Remedial Design Report
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 153021

New York State Professional Engineer Certification:

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

Marek Ostrowski, P.E.
Professional Engineer
New York State P.E. License #073661

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Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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List of Abbreviations

ADT	Aquifer Drilling and Testing, Inc.
BC	Brown and Caldwell Associates
bgs	below ground surface
BMM	Bucket Mixing Method
BMP	Best Management Practice
CAMP	Community Air Monitoring Plan
CCR	Construction Completion Report
CIH	Certified Industrial Hygienist
CMP	Construction Management Plan
COC	Chain-of-custody
CPP	Citizens Participation Plan
CQAPP	Construction Quality Assurance Project Plan
CQCPP	Construction Quality Control Project Plan
CSSHASP	Contractor Site-Specific Health and Safety Plan
DER	Division of Environmental Remediation
DI	Deionized Water
EE	Environmental Easement
ESD	Explanation of Significant Differences
FER	Final Engineering Report
FFS	Focused Feasibility Study Report
GGBFS	Ground Granulated Blast Furnace Slag
HASP	Health & Safety Plan
IC	Institutional Control
ISS	In-Situ Solidification
Kh	Hydraulic Conductivity
LIPA	Long Island Power Authority
MGP	Manufactured Gas Plant
MPTP	Maintenance and Protection of Traffic Plan
msl	mean sea level
NAD	North American Datum
NAPL	Non-Aqueous Phase Liquids
NAVD	North American Vertical Datum
NYCRR	New York State Codes, 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
O.D.	Outside Diameter
OM&M	Operation, Monitoring and Maintenance
OSHA	Occupational Safety and Health Administration

PDI	Pre-design Investigation
PID	Photoionization Detector
PSI	Pounds per Square Inch
PRAP	Proposed Remedial Action Plan
PSA	Preliminary Site Assessment
PVC	Polyvinyl Chloride
QA	Quality Assurance
RAOs	Remedial Action Objectives
RDR	Remedial Design Report
RDWP	Remedial Design Work Plan
RFP	Request for Proposal
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
rpm	revolutions per minute
SCDHS	Suffolk County Department of Health Services
SCOs	Soil Cleanup Objectives
SESC	Soil Erosion and Sediment Control
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SPDI	Supplemental Pre-Design Investigation
SPT	Standard Penetration Test
SWPPP	Storm Water Pollution Prevention Plan
TS	Treatability Study
TSD	Treatment, Storage and Disposal
UCS	Unconfined Compressive Strength
UCWP	Utility Corridor Work Plan
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VHB	Vanasse, Hangen, Brustlin
VOCs	Volatile Organic Chemicals
WMP	Waste Management Plan
w.w.	wet weight

Section 1

Introduction

This Remedial Design Report (RDR) has been prepared by Brown and Caldwell Associates (BC) to present the design elements associated with the construction and implementation of the selected remedy to address known soil and groundwater impacts at the Patchogue Former Manufactured Gas Plant (MGP) Site. The remedy addresses contaminated soil and groundwater resulting from the operation of the former MGP located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (See Figure 1-1). Contaminated media are present primarily in the subsurface of certain portions of the National Grid owned property, referred to as the Site, and in the adjacent property, referred to as the Off-Site Property.

This RDR has been prepared in accordance with the Order on Consent, Index Number A2-0552-0606 (the Order) signed by KeySpan Corporation (a predecessor company of National Grid) and the New York State Department of Environmental Conservation (NYSDEC). The Order was signed March 4, 2007. The development of an RDR is a requirement of the Order based on the findings of the presence of contamination requiring remedial action.

The "Record of Decision (ROD), K- Patchogue MGP, Patchogue, Suffolk County, Site No. 152182, March 2011" was issued by the NYSDEC on March 31, 2011. Following that, the "Draft Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, NY (Brown and Caldwell Associates, August 2011) (RDWP) was submitted to the NYSDEC by National Grid on August 30, 2011. The NYSDEC approved the draft RDWP in a letter dated December 22, 2011. The "Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, February 2012) was finalized and submitted to the NYSDEC on February 24, 2012.

The "Remedial Design Report (50-75% Submission) Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York (Brown and Caldwell Associates, December 2012)" (RDR) was submitted to the NYSDEC on December 26, 2012. The NYSDEC provided comments on the 50-75% Submission by letter dated June 12, 2013; National Grid submitted a response to comments letter on August 6, 2013.

On October 10, 2017, the NYSDEC issued an "Explanation of Significant Differences, K – Patchogue MGP Site" (ESD). The ESD outlined a modification to the remedy selected in the ROD. The modification involves using in-situ solidification (ISS) instead of an excavation-based approach for the Off-Site Property.

