary shall first receive approval from the Project Manager and Site Safety Officer (SSO).
3. Prior to performing this work, the Project Manager (PM) shall ensure that a Field Work Safety Plan (FWSP) is prepared and approved by the PM, the employee's manager, the SSO, and cognizant Health and Safety Manager.
4. Only "qualified BC employees" shall enter the flash protection boundary wearing the proper Personal Protective Equipment (PPE) and only for Hazard/Risk Categories 0-2 – see the 'Warning' section below. BC personnel shall acquire the proper PPE from the SSO and/or RSUM.

WARNING

Qualified BC personnel are limited to work in Hazard/Risk Categories 0-2, and therefore only require PPE meeting the requirements of Hazard/Risk Categories 0-2.

Only qualified electricians shall conduct work categorized as a Hazard/Risk Category of 3 or 4.

Qualified BC personnel are NOT to cross a flash protection boundary which involves a Hazard/Risk Category 3 or 4 situation.

BC employees and management shall review the **Health and Safety Manual #513 – Arc Flash** for detailed requirements.

Questions concerning this policy should be directed to the BC Office Electrical Engineering Manager and to the RSUM.

Definitions

Energized Electrical Work. Work performed on or near energized electrical systems or equipment with exposed components operating at 50volts or greater. Electrical system testing, thought to be de-energized, but not yet proven to be (for example, a LO/TO effectiveness check).

Flash Protection Boundary. The distance from energized exposed electrical equipment at which an unprotected person will receive a curable burn: 2nd degree burn or blistering. Work performed inside this boundary requires that the person be a "qualified person" and the use of Personal Protective Equipment (PPE) to protect against arc flash burns.

Newly installed/serviced electrical equipment may contain an Arc Flash Label that will identify the energy, hazard category and PPE requirements associated with the equipment. For all other unlabeled equipment, where the specific flash protection boundary (energy, hazard category, and applicable PPE) is not established or cannot be established first (prior to live electrical exposure), BC personnel shall maintain a 4-foot minimum observation distance (BC prefers 10 feet) from the exposed (i.e. doors open, covers off) live electrical equipment. In the event that the 4-foot minimum distance must be crossed, BC personnel shall don PPE appropriate for Hazard/Risk Category 2.

Qualified BC Employee. A person with the training and experience having knowledge of energized electrical equipment hazards from an operational standpoint and from the safety training standpoint.

Educational credentials alone do not make a person qualified. Determination of qualification shall be established by the employee's supervisor or other designated knowledgeable management representative.

3.4.22 Boating Safety

Boating or similar activities on aerated water treatment ponds and/or tanks by BC personnel is not permitted. The aeration process affects the buoyancy of the liquid and therefore boats can not consistently stay afloat.

Performing work activities from a boat can present unique hazards to employees. The following guidelines can help mitigate the risk. The boat can become unstable if the weight in it is excessive or loaded improperly. Too much weight will reduce maneuverability and freeboard (the height of the boat sides above the water) and can increase the risk of sinking.

When boarding the boat, the operator must be sure that the boat is secure. With one hand on the boat, each employee should quickly lower themselves straight down into the center of the boat. A United States Coast Guard (USCG) certified personal floatation device will be worn by each BC employee in the boat. In addition, other USCG-required items (i.e., throwable flotation device, retrieval line, etc.) will be present on the boat. To move around in a boat, one should step along the fore-and-aft centerline of the boat while the boat is held in place along the pier.

Do not board the boat while carrying equipment, rather first board the craft and then have someone hand in the equipment or place the equipment in the boat prior to launch The amount and location of weight is critical and can reduce the risk of capsizing. Weight should be kept towards the middle or centerline of the boat, both fore-and-aft and side-to-side, also the weight should be kept low to the bottom of the boat to reduce the center of gravity.

It is not anticipated that waves of substantial size will be encountered, however, if a wave approaches the boat, steer the bow towards the oncoming wave. Overloading the boat increases draw and the potential for swamping. Watercraft must be operated within the boat manufacturers weight limits.

Should the boat capsize, Brown and Caldwell personnel shall abandon the boat and return to shore as quickly as possible. It is important that the employees attempt to remove themselves from the water as soon as possible, and get inside and call for help. Hypothermia (cold stress) is a significant risk for anyone involved in a boating accident due to the rapid conduction of body heat by cold water. Wet or dry suits are recommended for cold weather/cold water (less than 45° F) operations.

3.4.23 Building Collapse

Buildings collapse for a variety of reasons. Natural phenomena such as earthquakes, hurricanes, floods, mudslides, avalanches, and storms are the usual cause for building collapses. Vacant buildings may be at risk for collapse since maintenance-related activities have been often neglected thus resulting in structural damage.

Project personnel should attempt to answer the following questions whenever working near suspect building structures.

- Are there any vacant buildings present on site?
- Will it be necessary to enter or work next to the vacant building(s)?
- Are there any apparent hazards including external damage, falling objects, sticky doors, structural instability, or possible asbestos and/or lead paint?
  - External damage may include, but not necessarily be limited to, foundation cracks, damaged or missing porch roofs and overhangs supports, gaps between steps and the structure, missing supports or portions of walls, and "washed away" ground.
  - Falling objects may include, but not necessarily be limited to, building cornices, gutters, bricks, and roofs/roofing materials.
- Be aware that when entering a building, if the door sticks at the top it could mean the ceiling is ready to fall. If you force the door open, stand outside the doorway clear of falling debris.
- Has the building(s) been inspected by a qualified professional and deemed safe for entry?
- Are there any viable alternatives for conducting work that preclude the need to enter or work next to the suspect building(s)?

If you have any concerns about entering the building after answering the above questions, speak with the PM immediately. The client will need to be informed that a proper building inspection or engineering controls may be needed before work can be performed.

If you don't feel safe entering a building, then notify the PM and RSUM and stay outside the building at an appropriate distance to avoid falling debris.

3.4.24 Personal Safety - Urban Setting

Working in a distressed neighborhood may present hazards associated with street violence or other crime. In these situations, mental preparation before going to the Site and awareness while on Site are of key importance. If in doubt, always ask Site or client personnel about the safety of a neighborhood. Forethought should be given to arranging to work during daylight hours if possible. Take advantage of any Site security measures (monitoring cameras, security guards) and investigate such measures prior to the field work. Once in the field, work in parties of two or more and stay within view of the general public. Keep a charged cell phone nearby or on your person at all times. Become familiar with your location so you can effectively communicate it over the phone.

In addition to these basic principals, the following is a list of common personal safety rules that apply not only to work at the Site, but to general safety practices while in the field and also between work shifts.

- If at all possible, work/travel in groups. Do not venture out alone.
- Be alert. Notice who passes you and who's behind you. Maintain distance between yourself and strangers. Know where you are, and note potential exit paths.
- If work has paused do not appear slack or distracted. Do not sit in a vehicle with the doors unlocked.
- Walk in well-lighted areas. Don't walk close to bushes, alleys, and so on. In dark or deserted neighborhoods, walk down the middle of the street (be alert to vehicle traffic).
- If a car pulls up slowly, or the occupants of the vehicle bother you, cross the street and walk or run in the other direction. If you are pursued, dial 911.
- If you feel someone is following you, turn around and check. Proceed to the nearest lighted house or place of business.
- Don't overburden yourself with bags or packages, which might impede running or taking care of yourself.
- Be aware of loose clothing, packs/purses and hair. These give an assailant an easier method of grabbing and controlling you. Wear unrestrictive clothing for ease of movement (but not overly loose).
- Carry a non-weapon personal safety device (such as a whistle, panic button, or key light) - anything that could visually or audibly draw attention to your location.
- What you carry in your hand(s) is important. Valuables make you a potential target. Items such as a hand auger or tool may help you be perceived as a less-than-inviting victim.
- Carry as little cash as possible.