The 90-95% RDR was submitted to the NYSDEC on February 12, 2018. The NYSDEC provided comments on the 90-95% RDR by letters dated November 21, 2018 and December 3, 2018. National Grid submitted responses to the comment letters on December 4, 2018 and December 6, 2018.

This 100% Submission of the RDR presents the design of the selected remedy and incorporates the NYSDEC comments on the 90-95% Submission.

1.1 Site Background

1.1.1 Site Location and Setting

The remedy will be implemented at the property located at 234 West Main Street (Former MGP Site) and the adjacent property located at 210 West Main Street. The Former MGP Site is hereafter referred to as the "Site" and the adjacent property is hereafter referred to as the "Off-Site Property" (Figure 1-2).

The Site is zoned as an industrial property under Block 9 and Lot 6.4 and is located in a mixed commercial and residential area. The Site is currently undeveloped and vacant. The perimeter of the Site is secured with a locked chain-link fence. The Site is rectangular 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, 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.

The Site is divided into three areas: the Northern Area, the Central/Core Area, and the Southern Area. The Northern Area comprises the narrow northern portion of the Site, bordered by West Main Street to the north, and ending approximately where the Site extends west. The Northern Area surface is made of two concrete and asphalt slabs with a combined size of approximately 240 feet by 60 feet, a gravel driveway, and sparse vegetation around the perimeter. The Central/Core Area begins where the Site widens, approximately 270 feet from the northern face of the 234 West Main Street Property and is bordered to the south and west by chain-link fencing. To the east of this area is the Off-Site Property. Fencing formerly separated the two properties but has been removed in preparation for remedial activities. The Central/Core Area is where the majority of the former MGP structures were located. The surface of the Central/Core Area is primarily low-growth vegetation and crushed stone, which was installed during previous remedial activities. The western boundary of the Site slopes steeply upwards. The Southern Area comprises the densely-vegetated area south of the chain link fencing boundary of the Central/Core Area. This area also has considerable concrete debris on the ground surface.

The Off-Site Property is bordered to the west by the Central/Core Area of the Site, to the east by the Patchogue River, and to the north by 206 West Main Street. The Off-Site Property, at 210 West Main Street, is being leased to National Grid for the duration of remedial activities. The Off-Site Property covers approximately 0.80 acres. It includes a two-story commercial/industrial building of approximately 12,000 sf. The remainder of the Off-Site Property ground surface is completely paved, except for the narrow soil walkway east of the building. Six-foot high chain-link fencing runs along the eastern property line and separates the Patchogue River from the rest of the Off-Site Property. There is a 4-foot wide chain-link gate at the southern corner of the Off-Site Property that allows access to the Patchogue River.

The overall layout of the remediation area, encompassing both the Site and the Off-Site Property, is shown on Drawing C-110 (Appendix A).

1.1.2 Regulatory History

The history of the Site is detailed in historic documents related to the investigation and remediation, including:

- "Record of Decision, K-Patchogue MGP, Patchogue, Suffolk County, Site No. 152182", NYSDEC, March 31, 2011.
- "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York", as prepared by TetraTech EC, Inc. and dated December 2009 (referred to as RIR);
- "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" prepared by Vanasse, Hangen, Brustlin (VHB) and dated March 2002 (referred to as PSA);
- "Focused Feasibility Study, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk" prepared by Brown and Caldwell Associates and dated May 2011;
- "Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, February 2012);
- "Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" (Brown and Caldwell Associates, February 2012); and
- "Remedial Design Report (50-75% Submission), NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, December 2012).
- "Explanation of Significant Differences, K – Patchogue MGP Site, Village of Patchogue, Suffolk County, Site No. 152182", NYSDEC, October 2017.

1.1.3 Remedial Investigation and Pre-Remedial Design Summary

The findings from the assessment and investigation activities into the subsurface conditions and the nature and extent of MGP-related impacts at the Site are presented in the following documents:

- The Preliminary Site Assessment (PSA) as presented in "Preliminary Site Assessment Report Order on Consent D1-001-99-05, NYSDEC Site No. 1-52-182 Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York", [Vanasse, Hangen, Brustlin 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 Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, May 2011) (FFS).
- The Limited Field Investigation conducted on January 6, 2012 as presented in "Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" (Brown and Caldwell Associates, February 2012).
- The Pre-Remedial Design activities as presented in "Remedial Design Report, 50-75% Submission, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, December 2012).
- The Off-Site Property investigation as presented in the letter reports dated June 18, 2014 and April 25, 2016.