- Hold your purse tightly, close to your body. Keep your wallet in a front or in a buttoned, hip pocket. When at a fixed location, lock your valuable items away and out of site (i.e., in a trunk).
- Be careful when people stop you for directions or information. Always reply from a distance; never get too close to a stranger' car.
- If you feel that you are in danger, don't be afraid to scream and run.
  - Toss wallet/keys away from direction of escape.
  - Don't attach car keys to house keys.
  - Leave large valuables (purse, laptop) locked and hidden in the vehicle.

3.4.25 Drowning Hazards – Wading Activities

Personnel may not perform work activities in or near water without an observer in attendance. The minimum required protection during wading activities for this project a TYPE III personal flotation device (PFD), or flotation aid. This type of PFD is similar to a jacket in style and is designed so that wearers can put themselves in a face-up position in the water. The wearer may have to tilt their head back to avoid turning face down. TYPE III has the same minimum buoyancy as a TYPE II PFD. Float coats, fishing vests, and vests designed for various water sports are examples. TYPE II PFD, a near-shore buoyant vest, is shaped like an upside down "U" with an open back. This type will turn some unconscious wearers to a face-up position. An adult size provides at least 15.5 pounds buoyancy while a medium child size provides 11 pounds.

A TYPE IV PFD, or throwable device, is intended for use in areas where help is always present. It is designed to be thrown to a person in the water and grasped and held by the user until rescued. It is not designed to be worn. Type IV devices include buoyant cushions, ring buoys, and horseshoe buoys. Ring buoys will be available in the truck and accessible by support personnel to address the hazard of slips, trips and/or falls that may occur.

3.5 Natural Phenomena

Natural phenomena such as weather-related emergencies and acts of nature can affect employees' safety. Natural phenomena can occur with little or no warning. If an emergency situation arises as a result of natural phenomena, adhere to the contingency procedures outlined in Section 10. The following natural phenomena have been identified and may be encountered during scheduled field activities.

☒ Sunburn	☒ Heat Stress
☒ Cold Stress	☒ Lightening/Electrical Storms
☐ Hurricanes	☐ Tornados and Strong/Straight Line Winds
☐ Earthquakes	

3.5.1 Sunburn

Working outdoors with the skin unprotected for extended periods of time can cause sunburn to the skin. Excessive exposure to sunlight is associated with the development of skin cancer. Field staff should take precautions to prevent sunburn by using sunscreen lotion and/or wearing hats and long-sleeved garments.

3.5.2 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Heat-related illnesses range from heat fatigue to heat stroke, with heat stroke being the most serious condition. The effects of ambient temperature can cause physical discomfort, loss of efficiency, and personal injury, and can increase the probability of accidents. In particular, protective clothing that decreases the body's ventilation can be an important factor leading to heat-related illnesses.

To reduce the potential for heat-related illness, workers should drink adequate water to stay properly hydrated, establish a work schedule that will provide sufficient rest periods for cooling down, and have access to adequate shade (which includes resting inside a vehicle with the air conditioner running). Personnel shall maintain an adequate supply of non-caffeinated drinking fluids on site for personal hydration – a minimum of one quart of water per employee per hour. Workers should be trained and aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions. These are summarized in the table below.

Condition	Signs	Symptoms	Response
Heat Rash or Prickly Heat	Red rash on skin.	Intense itching and inflammation.	Increase fluid intake and observe affected worker.
Heat Cramps	Heavy sweating, lack of muscle coordination.	Muscle spasms, and pain in hands, feet, or abdomen.	Increase fluid uptake and rest periods. Closely observe affected worker for more serious symptoms.
Heat Exhaustion	Heavy sweating; pale, cool, moist skin; lack of coordination; fainting.	Weakness, headache, dizziness, nausea.	Remove worker to a cool, shady area. Administer fluids and allow worker to rest until fully recovered. Increase rest periods and closely observe worker for additional signs of heat exhaustion. If symptoms of heat exhaustion recur, treat as above and release worker from the day's activities after he/she has fully recovered.
Heat Stroke	Red, hot, dry skin; disorientation; unconsciousness	Lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse.	Immediately contact emergency medical services by dialing emergency medical services. Remove the victim to a cool, shady location and observe for signs of shock. Attempt to comfort and cool the victim by administering small amounts of cool water (if conscious), loosening clothing, and placing cool compresses at locations where major arteries occur close to the body's surface (neck, underarms, and groin areas). Carefully follow instructions given by emergency medical services until help arrives.

3.5.3 Cold Stress

Workers performing activities during winter and spring months may encounter extremely cold temperatures, as well as conditions of snow and ice, making activities in the field difficult. Adequate cold weather gear, especially head and foot wear, is required under these conditions. Workers should be aware of signs and symptoms of hypothermia and frostbite, as well as first aid for these conditions. These are summarized in the table below.

Condition	Signs	Symptoms	Response
Hypothermia	Confusion, slurred speech, slow movement.	Sleepiness, confusion, warm feeling.	Remove subject to a non-exposed, warm area, such as truck cab; give warm fluids; warm body core; remove outer and wet clothing and wrap torso in blankets with hot water bottle or other heat source. Get medical attention immediately.
Frostbite	Reddish area on skin, frozen skin.	Numbness or lack of feeling on exposed skin.	Place affected extremity in warm, not hot, water, or wrap in warm towels. Get medical attention.
Trench Foot	Swelling and/or blisters of the feet	Tingling/itching sensation; burning; pain in the feet	Remove wet/constrictive clothing and shoes. Gently dry and warm feet with slight elevation. Seek medical attention.

3.5.4 Lightning/Electrical Storms

Lightning can be unpredictable and may strike many miles in front of, or behind, a thunderstorm. Workers will therefore cease field operations at the **first** sign of a thunderstorm and suspend activities until at least 30 minutes after the last observed occurrence of lightning or thunder. For purposes of this HASP, signs of a thunderstorm will include any visible lightning or audible thunder.

In the event of a thunderstorm, field personnel will take the following actions.

- Get inside a permanent building structure (not a shed or canopy) or fully enclosed metal vehicle (not a convertible or camper shell) with the windows fully up.
- If in a house or building, do not use the telephone or any electrical appliance that's connected to the building's electrical wiring.
- Stay away from tall isolated objects, such as trees, drill rigs, telephone poles, or flag poles.
- Avoid large open areas, such as fields or parking lots, where a person is the relatively highest object.
- Stay away from lakes, ponds, railroad tracks, fences, and other objects that could transmit current from a distant lightning strike.
- If caught out in the open without time to escape or find shelter, seek a low area (if time permits), crouch down, and bend forward holding the ankles. Tuck the head so that it's not the highest part of the body, without letting it touch the ground. Under no circumstances lay down.

If a person struck by lightning contact emergency medical services, even if he/she appears only stunned or otherwise unhurt as medical attention may still be needed. Check for burns, especially at fingers and toes, and areas next to buckles and jewelry.

3.5.5 Hurricanes

The key to responding to hurricane conditions is being informed. Before taking to the roads to leave for or from a jobsite during suspect hurricane conditions, listen to the radio for current and forecast conditions. Know what the weather reports mean by "watch" and "warning." A hurricane watch means hurricane conditions are possible in the specified area of the watch, usually within 36 hours. A hurricane warning indicates hurricane conditions are expected in the specified area of the warning, usually within 24 hours.

If watch or warning conditions exist, employees will communicate with the project manager to determine the appropriate course of action. Travel to or from work is not recommended if the employee will travel in the vicinity of a hurricane warning area. Restrictions on travel during hurricane watches are largely dependent on the actual weather conditions at the time. Employees are discouraged from driving during weather conditions where visibility and vehicle control are severely limited.

For long term projects with temporary or permanent office area, keep an emergency preparedness kit consisting of, but not limited to:

- Current project/office contacts list - how to reach folks in an emergency ,
- Blankets,
- Flashlights,
- Radio (operated by batteries),
- Batteries for flashlight and radio (note: batteries should be replaced annually to assure freshness) ,
- Water (unless there is a water bubbler that can be used with no electricity), and
- Snack crackers, dried fruit, etc. - a source of food that won't go bad.

3.5.6 Tornados and Strong/Straight Line Winds

Tornados and strong or straight line winds are potentially dangerous weather conditions because both have the ability to generate on very short notice (in some cases under one hour from clear weather conditions). Tornados and strong or straight line winds both have the same warning properties and recommendations. If a tornado "watch" is issued for your area, it means that a tornado is "possible". If a tornado "warning" is issued, it means that a tornado has actually been spotted, or is strongly indicated on radar, and it is time to go to a safe shelter immediately.

Be alert to what is happening outside, but do not place yourself in jeopardy by standing next to windows. Some common observations during a tornado include: a sickly greenish or greenish-black color to the sky; if there is a watch or warning announced or posted; an abrupt fall of hail (however, hail can occur in the absence of a tornado); a strange quiet that occurs within or shortly after a thunderstorm; clouds moving by very fast, especially in a rotating pattern or converging toward one

area of the sky; a sound like a waterfall or rushing air at first, but turning into a roar as it comes closer (the sound of a tornado has been likened to that of both railroad trains and jets); debris dropping from the sky; an obvious "funnel-shaped" cloud that is rotating; or debris such as branches or leaves being pulled upwards, even if no funnel cloud is visible.

During a tornado warning or tornado occurrence, each employee is instructed to do the following:

- Proceed to interior rooms and halls on the lowest floor ***(do not use an elevator to exit an upper floor)***. Avoid halls that open to the outside in any direction. If there are no interior hallways, avoid those that open to the southwest, south, or west, since that is usually the direction from which the tornado will come.
- Stay away from glass, both windows and doors. Crouch down, and make as small a "target" as possible. If you have something with which to cover your head, do so, otherwise, use your hands.
- Exercise extreme caution when leaving your area of shelter. Be aware of potential hazards (i.e., natural gas smell, smoke, fire). In the event these hazards are encountered in your area of shelter, immediately evacuate the shelter. If the building/shelter has been damaged by a tornado, do not flush the toilets, as the sewer lines may have been damaged.
- If you are traveling in an automobile and can see a tornado, do not stay in your car and try to outrun a tornado. If possible, stop the car and enter the nearest business and seek shelter.
- If you are outside and it is not possible to get inside, seek a low lying ditch, culvert, etc. and keep your body as low to the ground and as braced as possible.

3.5.7 Earthquakes

Earthquakes strike suddenly, violently, and without warning. If your project is located near a fault line, earthquakes are an unpredictable possibility. For long-term projects with temporary or permanent office area, keep an emergency preparedness kit consisting of, but not limited to:

- Current project/office contacts list - how to reach folks in an emergency,
- Blankets,
- Flashlights,
- Radio (operated by batteries),
- Batteries for flashlight and radio (note: batteries should be replaced as needed to assure freshness),
- Water (unless there is a water bubbler that can be used with no electricity), and
- Snack crackers, dried fruit, etc. - a source of food that won't go bad.

This kit is meant to serve as overnight survival in the event that it becomes unsafe to leave the project site. The kit's contents should be suited to meet the size and needs of your project.

If you feel the earth shaking, consider the following tips:

- Drop down; take cover under a desk or table and hold on.
- Stay indoors until the shaking stops and you are sure it is safe to exit.
- Stay away from bookcases, shelves, or anything that could fall on you.
- Stay away from windows.
- If inside a building, expect fire alarms and sprinklers to go off during the quake.
- If you are outdoors, find a clear spot away from buildings, trees, and power lines. Drop to the ground and cover your head.

If you are in a car, slow down and drive to a clear place, preferably away from power lines. Stay in the car until the shaking stops.

3.6 Biological Hazards

The following biological hazards have been identified and may be encountered during scheduled field activities.

☐ Bloodborne Pathogens/Sanitary Waste	☒ Rodents and Mammals
☒ Reptiles/Snakes	☒ Venomous Insects
☒ Mosquitoes	☐ Fire Ants
☒ Spiders/Scorpions	☒ Ticks
☒ Poisonous Plants	

If any biological hazards are identified at the Site, workers in the area will immediately notify the SSO and nearby personnel.

3.6.1 Bloodborne Pathogens/Sanitary Waste

Potential exposure to bloodborne pathogens may occur during some work activities (e.g., sewer video surveys or source sampling), rendering first aid or CPR. Direct contact is an important route of exposure for bloodborne pathogens due to puncture injuries, contact with abraded skin, or contact with areas such as the eyes, without appropriate protection. While very few organisms can enter the body through normal intact skin, direct contact with sewage, blood and body fluids is to be avoided. Site personnel should thoroughly wash their hands and face before eating, drinking or smoking and before leaving the work site.

Exposure controls and Universal Precautions are required at suspect locations, in order to prevent contact with blood or other potentially infectious materials as specified in Brown and Caldwell's *Bloodborne Pathogens Program*. All blood or other potentially infectious material will be considered infectious regardless of the perceived status of the source individual. A Hepatitis B vaccination will be

offered to BC personnel before the person participates in a task where direct exposure to potentially infectious materials is a possibility (i.e., first aid or CPR). For personnel who have potential exposure to sanitary wastes, a current tetanus/diphtheria inoculation or booster is recommended.

3.6.2 Rodents/Mammals

Animals may potentially carry the rabies virus or disease causing agents. Do not attempt to feed or touch animals. Feces from some small mammals may contain diseases such as Hanta Virus. Avoid generating dust in the vicinity of rodent feces. In addition, animals such as dogs or wild predators (i.e., cougars or coyotes) may pose an attack hazard. Persons should slowly back away in a non-threatening manner if an encounter with a threatening animal occurs. In order to avoid such encounters, use the buddy system and make noise when working in areas where such animals may be present.

3.6.3 Reptiles/Snakes

The primary reptiles of concern are venomous snakes (rattlesnake, water moccasin, and copperhead). Avoid contact and areas that may harbor snake populations including high grass, shrubs, and crevices. In the event of a bite, immobilize the affected area and contact emergency medical services. If more than 30 minutes from emergency care, apply bandage wrap two to four inches above the bite (**note**: bandage should be loose enough to slip your finger underneath).

Wear shoes and heavy pants when walking and hiking in areas where snakes are likely found. Do not reach into rocky cracks, under logs, or large rocks. Even if a snake looks dead, do not touch it. A snake can still bite up to one hour after its death. Do not get near or tease a snake. Snakes are shy creatures and generally will not attack unless bothered.

Diamond Back Rattle Snake

Diamond backs are large snakes. They have a row of dark diamonds down the back and a rattle on their tail. These snakes have cat-like eyes and a pit between their nostril and eye. Eastern diamond backs like pine flat woods and scrub areas where palmetto thickets and gopher tortoise burrows are found. These snakes travel during the day and hide at night.

Timber Rattle Snake

Timber rattle snakes have a reddish-brown stripe running down the center of their back and black crossbands. Their tails are solid black with a rattle. These snakes have cat-like eyes and a pit between their nostril and eye. Timber rattlers live in damp river beds, pine flat woods, swamps, and cane thickets.

Pygmy Rattle Snake

These small snakes are light to dark grey in color. They have a tiny rattle. Pygmy rattle snakes have cat-like eyes and a pit between their nostril and eye. These snakes are found in lowland pine flat woods, prairies, around lakes, ponds, and swamps. Pygmy rattlers are aggressive and will strike anything within striking range.

Cottonmouth (Water Moccasin)

Young cottonmouths are often mistaken for copperheads because of their reddish-brown crossbands. As these snakes age, their cross bands darken until they become almost solid black. Cottonmouths live near water sources like lakes, streams, rivers, ponds, and swamps. When threatened, cottonmouths may coil and open their mouths as though ready to bite. The white inside of the mouth is what gives this snake its name, "cottonmouth".