All of the aforementioned reports are on file with the NYSDEC and in the repository for Patchogue located at the Patchogue Medford Library in Patchogue, NY.

The results of the pre-remedial design activities and the Off-Site Property investigation are discussed in Section 2 of this RDR.

1.1.4 Utility Corridor Activities

In planning for the implementation of the full-scale remedy, it was determined that overhead lines located at the Site needed to be relocated from the eastern side of the Site to the western side to allow for overhead clearance of construction equipment and to prevent the undermining of the utility poles during remedial activities. Per discussions with representatives of the Long Island Power Authority (LIPA), the owner of the overhead lines, allowed for the relocation of the lines along the eastern property line of the Site to the western side of the Site. To facilitate the relocation, the document entitled "Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" was prepared by Brown and Caldwell Associates and submitted to the NYSDEC on February 8, 2012. The NYSDEC approved the draft UCWP in a letter dated February 9, 2012.

The utility relocation activities on the western side of the Site were implemented in June-July 2012 to create a "utility corridor" in which the utility poles and overhead lines would be reinstalled prior to the implementation of the remedial activities for the remainder of the Site. National Grid excavated and replaced impacted soils identified in the northwestern corner of the Site (around the MW-2 cluster). In addition, soils in an adjacent area were excavated to a depth of 2 ft., disposed off-Site and a cap (crushed stone) was installed. The location of the Utility Corridor is shown on Drawing C-101 (Appendix A).

Documentation of the implementation of the Utility Corridor Work Plan is presented in the "Construction Completion Report, Utility Corridor Work Plan Implementation, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, December 2012) (CCR).

1.1.5 Former Gas Manifold and Associated Piping Removal

National Grid conducted the removal a former gas manifold and associated piping located in the northeastern corner of the Core Area. The work was performed to decommission/remove the gas manifold and associated piping prior to implementation of the full-scale remedy. The removal activities were conducted between September 22 and 24, 2018 in accordance with the Notice of Intrusive Activities (NOIA) letter submitted to the NYSDEC on May 22, 2018. The activities included excavation and exposing the gas piping, determining if the gas piping was active and abandoned, removing the gas manifold and associated piping, and capping the ends of piping at the property line. After the work was completed, a letter summarizing the implementation of the intrusive site activities was prepared and submitted to NYSDEC on November 28, 2018.

1.2 Summary of Remedial Design

A draft RDWP was developed and submitted to the NYSDEC on August 30, 2011 to detail the activities and procedures proposed to be included in the development of the remedial design for the Site and the Off-Site Property in accordance with the ROD. The NYSDEC approved the draft RDWP in a letter dated December 22, 2011. The document entitled "Remedial Design Work Plan (RDWP), Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" was finalized by Brown and Caldwell Associates and submitted to the NYSDEC on February 24, 2012.

The RDWP was prepared based on the remedy selected in the ROD, which required the implementation of ISS at the Site and excavation and disposal for the Off-Site Property. However, in 2016, National Grid conducted an analysis of remedial technologies to address impacted materials at the Off-Site Property, comparing excavation and disposal, as specified in the ROD, to ISS. ISS was found to offer several advantages over excavation/disposal. Subsequently, in October 2017 the NYSDEC issued an ESD, modifying the selected remedy to include ISS at the Off-Site Property, instead of the excavation and

disposal. Therefore, based on the ROD and as amended by the ESD, the final remedy includes the use of ISS to address the impacted material both at the Site and at the Off-Site Property.

The remedial design presented in this RDR is based on the RDWP that was prepared in accordance with the requirements of the ROD, as well as on the remedy modification outlined in the subsequent ESD.

1.3 Remedial Design Report Objectives

The objectives for the remedial design, as presented in the February 2012 RDWP, include the following:

- To summarize the results of the pre-design and supplemental pre-design activities performed in support of the remedial design;
- To present the remedial design for the implementation of the proposed remedial construction activities;
- To provide descriptions of the proposed methods and procedures that will be used to implement the proposed remedial construction activities;
- To incorporate the design aspects into Construction Drawings and Technical Specifications necessary for a Remedial Contractor to implement the remedial construction activities;
- To identify the project plans (Community Air Monitoring Plan (CAMP), Construction Quality Assurance Project Plan (CQAPP), Health and Safety Plan (HASP), Citizens Participation Plan (CPP), Maintenance and Protection of Traffic Plan (MPTP), Storm Water Pollution Prevention Plan (SWPPP), Waste Management Plan (WMP) that will be used during the remedial construction activities; and
- To prepare a schedule for the implementation of the activities associated with the proposed remedial construction.