Copperhead

Copperheads have dark coppery red-brown hourglass crossbands on a lighter brown color. The top of the head is covered with large plate-like scales. Copperheads have cat-like eyes and a pit between their nostril and eye. These snakes live in rocky, wooded areas and low, wet swampy areas. Copperheads are sluggish and rarely bite, unless stepped on or touched.

Coral Snake

The body of this snake is ringed with black, yellow and red bands. (Remember: Red on yellow can kill a fellow. Red on black, venom lack.) The head of a coral snake is black, while the tail is black and yellow.

3.6.4 Venomous Insects

Common examples include bees, fire ants and wasps. Avoid contact with insects and their hives. If stung, remove the stinger by gently scraping it out of the skin (do not use tweezers). If the worker is stung by an insect, immediately apply an ice pack to the affected area and wash area with soap and water and apply antiseptic. If an allergic reaction occurs, contact emergency medical services for appropriate treatment. Seek medical attention immediately if you are allergic to venomous stings such as bees or if anaphylaxis symptoms are present.

3.6.5 Mosquitoes

Mosquitoes may transmit diseases such as West Nile Virus. Symptoms of West Nile Virus include: fever, headache, tiredness, body aches, and occasional rash. Avoid mosquito bites by wearing long sleeved shirt and long pants. Apply insect repellent to clothes and/or skin (if FDA approved for topical use). Report any dead birds in the area to local health officials. Mosquitoes are most active from dusk to dawn.

3.6.6 Fire Ants

Red and Black Fire Ants are capable of inflecting numerous stings (7 to 9) per ant in a matter of seconds, and large numbers of fire ants will typically attack at the same time. Fire ants are very aggressive and will sting simply upon coming in contact with skin. Individuals who are allergic to bees should carry bee sting kits when there is the potential to come in contact with fire ants. Fire ants are predominantly located in the southern United States.

The best way to avoid fire ants is to avoid disturbing their mounds. Fire ant mounds are typically constructed in disturbed habitats such as open fields, along roadsides, lawns, and many other open sunny areas. The mounds are constructed of dirt and/or other organic materials. Mounds are typically 10" to 24" in diameter and approximately 18" in height. If you disturb a mound, get away from the mound immediately.

Fire ant stings typically leave tiny red blisters and sometimes white pustules. Symptoms of stings include blistering, burning, swelling, pain, and irritation of the affected area. Recommended treatment consists of antihistamines along with topical antibiotic cream. Anaphylaxis symptoms such as shortness of breath, discomfort, lowered heart rate, etc. may also accompany fire ant stings. Seek medical attention immediately if you are allergic to venomous stings such as bees or if anaphylaxis symptoms are present.

3.6.7 Spiders/Scorpions

The black widow and brown recluse spiders are the most venomous. Avoid contact with spiders and scorpions and areas where they may hide. They favor dark hiding places. Inspect clothing and shoes before getting dressed. Wear gloves and safety shoes when working with lumbar, rocks, inspecting buildings, etc. Signs and symptoms of bites include: headache, cramping pain/muscle rigidity, rash and/or itching, nausea, dizziness, vomiting, weakness or paralysis, and convulsions or shock. Wash bite area with soap and water and apply antibiotic cream. Contact emergency medical services if allergic reaction or severe symptoms occur.

3.6.8 Ticks

Deer ticks may carry and transmit Lyme disease to humans. Signs of Lyme disease include a reddish "bulls-eye" around the affected area approximately a week after the bite. Symptoms include headache, fever, and muscle/joint pain. Persons suspecting infection should contact a health professional. Whenever possible avoid areas likely to be infested with ticks during the spring and summer months.

Wear light-colored clothing so ticks can be easily spotted and removed. Wear long sleeves and pants and tuck pant legs into boots or socks. Apply insect repellents to clothing and skin (if FDA approved for topical application). Persons with long hair should tie their hair back to minimize the potential for ticks to nestle in the scalp.

Personnel should self perform tick checks once daily field work is completed. If a tick is embedded in the skin, use tweezers to grasp the tick's head (near the skin) and pull straight out. Consider saving the removed tick for laboratory analysis.

3.6.9 Poisonous Plants

Common examples include poison ivy, poison oak and poison sumac. Avoid contact. Long-sleeved shirts and pants will allow some protection against inadvertent contact. If contact occurs, immediately wash the affected area thoroughly with soap and water. If an allergic reaction occurs, seek the care of a medical professional.

Poison Ivy is a trailing or climbing woody vine or a shrub-like plant with leaves that are each divided into three broad, pointed leaflets. The leaflets are commonly dark glossy green on top and slightly hairy underneath. They produce small yellowish or greenish flowers followed by berry-like drupes.

Poison Oak is a member of the same family as poison ivy and has a very similar appearance. Poison oak has leaves divided into three leaflets and generally has three to seven distinct lobes. Typically they are a shrubby type plant that can grow to eight feet in height, or sometimes can be a climbing plant.

The best way to prevent exposure is the ability to recognize these plants. Conduct an initial survey of the area to determine if the plants are present in the work area, and avoid contact with them.

If plants are located and work must be conducted in that area, have the plants removed if possible. If this is not possible, wear long sleeved shirts, gloves, and a heavy material type pants. Remember not to touch contaminated clothing. There are products available that can be applied to exposed skin, (similar to sunscreen products) prior to working around the plants. Tyvek suits may be another option used at the wearer's discretion to keep poisonous plant oils from getting on clothing. Please note that using Tyvek suits may increase the risk of heat stress conditions so extra precautions should be taken such as more frequent breaks and drinking plenty of fluids.

4. PERSONAL PROTECTIVE EQUIPMENT

The purpose of PPE is to protect employees from hazards and potential hazards they are likely to encounter during site activities. The amount and type of PPE used will be based on the nature of the hazard encountered of anticipated. Respiratory protection will be utilized when an airborne hazard has been identified using real-time air monitoring devices, or as a precautionary measure in areas designated by the RSUM or SSO.

Dermal protection, primarily in the form of chemical-resistant gloves and coveralls, will be worn whenever contact with chemically affected materials (e.g., soil, groundwater, sludge) is anticipated, without regard to the level of respiratory protection required.

On the basis of the hazards identified for this project, the following levels of personal protective equipment (PPE) will be required and used. Changes to the specified levels of PPE will not be made without the approval of the SSO after consultation with the RSUM.

4.1 Conditions Requiring Level D Protection

In general, site activities will commence in Level D PPE unless otherwise specified, or if the SSO determines on site that a higher level of PPE is required. Air monitoring of employee breathing zones will be routinely conducted using real-time air monitoring devices to determine if upgrading to Level C PPE is necessary. Level D PPE will be permitted as long as air monitoring data indicate that airborne concentrations of chemicals of concern are maintained below the site-specific action levels defined in Section 5.2. Level A or B PPE is not anticipated and is therefore not addressed in this plan. If Level A or B PPE is necessary, this HASP will be revised to reflect changes as appropriate.

It is important to note that dermal protection is required whenever contact with chemically-affected materials is anticipated. The following equipment is specified as the minimum PPE required to conduct activities at the Site:

- Work shirt and long pants,
- ANSI- or ASTM-approved steel-toed boots or safety shoes,
- ANSI-approved safety glasses, and
- ANSI-approved hard hat.

Other personal protection readily available for use, if necessary, includes the following items.

- Outer nitrile gloves (11 mil or thicker) and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event).
- Chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected soils or groundwater is anticipated.
- Full-body coveralls (e.g., Tyvek) sealed at the ankles when working in areas where ticks have been identified as a hazard.
- Safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected soils is anticipated.
- Hearing protection.
- Sturdy work gloves.
- High-visibility traffic safety vest.
- Type III personal floatation device (activities in or near water; i.e., wading)
- Full-faceshield (equipment decontamination)

Work will cease and PPE upgraded if action levels specified in Section 5.2 are exceeded. The RSUM will be notified whenever PPE is upgraded or downgraded.

4.2 Conditions Requiring Level C Protection

Note: Upgrade to Level C is allowed on this project with the exception of Cyanide. If cyanide is measured via colorimetric tube, or direct-reading instrument, to be above 2.5 ppm, then work stoppage will occur.

If air monitoring indicates that the site-specific action levels defined in Section 5.2 are exceeded, workers in the affected area(s) will upgrade PPE to Level C. In addition to the protective equipment specified for Level D, Level C also includes the following items.

- NIOSH-approved half- or full-face air-purifying respirator (APR) equipped with appropriate cartridges (reference Section 5.2). Note: safety glasses are not required when wearing a full-face APR.

Respirators will be stored in clean containers (i.e., self-sealing bag) when not in use. Respirator cartridges will be replaced in accordance with the following change-out schedule.

Type of Cartridge	Cartridge Change-out Schedule
Particulate (i.e., HEPA)	At least weekly or sooner the if employee detects an increase in breathing resistance. This will occur as the filter becomes loaded with particulate matter.
Sorbent (i.e., organic vapor)	At the end of each day's use or sooner if the employee detects an abnormal odor or other indicator.

Personnel who wear air-purifying respirators must be trained in their use and must have successfully passed either a qualitative or quantitative respirator fit test, and medical evaluation within the last 12 months in accordance with and 29 CFR 1910.134.

4.3 Stop Work Conditions

If air monitoring indicates that the site-specific action levels defined in Section 5.2 are exceeded, activities will cease, and personnel must evacuate the designated Exclusion Zone. The PM and RSUM will be contacted immediately.

Work will also cease if unanticipated conditions or materials are encountered or if an imminent danger is identified. The SSO will immediately contact the RSUM for consultation.

5. AIR MONITORING PLAN

Real-time air monitoring devices will be used to analyze airborne contaminant concentrations approximately every 15 minutes in the workers' breathing zones while workers are in the designated Exclusion Zone, or when task or exposure conditions change (whichever frequency is less). If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate.

Background concentrations will be determined at the beginning of each work shift by collecting several instrument readings upwind of the scheduled activities. Alternatively, background levels can be determined by collecting readings from a nearby (upwind) area that can reasonably be considered unaffected by Site activities.

Real-time measurements will be made as near as feasible to the breathing zone of the worker with the greatest exposure potential in each active work area. If authorized by the RSUM, real time measurements may cease being taken when enough historical data is generated to warrant its cessation. Air monitoring will be reinstated if potential exposure conditions change.

The equipment will be calibrated daily, and the results will be recorded on BC's Air Monitoring Form. The results of air monitoring will also be recorded on the Air Monitoring Form and will be retained in the project files following completion of field activities. A copy of the Air Monitoring Form is located in Appendix A.

5.1 Monitoring Instruments

5.1.1 Photoionization Detector and Flame Ionization Detector

On-site worker exposure to airborne contaminants will be monitored during intrusive site activities. A calibrated photoionization detector (PID) with a lamp strength of 10.6 eV or flame ionization detector (FID) will be used to monitor changes in personnel exposure to volatile organic compounds (VOCs). The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of VOCs in employee breathing zones. If VOCs are detected above predetermined action levels specified in Section 5.2, the procedures found in Section 4 of this HASP will be followed.

5.1.2 Real-Time Aerosol Monitor

On-site worker exposure to airborne contaminants will be monitored during intrusive site activities. A miniature real-time aerosol monitor (mini-RAM or equivalent) will be used to monitor exposure to airborne dusts. The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of airborne dusts in employee breathing zones. If airborne dusts are detected above predetermined action levels specified in Section 5.2, the procedures found in Section 4 of this HASP will be followed.

5.1.3 Colorimetric Tubes

A hand-held Draeger pump along with Cyanide 2/a colorimetric Draeger tubes will be used to monitor changes in exposure to cyanide during intrusive site activities. Alternatively, a real-time cyanide detector (i.e., Draeger Pac III) may be used. The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of cyanide in employee breathing zones. If cyanide is detected above predetermined action levels specified in Section 5.2, the procedures found in Section 4 of this HASP will be followed.

In addition, Draeger tubes will be used to monitor for the presence of benzene per the action levels specified in the tables below.

5.1.4 Combustible Gas and Hydrogen Sulfide Gas Monitoring

A multi-gas detector will be used to monitor changes in levels/exposure to combustible gases (lower explosive limit; LEL) and hydrogen sulfide gas during intrusive site activities. The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of target compound in the vicinity of boreholes, test pits, sewers, or elsewhere, as necessary. If target compounds are detected above predetermined action levels specified below, work will cease and the Regional Safety Unit Manager will be contacted immediately.

5.2 Site Specific Action Levels

The following action levels were developed for exposure monitoring with real-time air monitoring instruments. Air monitoring data will determine the required respiratory protection levels at the Site during scheduled intrusive activities. The action levels are based on sustained readings indicated by the instrument(s). Air monitoring will be performed and recorded at up to 15-minute intervals.

If elevated concentrations in the breathing zone are indicated, the monitoring frequency will be increased, as appropriate. If during this time, sustained measurements are observed in the breathing zone, the following actions will be instituted, and the PM and RSUM will be notified. For purposes of this HASP, sustained readings are defined as the average airborne concentration maintained for a period of one (1) minute above established background levels.

5.2.1 Action Levels for VOCs

Drager tubes will be used to determine the presence or absence of benzene when PID/FID readings exceed 1 ppm.

Activity	Action Level	Level of Respiratory Protection
Soil-intrusive activities, including groundwater monitoring	< 5 ppm above background (**no benzene indicated**)	Level D: No respiratory protection required. **Note**: For PID/FID values above 1 ppm, benzene is to be analyzed for with a colorimetric tube.
	5 to 25 ppm above background (**no benzene indicated**) or **Benzene indicated** < 1.0 ppm (colorimetric tube)	Level C: Half-or full-face air-purifying respirator fitted with organic vapor/HEPA filter cartridges. **Note**: For PID/FID values above 1 ppm, benzene is to be analyzed for with a colorimetric tube. **Contact RSUM prior to respirator upgrade.**
	> 25 ppm above background (**no benzene indicated**) or **Benzene indicated** > 1.0 ppm (colorimetric tube)	Cease operations and evacuate work area. Contact Director and PM immediately.

5.2.2 Action Levels for Airborne Dust

Activity	Action Level	Level of Respiratory Protection
Soil-intrusive activities	< 0.5 mg/m^3 above background	Level D: No respiratory protection required.
	0.5 to 2.5 mg/m^3 above background	Level C: Half-or full-face air-purifying respirator fitted with organic vapor/HEPA filter cartridges. **Increase engineering controls.** **Contact RSUM prior to respirator upgrade.**
	> 2.5 mg/m^3 above background	Cease operations and evacuate work area. Contact Director and PM immediately.

5.2.3 Action Levels for Cyanide

Activity	Action Level	Level of Respiratory Protection
Soil-intrusive activities	< 2.5 ppm	Level D: No respiratory protection required.
	≥ 2.5 ppm	Cease operations and evacuate work area. Contact Director and PM immediately.

5.2.4 Action Levels for Hydrogen Sulfide and LEL

Activity	Action Level	Level of Respiratory Protection
Not anticipated for this project	< 5 ppm H_2S < 5% LEL	Level D: No respiratory protection required.
	≥ 5 ppm H_2S ≥ 5% LEL	Cease operations and evacuate work area. Contact Director and PM immediately.

5.3 Community Air Monitoring Plan

Community air monitoring will be performed in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan, included in Appendix F. Air monitoring readings will be recorded in a logbook and will be available for review by the NYSDEC and NYSDOH. Real-time air monitoring will be conducted during work activities for VOCs and particulates (i.e., dust). Air monitoring will be performed continuously for all ground intrusive activities.