1.3.1 Summary of the Remedy

The NYSDEC selected the remedy for the Patchogue Former MGP Site based on the results of the evaluation detailed in the 2011 FFS and the public's input into the Proposed Remedial Action Plan (PRAP), as documented in the ROD. The remedy was subsequently modified, as presented in the 2017 ESD. The final components of the remedy 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 Division of Environmental Remediation (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. **Excavation of the following materials:**
   - Any existing former MGP structures (i.e. piping), debris, and major obstructions (i.e. rail road), to allow for 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.
   - Soils in an area of approximately 40 feet long by 20 feet wide, located along the west-southwest portion of the on-Site remedial area, to the depth of 4 feet bgs. The area will be backfilled with certified clean fill or on-Site material approved for reuse and a two-foot thick soil cover will be installed.
   - The excavations will be backfilled with stockpiled soils (properly vetted through NYSDEC for re-use) and/or certified imported clean soil, the top two-feet of which will meet the 6NYCRR 375-6.7(d) restricted-residential criteria for backfill.
3. **In-Situ Solidification (ISS) of Soil:**
   - ISS of impacted soil will include areas of MGP-related source material and associated soil, with the deepest targeted treatment being approximately 23 bgs. The soil will be mixed in-place with cement and/or other hardening materials to form a solid mass with low hydraulic conductivity relative to surrounding soils to prevent migration of MGP-related contaminants. The horizontal and vertical extents of the ISS area were determined utilizing the results of investigation activities and are intended to encapsulate the impacts. Additional ISS treatment may be implemented in response to the requirements of the quality control sampling discussed in the CQAPP, included as Appendix B. The ISS will be performed via the bucket-mixing method (BMM).
   - During the ISS, admixtures such as Portland cement, ground granulated blast furnace slag (GGBFS) and other materials (e.g., bentonite or other reagents) are combined with the soils during treatment. As a result, the volume of the ISS mass is greater than the initial volume of the in-place soil. The additional solidified soils (i.e., ISS-related swell) needs to be contained and managed. Prior to ISS activities, the ISS area will be pre-excavated to a certain depth and/or bermed in order to contain the ISS-related swell. Since the groundwater table at the Site is relatively shallow and based on the time of the year and the timing/intensity of precipitation events, groundwater can be expressed at the surface. The ISS swell will be mostly contained through a shallow excavation and berm using the excavated soils.
   - Following ISS treatment, the top layer of the solidified material, including the swell, will be excavated to accommodate the installation of the Site cover. The excavated material will be transported and disposed off-Site at a National Grid/NYSDEC approved landfill or treatment facility. The final depth of the top surface of the solidified soils will be four feet bgs.
   - Solidified soils will be covered by a total of four feet of clean soil to protect them from freeze-thaw cycles. The top two feet of the Site cover will meet 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.
4. **Odor/Dust Control:** On-Site material handling (blending operations, excavation, soil segregation, loading, ISS grout plant operations, backfill placement) will be performed in such manner as to minimize air emissions. Odor suppression materials such as sprayable foam will be available on-Site at all times. 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 work areas during all ground-intrusive activities at the Site.
5. **Site Cover:** Installation of a Site cover to allow for restricted-residential use of the Site. The Site will be restored to its existing grade. Soil cover will be installed 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. In the future, depending on the Site development, the Site cover may incorporate structures, such as buildings, pavement, and sidewalks in addition or instead of the soil cover.

6. **Institutional Controls:** Imposition of an institutional control in the form of an environmental easement for the Site and the Off-Site Property that:
   a. Requires the remedial party or site owner to complete and submit to the NYSDEC 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.
7. **Site Management Plan:** A Site Management Plan is required which includes the following:
   a. An Institutional and Engineering Control Plan that identifies use restrictions and engineering controls for the Site and the Off-Site Property 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 6 above.
      - Engineering Controls: The ISS area discussed in Paragraph 3 and the Site cover discussed in Paragraph 5 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 building located on the Off-Site Property become occupied or should any buildings be developed on the Site or the Off-Site Property 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.