The Community Air Monitoring Plan (CAMP) is not intended for use in establishing action levels for worker respiratory protection.

5.3.1 CAMP VOC Action Levels

Based on monitoring at the downwind perimeter of the Exclusion Zone, the following action levels for VOCs are in accordance with the NYSDOH Generic Community Air Monitoring Plan:

Action Level at Downwind Perimeter of Exclusion Zone	Response
Below 5 ppm above background for the 15-minute average	Continue and/or resume work activities
> 5 ppm above background for the 15-minute average	Temporarily halt work and continue monitoring
5 to < 25 ppm	Work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions and continue monitoring
> 25 ppm	Cease operations. Contact PM and BC Director of Health and Safety or designee immediately.

Upwind concentrations will be measured periodically to establish background concentrations.

The NYSDOH CAMP is provided in Appendix F for additional details associated with work stoppage and restart.

5.3.2 CAMP Particulate Action Levels

Based on monitoring at the downwind perimeter of the Exclusion Zone, the following action levels for particulates are in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan:

Action Level at Downwind Perimeter of Exclusion Zone	Response
> 0.1 mg/m^3 above background for the 15-minute average or if airborne dust is observed leaving the work area	Employ dust suppression techniques

Action Level at Downwind Perimeter of Exclusion Zone	Response
0.1 to 0.15 mg/m^3	Work may continue with dust suppression techniques provided downwind PM-10 particulate levels do not exceed 0.15 mg/m^3 above background for the 15-minute average and airborne dust is not observed leaving the work area
> 0.15 mg/m^3 with dust suppression techniques implemented	Cease operations. Contact PM and BC Director of Health and Safety or designee immediately.

Upwind concentrations will be measured periodically to establish background concentrations.

The NYSDOH CAMP is provided in Appendix F for additional details associated with work stoppage and restart.

6. SITE CONTROL MEASURES

The SSO will conduct a safety inspection of the work site before each day's activities begin to verify compliance with the requirements of the HASP. Results of the first day's inspection will be documented on the Site Safety Checklist. A copy of the checklist is included in Appendix B. Thereafter, the SSO should document unsafe conditions or acts, along with corrective action, in the project field log book.

Procedures must be followed to maintain site control so that persons who may be unaware of site conditions are not exposed to hazards. The work area will be barricaded by tape, warning signs, or other appropriate means. Site equipment or machinery will be secured and stored safely.

Access to the specified work area will be limited to authorized personnel. Only BC employees and designated BC subcontracted personnel, as well as designated employees of the client, will be admitted to the work site. Personnel entering the work area are required to sign the signature page of this HASP, indicating they have read and accepted the health and safety practices outlined in this plan.

In some instances it may be necessary to define established work zones: an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone. Work zones may be established based on the extent of anticipated contamination, projected work activities, and the presence or absence of non-project personnel. The physical dimensions and applicability of work zones will be determined for each area based on the nature of job activity and hazards present. Within these zones, prescribed operations will commence using appropriate PPE. Movement between zones will be controlled at checkpoints.

Considerable judgment is needed to maintain a safe working area for each zone, balanced against practical work considerations. Physical and topographical barriers may constrain ideal locations. Field measurements combined with climatic conditions may, in part, determine the control zone distances. Even when work is performed in an area that does not require the use of chemical-resistant clothing, work zone procedures may still be necessary to limit the movement of personnel and retain adequate site control.

Personnel entering the designated Exclusion Zone should exit at the same location. There must be an alternate exit established for emergency situations. In all instances, worker safety will take precedence over decontamination procedures. If decontamination of personnel is necessary, exiting the Site will include the decontamination procedures described in the following section.

7. DECONTAMINATION PROCEDURES

Decontamination will take place in the decontamination area identified on-Site. Workers, PPE, sampling equipment, and heavy equipment leaving the exclusion area will be inspected to determine the level of decontamination necessary to prevent the spread of potentially hazardous materials. Unnecessary equipment and support vehicles are to be left outside the designated Exclusion Zone so that decontamination will not be necessary.

Despite protective procedures, personnel may come in contact with potentially hazardous compounds while performing work tasks. If so, decontamination needs to take place using an Alconox or trisodium phosphate (TSP) wash, followed by a rinse with clean water. Standard decontamination procedures for levels C and D are as follows.

- equipment drop,
- boot cover and outer glove wash and rinse,
- boot cover and outer glove removal,
- suit removal,
- safety boot wash and rinse,
- inner glove wash and rinse,
- respirator removal,
- inner glove removal, and
- field wash of hands and face.

Site workers should employ only applicable steps in accordance with level of PPE worn and extent of contamination present. The SSO shall maintain adequate quantities of clean water to be used for personal decontamination (i.e., field wash of hands and face) whenever a suitable washing facility is not located in the immediate vicinity of the work area.

Disposable items will be disposed of in an appropriate container. Wash and rinse water generated from decontamination activities will be handled and disposed of properly. Non-disposable items (i.e., respirators) may need to be cleaned or sanitized before reuse. Each site worker is responsible for the maintenance, decontamination, and sanitizing of their own PPE.

Used equipment may be decontaminated as follows.

- Remove adhered materials (i.e., dirt or mud) to increase the effectiveness of the decontamination process.
- An Alconox or TSP and water solution may be used to wash the equipment.
- The equipment will then be rinsed with clean water until it is determined clean.

Each person must follow these procedures to reduce the potential for transferring chemically affected materials off site.

8. TRAINING REQUIREMENTS

BC Site personnel, including subcontractors and visitors conducting work in controlled areas of the Site, must have completed the appropriate training as required by 29 CFR 1910.120. In addition, the SSO will have completed the 8-hour Site Supervisor course, have current training in first aid and CPR, and any additional training appropriate to the level of site hazards. Further site-specific training will be conducted by the SSO prior to the initiation of project activities. This training will include, but will not necessarily be limited to, emergency procedures, site control, personnel responsibilities, and the provisions of this HASP. Each employee will document that they have been briefed on the hazards identified at the site and that they have read and understand the requirements of this HASP by signing the H&S Plan Acknowledgement Form attached as Appendix C.

A daily morning briefing to cover safety procedures and contingency plans in the event of an emergency is to be included with a discussion of the day's activities. These daily meetings will be recorded on the Daily Tailgate Safety Meeting Form. A copy of the Daily Tailgate Safety Meeting Form is included in Appendix D.

9. MEDICAL SURVEILLANCE REQUIREMENTS

BC Site personnel, including subcontractors and site visitors, who will or may work in an area designated as an exclusion zone must have fulfilled the appropriate medical monitoring requirements in accordance with 29 CFR 1910.120(f). Each individual entering an exclusion zone must have successfully completed an annual surveillance examination and/or an initial baseline examination within the last 12 months.

Medical surveillance is conducted as a routine program for BC field staff in accordance with the requirements of 29 CFR 1910.120(f). There will not be any special medical tests or examinations required for staff involved in this project.

A Hepatitis B vaccination will be offered to BC personnel before the person participates in a task where direct exposure to potentially infectious materials is a possibility (i.e., first aid or CPR). For personnel who have potential exposure to sanitary wastes, a current tetanus/diphtheria inoculation or booster is recommended.

10. CONTINGENCY PROCEDURES

Minimum emergency equipment maintained on site will include a fully charged ABC dry chemical fire extinguisher, an adequately stocked first aid kit, and an emergency eyewash station (when corrosive chemicals are present). In addition, employees will consider maintaining the personal emergency supply items listed in Section 3: Natural Phenomena, as appropriate.

In the event of an emergency, site personnel will signal distress with three blasts of a horn (a vehicle horn will be sufficient), or other predetermined signal. Communication signals, such as hand signals, must be established where communication equipment is not feasible or in areas of loud noise.

It is the SSO's duty to evaluate the seriousness of the situation and to notify appropriate authorities. The first part of this plan contains emergency telephone numbers as well as directions to the hospital. Nearby telephone access must be identified and available to communicate with local authorities. If a nearby telephone is not available, a cellular telephone will be maintained on site during work activities. The operation of the cellular phone will be verified to ensure that a signal can be achieved at the work location.

The SSO, or designee, should contact local emergency services in the event of an emergency. After emergency services are notified, the PM and RSUM will be notified of the situation as soon as possible. If personal injury, property damage or equipment damage occurs, the PM and BC Risk Manager will be contacted as soon as practicable. An Accident/Incident Investigation Report will be completed within 24 hours by the SSO, or other designated person. A copy of the Accident/Incident Investigation Report is included in Appendix E.

10.1 Injury or Illness

If an exposure or injury occurs, work will be temporarily halted until an assessment can be made to determine it is safe to continue work. The SSO, in consultation with the RSUM, will make the decision regarding the safety of continuing work. The SSO will conduct an investigation to determine the cause of the incident and steps to be taken to prevent recurrence.

In the event of an injury, the extent and nature of the victim's injuries will be assessed and first aid/CPR will be rendered as appropriate. If necessary, emergency services will be contacted or the individual may be transported to the nearby medical center. The mode of transportation and the eventual destination will be based on the nature and extent of the injury. A hospital route map is presented at the front of this HASP.

In the event of a life-threatening emergency, the injured person will be given immediate first aid and emergency medical services will be contacted by dialing the number listed in the Critical Project

Information section at the beginning of this plan. The individual rendering first aid will follow directions given by emergency medical personnel via telephone.

10.2 Vehicle Collision or Property Damage

If a vehicle collision or property damage event occurs, the SSO, or designee, will contact the BC Risk Manager for appropriate action.

10.3 Fire

In the event of fire, the alarm will be sounded and Site personnel will evacuate to a safe location (preferably upwind). The SSO, or designee, should contact the local fire department immediately by dialing 911. When the fire department arrives, the SSO, or designated representative, will advise the commanding officer of the location and nature of the fire nature, and identification of hazardous materials on site. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. Site personnel should not attempt to fight a fire if it poses a risk to their personal safety.

Note that smoking is not permitted in controlled areas (i.e., exclusion or contamination reduction zones), near flammable or combustible materials, or in areas designated by the facility as non-smoking areas.

10.4 Underground Utilities

In the event that an underground conduit is damaged during subsurface work, mechanized equipment will immediately be shut off and personnel will evacuate the area until the nature of the piping can be determined. Depending on the nature of the broken conduit (e.g., natural gas, water, or electricity), the appropriate local utility will be contacted.

10.5 Site Evacuation

The SSO will designate evacuation routes and refuge areas to be used in the event of a Site emergency. Site personnel will stay upwind from vapors or smoke and upgradient from spills. If workers are in an Exclusion or Contamination Reduction Zone at the start of an emergency, they should exit through the established decontamination corridors, if possible. If evacuation cannot be done through an established decontamination area, site personnel will go to the nearest safe location and remove chemically-affected clothing there or, if possible, leave it near the Exclusion Zone. Personnel will assemble at the predetermined refuge following evacuation and decontamination. The SSO, or designated representative, will count and identify site personnel to verify that all have been evacuated safely.

10.6 Spill of Hazardous Materials

If a hazardous material spill occurs, site personnel should locate the source of the spill and determine the hazard to the health and safety of site workers and the public. Attempts to stop or reduce the flow should only be performed if it can be done without risk to personnel.

Isolate the spill area and do not allow entry by unauthorized personnel. De-energize sources of ignition within 100 feet of the spill, including vehicle engines. Should a spill be of the nature or extent that it cannot be safely contained, or poses an imminent threat to human health or the environment, an emergency cleanup contractor will be called out as soon as possible. Spill containment measures listed below are examples of responses to spills.

- Right or rotate containers to stop the flow of liquids. This step may be accomplished as soon as the spill or leak occurs, providing it is safe to do so.
- Sorbent pads, booms, or adjacent soil may be used to dike or berm materials, subject to flow, and to solidify liquids.
- Sorbent pads, soil, or booms, if used, must be placed in appropriate containers after use, pending disposal.
- Contaminated tools and equipment shall be collected for subsequent cleaning or disposal.

11. DOCUMENTATION

The implementation of the HASP must be documented on the appropriate forms (see appendices) to verify employee participation and protection. In addition, the regulatory requirements must be met for recordkeeping on training, medical surveillance, injuries and illnesses, exposure monitoring, health risk information, and respirator fit-tests. Documentation of each BC employee's health and safety records is maintained by the Health and Safety Data Manager in Walnut Creek, California.

Health and safety documentation and forms completed, as specified by this plan, are to be retained in the project file.

Other relevant project-specific health and safety documents, such as MSDSs or client-specified procedures, will be attached to this HASP in Appendix F.

APPENDIX A

Air Monitoring Form

BROWN AND CALDWELL

Air Monitoring Form

Instructions: Complete this form immediately prior to project start.

Name of Project/Site:			Project No:
Project/Site Location:			
Employee Performing Air Monitoring: (Print and Sign):			Date:
Photo Ionization/Flame Ionization Detectors (PIDs/FIDs)			
☐ PID ☐ FID	Manufacturer:	Model:	Serial #:
Initial Calibration Reading:		End-of-Use Calibration Reading:	
Calibration Standard/Concentration:			
Mini-RAM Dust Monitor			
Manufacturer:		Model:	Serial #:
Zeroed in Z-Bag? ☐ Yes ☐ No			

Monitoring Data

Time	Location and Activity	PID/FID (ppm)	Mini-RAM (mg/m^3)	Time	Location and Activity	PID/FID (ppm)	Mini-RAM (mg/m^3)

APPENDIX B

Site Safety Checklist

BROWN AND CALDWELL

Site Safety Checklist

Instructions: Complete this form immediately prior to project start.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Completing Checklist: (Print and Sign):	Date:

Yes	No	N/A		Yes	No	N/A	
☐	☐	☐	Written Health and Safety (H&S) Plan is on site?	☐	☐	☐	Respirators are available, properly cleaned, and stored?
☐	☐	☐	Addenda to the H&S Plan are documented on site?	☐	☐	☐	Overhead utilities do not present a hazard to equipt./personnel?
☐	☐	☐	H&S Plan information matches conditions/activities at the site?	☐	☐	☐	Traffic control measures have been implemented?
☐	☐	☐	H&S Plan read/signed by all site personnel, including visitors?	☐	☐	☐	Trenches and excavations are safe for entry?
	☐	☐	☐ Daily tailgate H&S meetings have been held/documented?	☐	☐	☐	Soil Spoils are at least 2 feet from the edge of the excavation?
☐	☐	☐	Site personnel have required training and medical?	☐	☐	☐	Emergency/FA equipt. is on site as described in the H&S Plan?
☐	☐	☐	Air monitoring is performed/documented per the H&S Plan?	☐	☐	☐	Drinking water is readily available?
☐	☐	☐	Air monitoring equipment has been calibrated daily?	☐	☐	☐	Phone is readily available for emergency use?
☐	☐	☐	Site zones are set up and observed where appropriate?	☐	☐	☐	Utility locator has cleared subject locations?
☐	☐	☐	Access to the work area limited to authorized personnel?		☐	☐	☐ Proper drum and material handling techniques are used?
☐	☐	☐	Decontamination procedures followed/match the H&S Plan?		☐	☐	☐ Waste containers/drums are labeled appropriately?
☐	☐	☐	Decontamination stations (incl. hand/face wash) are set up and used?	☐	☐	☐	Ext. cords are grounded/protected from water/vehicle traffic?
☐	☐	☐	PPE used matches H&S Plan requirements?		☐	☐	☐ Tools and equipment are in good working order?
☐	☐	☐	Hearing protection used where appropriate?	☐	☐	☐	GFCIs used for portable electrical tools and equipment?