1.4 Remedial Design Report Organization

This document is organized in the following sections:

Section	Contents
Section 1 – Introduction	This section provides a brief description of the location of the Site, the regulatory history, the historical operations performed on the Site, a summary of the approved RDWP, and the remedial action/design objectives for the proposed remedial construction activities.
Section 2 – Pre-Remedial Design Activities	This section of the RDR summarizes the activities implemented to gather information in support of the design of the remedial construction activities.
Section 3 – Remedial Components	This section details the current design for the remedial construction activities.
Section 4 – Schedule	This section presents a project milestone schedule for the implementation of the selected remedy for the Site.
Section 5 – Identification of Federal, State, and Local Permits and Approvals	This section of the RDR summarizes the permits that will be necessary to implement the proposed remedial construction activities.
Section 6 – Project Implementation and Contractor Selection	This section of the RDR details the procedures to be followed to select a Remedial Contractor to implement the proposed remedial construction activities.
Section 7 – Construction Quality Assurance/Quality Control	This section references the Construction Quality Assurance Project Plan to be utilized to ensure integrity of the data produced as a result of the implementation of the remedial construction activities.
Section 8 – Health and Safety Plan	This section references the health and safety measures to be taken in order to ensure worker and public safety during the implementation of the remedial construction activities.
Section 9 – References	Presents a list of the references cited in the RDR.

Section 2

Pre-Remedial Design Activities

The following sections detail the pre-remedial design activities that were performed at the Site. The purpose of the pre-remedial design activities was to obtain supplemental site information necessary for the completion of the design of the remedy selected in the ROD. As described in the RDWP, these activities included;

- A groundwater flow modeling study and associated field activities to support the study,
- An ISS Treatability/Compatibility Study,
- A supplemental geotechnical evaluation,
- Also, a soil boring program was conducted prior to implementing the activities to create a utility corridor,
- An off-Site investigation implemented to further evaluate the extent of MGP-related impacts on the property adjacent to the Site, and
- The results of the Community Air Monitoring Plan activities conducted during the field activities

These efforts, and the findings from these activities, are provided in the sections below.

Field activities were conducted in accordance with the approved RDWP, HASP, and other approved work plans for specific activities as described in the sections below.

2.1 Property Access Activities

Pre-remedial design field activities were conducted on both at the Site and the Off-Site Property, and thus, upon approval of the RDWP, National Grid established access with the owner of the Off-Site Property to conduct these activities.

2.2 Utility Clearance

Prior to conducting the various ground intrusive activities described in the sections below, the locations for these activities were marked in the field. Dig Safely New York was contacted to obtain utility clearance. Additionally, the Village of Patchogue and Suffolk County were contacted to obtain clearance for utilities that they maintain (i.e., sewer and water). Available information regarding the location of utilities from National Grid and the Off-Site Property owner was also reviewed. In addition, prior to performing intrusive work, a surface geophysical survey Contractor (Utility Survey, Inc. of Washingtonville, New York) was contracted to attempt to identify and mark locations of potential subsurface structures, piping, utilities and other potential subsurface impediments within the proposed investigation areas. The survey Contractor marked out a radius of 10 feet from each proposed boring location.

2.3 Investigation-Derived Waste Management

Wastes that were generated from the implementation of the pre-remedial design tasks were containerized and temporarily staged on-Site in New York State Department of Transportation (NYSDOT)-specification 55-gallon drums prior to the implementation of the UCWP. These wastes were treated and

disposed of with the non-hazardous soils excavated from the utility corridor at Bayshore Soil Management, LLC (United States Environmental Protection Agency Identification Number: NJ1225001522) facility in Keasbey, New Jersey.

Additional information regarding the treatment and disposal of the investigation derived waste is documented in the CCR.

2.4 Groundwater Flow Modeling Study

A groundwater flow modeling study was performed as part of the design process to assess the potential of the implementation of the planned ISS to adversely affect local hydrogeological conditions, and to estimate the volume of water that may be generated during dewatering for construction, if required. The objectives of this groundwater flow modeling task were 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;
- Evaluate the influences of ISS in terms of the change of groundwater flow and groundwater levels relative to the baseline condition; and
- Evaluate the rate and amount of water that may be generated from dewatering, if required, during remedial construction activities.

This groundwater flow modeling study, including model development, calibration of the model to existing conditions, simulation of the effects of ISS on groundwater flow and groundwater levels, and simulation of dewatering for construction, are provided in the "Draft Ground Water Model Report, Patchogue (West Main Street), Former Manufactured Gas Plant (MGP) Site" (GWMR) prepared by Brown and Caldwell Associates, and dated November 2012, (included in Appendix C). The GWMR was prepared prior to the expansion of the area to be subjected to ISS as described in Section 1. The model was subsequently re-rerun to simulate the increase in the volume and area of ISS. The additional model runs did not change the conclusions in the report in Appendix C.

Note that the dewatering was modelled as part of the overall remedy evaluation and selection process. However, the final remedy for the Site is based on the ISS, which does not require dewatering.

As described in the RDWP, field data collection was conducted to support development and calibration of the groundwater flow model. These field activities are described in Section 2.5 below.