Notes

(All "no" answers must be addressed and corrected immediately. Note additional health and safety observations here):

APPENDIX C

H&S Plan Acknowledgement Form

BROWN AND CALDWELL

H&S Plan Acknowledgement Form

Instructions: Complete this form immediately prior to project start or as new personnel join the project.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Performing Briefing: (Print and Sign):	Date:

Employee Acknowledgement:

The following signatures indicate that these personnel have read and/or been briefed on this Health and Safety (H&S) Plan and understand the potential hazards/controls for the work to be performed.

Important Notice to Subcontractor(s):

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own H&S Plan for this project or other health and safety program documents for review.

BC's Health and Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's H&S Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's H&S Plan to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the BC H&S Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Print	Sign	Date	Print	Sign	Date

APPENDIX D

Daily Tailgate Meeting Form

BROWN AND CALDWELL

Daily Tailgate Meeting Form

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Completing Form: (Print and Sign):	Date:

Employee Acknowledgement:

The following signatures indicate that these personnel have read and/or been briefed on this Health and Safety (H&S) Plan and understand the potential hazards/controls for the work to be performed.

Important Notice to Subcontractor(s):

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own H&S Plan for this project or other health and safety program documents for review.

BC's Health and Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's H&S Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's H&S Plan to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the BC H&S Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Print	Sign	Date	Print	Sign	Date

Plan of the Day

(Describe the activities that are planned to be performed today)

Potential Hazards and Topics Discussed

(Describe the potential hazards and controls that may be associated with planned activities)

☐ Electrical ☐ Chemical ☐ Biological ☐ Physical ☐ Other (specify):

APPENDIX E

Incident Investigation Report

BROWN AND CALDWELL

Incident Investigation Report

Instructions:

If an accident or incident occurs, complete all applicable information in this form, make a copy for your records, and immediately forward the original to the office Health and Safety Coordinator (HSC). If fields are not applicable, indicate with "N/A". Use separate sheet(s) if necessary and attach sketches, photographs, or other information that may be helpful in understanding how the accident/incident occurred.
HSC – Review and enter report into the BC Online Safety Observation and Incident Reporting System within 3 workdays of receipt. File original in appropriate office health and safety file.

NOTE:

This report is important – please take the time necessary to properly complete it. Incomplete reports will be forwarded to appropriate management for review and action.

General Information

Date of Accident/Incident	**Time of Accident/Incident:**	**Date Accident/Incident Reported:**	**To Whom:**
Exact Location of Accident/Incident (Street, City, State)**:**			**BC Office:**
Name Project:			**Project Number:**
Employee Completing the Investigation (Print and Sign)**:**			**Date:**

Injured/Ill Employee/Property Damage Information

Employee Name:	**Employee No.**	**Department:**	**Phone Number:**
Job Title:		**Manager's Name and Phone Number:**	
Nature of Injury/Illness (laceration, contusion, strain, etc.)**:**		**Body Part Affected** (arm, leg, head, hand, etc.)**:**	
Describe Property Damage and Estimate Loss :			

Description of Accident/Incident

Describe the accident sequentially, beginning with the initiating event, and followed by secondary and tertiary events. End with the nature and extent of injury/damage. Name any object or substance and tell how they were included. Examples: 1) Employee was pulling utility cart that was loaded with wastepaper from office area to hallway. Wheel of utility cart caught against door casing. Bags of heavy wastepaper that were in cart fell to end of cart. Cart tipped over onto foot of employee. Right foot was crushed between utility cart and door casing, resulting in severe contusion to right foot of employee. 2) Employee was driving rental car from office to project site. Car struck icy section of road. Employee lost control of vehicle, which skidded across road into concrete abutment on side of road. Accident resulted in damage to right fender, tire, headlight, and grill.

Analysis of Accident Causes

Immediate Causes - Substandard Actions

What substandard actions caused or could have caused the accident/incident? State the actions on the part of the employee or others that contributed to the occurrence of the accident/incident. Examples: 1) Employee overloaded the utility cart with wastepaper. 2) Employee exceeded safe speed on icy road, and was inattentive to hazard.

Codes (check all that apply)

- ☐ 1. Operating equipment without authority
- ☐ 2. Failure to warn
- ☐ 3. Failure to secure
- ☐ 4. Operating at improper speed
- ☐ 5. Making safety devices inoperable
- ☐ 6. Removing safety devices
- ☐ 7. Using defective equipment
- ☐ 8. Using equipment improperly
- ☐ 9. Failure to use PPE properly
- ☐ 10. Improper loading
- ☐ 11. Improper placement
- ☐ 12. Improper lifting
- ☐ 13. Improper position for task
- ☐ 14. Servicing equipment in operation
- ☐ 15. Horseplay
- ☐ 16. Alcohol or drug influence
- ☐ 17. Other (specify)

Immediate Causes - Substandard Conditions

What substandard conditions caused or could have caused the accident/incident? State the conditions that existed at the time of the accident (the specific control factors that were or may have been the direct or immediate cause or causes of the accident). Examples: 1) Wheel of utility cart was worn and would not roll properly; utility cart was overloaded with wastepaper. 2) Road was covered with icy spots; weather was foggy.

Codes (check all that apply)

- ☐ 1. Inadequate guards or barriers
- ☐ 2. Inadequate or improper PPE
- ☐ 3. Defective tools, equipment, or materials
- ☐ 4. Congestion or restricted action
- ☐ 5. Inadequate earning system
- ☐ 6. Fire and explosion hazards
- ☐ 7. Poor housekeeping
- ☐ 8. Noise exposures
- ☐ 9. Radiation exposures
- ☐ 10. High or low temperature exposures
- ☐ 11. Inadequate or excess illumination
- ☐ 12. Inadequate ventilation
- ☐ 13. Hazardous environ. conditions (vapors, dusts, etc.)
- ☐ 14. Other (specify)

Basic Causes - Personal and Job Factors

What personal and/or job factors caused or could have caused the accident/incident? State the influencing factors or underlying causes, either conditions or actions or both, that contributed to the accident/incident. Examples: 1) Employee had not been instructed in overloading hazards. 2) Employee had not been trained in driving under winter conditions; company has no driver training program.

Codes (check all that apply)

Personal Factors

☐ 1. Inadequate capability ☐ 2. Lack of knowledge ☐ 3. Lack of skill ☐ 4. Improper motivation

☐ 5. Other (specify):_____

Job Factors

☐ 1. Inadequate leadership/supervision ☐ 2. Inadequate engineering ☐ 3. Inadequate purchasing ☐ 4. Inadequate maintenance ☐ 5. Inadequate tools/equipment
☐ 6. Inadequate work standards/procedures ☐ 7. Inadequate Wear and tear ☐ 8. Abuse or misuse
☐ 9. Other (specify):

Remedial Actions

Describe the actions taken or planned to prevent recurrence of accident/incident - provide the implementation date and person responsible for any planned corrective action.. Examples: 1) Wheels of utility cart were replaced with larger size wheels; all carts were inspected for safe operation; employees were instructed in overloading hazards. 2) All project personnel were instructed at the safety training meeting on driving under hazardous conditions; driver training program will be implemented.

Codes (check all that apply)

Job Factors

☐ 1. Reinstruction of personnel involved ☐ 2. Reprimand of personnel involved ☐ 3. Temporary/permanent reassignment of personnel ☐ 4. Action to improve clean-up
☐ 5. Equipment repair or replacement ☐ 6. Improve design ☐ 7. Improve construction ☐ 8. Improve PPE ☐ 9. Install of safety guard or device ☐ 10. Work method change
☐ 11. Order use of safer materials ☐ 12. Regional Safety Unit Manager Review
☐ 13. Other (specify):

APPENDIX F

Generic New York State Department of Health Community Air Monitoring Plan

APPENDIX G

Miscellaneous Health and Safety Information