2.5 Field Activities to Support Groundwater Flow Modeling Study

The three primary stratigraphic units encountered at the Site, from shallowest to deepest, include fill, alluvial deposits and glacial outwash deposits (i.e., the upper glacial aquifer). To assess if the hydraulic properties vary significantly between these units or within these units, data were collected to estimate hydraulic properties of the units and thus facilitate their simulation in the groundwater flow model. The evaluation included: (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).

Prior to these field activities, there were several existing wells screened discretely in the glacial outwash. None of the existing wells were screened discretely in the fill or alluvial deposits. Accordingly, couplets of temporary piezometers were installed at several locations at the Site. Each couplet included one

piezometer screened in the fill and one piezometer screened in the outwash. This permitted 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 were used as part of the couplet where subsurface conditions permitted. As the alluvial deposits are relatively thin and variable, they were not targeted for piezometer installation. Rather, the alluvial deposits were 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 conducted in support of the groundwater flow modeling study.

2.5.1 Install and Develop Temporary Piezometers

Seven temporary piezometers were installed at four locations (four couplets) to facilitate collecting water level measurements and estimating hydraulic conductivity in the fill and the outwash. These piezometers were designated PZ-1A, PZ-1B, PZ-2A, PZ-2B, PZ-3A, PZ-3B, and PZ-4A. The construction logs for these piezometers are provided in Appendix D. At one of the four proposed couplets locations, existing well MW-9D is screened discretely in the outwash and thus only one piezometer (PZ-4A), screened in the fill, was needed to provide a piezometer couplet. At the other three locations, two piezometers were installed; one with a screen interval set in the fill, and one with a screen interval set in the outwash. These locations were positioned proximal to previously drilled borings SB-115, SB-121, and SB-128. The locations of the piezometers are shown on Drawing C-103 (Appendix A). The six on-Site piezometers on National Grid's property (PZ-1A, PZ-1B, PZ-2A, PZ-2B, PZ-3A, and PZ-3B) were installed between March 21 and March 23, 2012. The one piezometer on the adjacent property (PZ-4A) was installed on May 23, 2012, following receipt of access permission from the property owner.

The soil borings advanced for the purposes of installing the piezometers were drilled using hollow-stem augers and sampled with a two-foot long, two-inch outside diameter (O.D.) split- spoon sampler from ground surface to the target depth indicated in Table 3-1 of the RDWP. Drilling and piezometer construction services were provided by Aquifer Drilling and Testing, Inc. (ADT) of Mineola, New York using a CME 1500 drill rig. The soil samples were described in the field to characterize soil type, including grain size, texture, and apparent moisture content. Soil samples were logged in accordance with the Burmister Soil Classification System and classified using the Unified Soil Classification System (USCS). Soils were also 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 non-aqueous phase liquids (NAPL) was described, where encountered. The soil descriptions were 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 were constructed of two-inch diameter, Schedule 40 PVC (polyvinyl chloride) casing with 0.020-inch slot PVC screens. The casing and screen were lowered into the borehole such that the screen is positioned within the targeted depth interval. The screen intervals for the piezometers intended to monitor the glacial outwash unit were set sufficiently deep so that the filter pack does not extend upward into the overlying units (e.g., alluvial deposits or fill).

Once the screen and casing were in place, the annular space between the screen and the borehole was filled with filter pack material sized appropriately for the screen slot size. The filter pack material was added until it extended above the top of the screen. If possible given the requirements for screen positioning described above, the filter pack was installed to extend at least two feet above the top of the screen.

A bentonite seal was placed in the annular space above the filter pack. Where the bentonite annular seal was installed at a depth below the water table, pellets of bentonite were used to construct the seal. Where the bentonite seal was positioned above the water table, a pre-hydrated bentonite mixture was used to construct the seal. Where possible, the bentonite seal was constructed to be a minimum of 24 inches thick, except in those cases where a screen was in too close a proximity to the ground surface to allow for this thickness; in these instances (i.e., PZ-1A, PZ-2A, PZ-3A, and PZ-4A), the piezometer construction was modified to provide a functional seal at the ground surface.

The annular space above the bentonite seal was 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 was 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) was installed to cover the top of the piezometer casing. The cover or casing was set in place with concrete such that surface water drains away from the piezometer.

A mark or notch was 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 was used to cap the top of the PVC casing.

After a minimum period of 24 hours had passed following piezometer installation to allow for the cement-bentonite grout to set, the piezometers were developed. Piezometer development was conducted using surging and pumping methods. The piezometers were developed until the water produced from the well was visibly clear and free of sediment or until there was no further decrease in turbidity after removal of approximately 10 well volumes of water. Water and sediment produced from development was containerized pending characterization and off-Site disposal.

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

As discussed in the RDWP, following completion of the groundwater flow modeling study, the temporary piezometers will be decommissioned, if located in the remediation area. The piezometers will be decommissioned in accordance with procedures described in Section 3.3.2 of the RDWP.

2.5.2 Water Level Measurements

After the temporary piezometers were installed and developed and water levels in the piezometers had returned to static conditions following development, the depth to water was measured in each well and piezometer at the Site. Measurements were made from the surveyed reference point using this point as the zero-depth reference. Measurements were made using an electronic water level meter, and measured to the nearest 0.01 foot. Two rounds of measurements were collected as part of this study. The initial round of water level measurements was conducted on July 18, 2012 and the second round was conducted on August 28, 2012. Monitoring wells MW-2S and MW-2D were decommissioned by ADT on June 4, 2012 as part of the implementation of the UCWP (Brown and Caldwell, February 2012). Each well was decommissioned in accordance with "CP-43: Groundwater Monitoring Well Decommissioning Policy" (NYSDEC, November 2009) by grouting in-place. Additional details about the decommissioning are presented in the CCR. The water level data from these two rounds are provided in Table 2-1.

Table 2-2 provides the calculated vertical hydraulic gradients between the fill and the underlying outwash deposits at each of the well/piezometer couplets where there is one well or piezometer screened discretely in the fill, and one screened discretely in the outwash. However, a vertical hydraulic gradient could not be calculated for the PZ-4A/MW-9D couplet because access to MW-9D was blocked by a roll-off container positioned over the well during the time of the testing. The container was being used on the adjacent property. The calculated vertical hydraulic gradients between the fill and outwash are very low, indicating that there is no apparent hydraulic separation between these two deposits. Thus, this supports the conclusion that the fill and outwash are considered as components of the same hydrostratigraphic unit, i.e., they are part of the same water-bearing zone.

2.5.3 Slug Test Monitoring Wells and Temporary Piezometers

In-situ hydraulic conductivity tests (i.e., slug tests) were performed on August 2, 2012 on the following piezometers and monitoring wells at the Site: PZ-1A, PZ-1B, PZ-2A, PZ-2B, PZ-3A, PZ-3B, PZ-4A, MW-1, MW-4D, MW-7D, and MW-8D. Per the RDWP, it was planned to also conduct slug tests on MW-2S, MW-2D, and MW-9D; however, MW-2S and MW-2D were decommissioned during construction activities for creating the utility corridor and MW-9D, located on the Off-Site Property, was inaccessible due to a roll-off container positioned over the well at the time of the field testing.

Rising head slug tests were conducted per the procedures described below:

- Prior to inserting equipment into the piezometer or well to conduct a slug test, the static water level was 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 was installed in the well/piezometer. The transducer was positioned at a depth below which the bailer (see below) would be lowered. Depth to water measurements were made with the transducer and manually with an electronic water level meter to confirm that the water level in the well was at static conditions, and that the transducer was functioning.
- A bailer, which was used as the slug, was inserted into the well below the water level. The water level was measured with the transducer and with the electronic water level meter until the water level returned to static following the introduction of the bailer.
- The bailer was rapidly removed from the well, and simultaneously with its removal, automatic measurement and logging of water level data was initiated. The data logger was set to record data on a logarithmic schedule so that measurements were recorded more frequently in the earlier part of the test, when the water level was changing at the fastest rate.
- Water level measurements with the data logger continued until the water level had returned to static levels or had recovered by approximately 90 percent.

Following completion of the test, the data was downloaded from the data logger and stored in the electronic project files. The change in water level versus time data were evaluated using analytical techniques developed by Hvorslev (1951), to estimate horizontal hydraulic conductivity (Kh) for the unit adjacent to each well and piezometer. The slug test plots and Kh calculations for each of the wells and piezometers are provided in Appendix E.

Table 2-3 provides a summary of the Kh estimates based on the analysis of the slug test data. The estimates indicate that, in general, the Kh of the fill is about ½-order of magnitude less than the Kh of the outwash. This is likely due to the poorer sorting, and relatively greater percentage of fine-grained material in the fill material relative to the more well sorted outwash deposits. The range of estimated Kh values for the fill and the outwash do overlap somewhat, with the highest Kh estimates in the fill being greater than the lowest Kh estimates for the outwash. These findings, combined with the low vertical hydraulic gradient between the fill and outwash deposits, further support the conclusion that the fill and outwash are components of the same hydrostratigraphic unit.

2.6 In-Situ Solidification Treatability/Compatibility Study

ISS is part of the selected remedy for the Site. To develop a cementitious mixture that will meet the Remedial Action Objectives (RAOs) established in the ROD while maintaining its integrity in the subsurface environment at the Site, a Treatability/Compatibility Study (i.e., Treatability Study, or TS) was conducted. The Study was 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. Results of the TS are used to prepare cost estimates and design specifications with regard to the full-scale ISS treatment.

2.6.1 ISS Mix Evaluation Criteria

Throughout the TS, results were evaluated with respect to two primary quantifiable criteria and one secondary qualitative criteria. The two primary quantifiable criteria were the reduction in hydraulic conductivity between the solidified mass and the untreated in-situ soils, and the Unconfined Compressive Strength (UCS) of the solidified mass. The secondary criterion was the ability of the mix to maintain its integrity and to contain the source material; this criterion was evaluated by qualitative means.

The volumetric expansion expected during the installation was also measured during the TS; however, this was not a direct evaluation criterion. Rather, the volumetric expansion was used to estimate the volume of the spoils that would need to be removed and disposed of during the installation.

The reduction of hydraulic conductivity was used to assess the effectiveness of mixes in reaching the RAO objective of achieving the groundwater quality criteria in the water-bearing zone surrounding the impacted soils. This reflects the mechanism by which the impacted soils act as a source of groundwater impacts. As groundwater flows through the impacted soils, it contacts the source material and becomes contaminated. Upon emerging from the downgradient surface of the source zone, groundwater displays the dissolved-phase concentrations that can potentially migrate and create a zone of exceedances of the water quality criteria. The potential for that is related to the overall mass flux of the dissolved colloidal organic carbons through the downgradient surface of the source zone. This mass flux is proportional to the flow rate of groundwater through the source zone, and the dissolved-phase colloidal organic carbon concentration in that groundwater. Reducing the hydraulic conductivity of the source zone material results in the proportional reduction of the groundwater flow through the source zone, and consequently, in the corresponding reduction in the mass flux. This, in turn, reduces the potential extent of the dissolved-phase impacts downgradient of the source. The actual reduction ratio of hydraulic conductivities was not specified for the purpose of this study. Instead, the evolution of the hydraulic conductivity values of the solidified mass throughout the range of reagent addition rates was observed, and the selection was based on achieving the near-asymptotic low value.

The UCS is related to two aspects of the remedy: the constructability of the ISS, and the post-remedy use of the Site. ISS is typically applied using overlapping columns or cells, either by the use of augers or by bucket mixing. Very high UCS values of the mix indicate that achieving the overlap, which requires mixing of new cells partially through cells that have already set, may be difficult. Conversely, low values of UCS may render the solidified mass unsuitable for bearing the loads anticipated during the post-remedy period. Typically, the UCS of approximately 50 to 200 psi is recommended; the actual values may be Site-specific (USEPA, 1993a and 1993b). The preliminary range of 50-100 psi was used in the TS based on the ease of construction and the anticipated future use of the Site as commercial property.

In summary, the effective mixes were assumed to be those that displayed the UCS values of 50-100 psi, achieved a near-minimum hydraulic conductivity obtained throughout the study, as well as maintained their integrity and did not release the source material from the solidified mass. The UCS and hydraulic

conductivity of the treatment aliquots were obtained from the testing which conformed to the respective ASTM methods identified later in the report; these tests produce quantitative results. The integrity and ability to contain the source material were evaluated using immersion testing; this test is based on a visual examination.

2.6.2 Treatability Study Overview

The TS comprised the following activities:

- Collection of samples of Site soils and impacted media from the proposed ISS area;
- Performance of a laboratory study; and
- Analysis of results and recommendations.

The elements of the TS are outlined in the subsequent sections. The outcome of the TS was the identification of at least one mixture that would achieve the RAOs and could be applied within the subsurface conditions at the Site.

2.6.3 Sample Collection

Three distinct soil types were identified at the Site during previous investigation activities: fill, alluvial deposits, and outwash deposits. In all three strata, locations were identified where MGP NAPL was observed. The alluvial deposits are generally thin and variable in composition. For the purposes of this TS, 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: alluvium and outwash (grouped into "native" deposits for the purpose of this TS) and fill, a conservative approach to develop the TS procedures was taken and samples that included materials from all three strata were collected for the use in the TS. These samples were obtained from areas where significant MGP-related impacts were noted. Using this approach, an ISS mixture was developed that would 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 TS. 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 alluvial deposits and outwash; however, the distinction between the two is difficult to establish, as both often display similar characteristics. Based on that, it is not deemed necessary to obtain separate samples of the alluvial deposits and outwash. Two treatability study samples were thus collected; one representative of the fill and one representative of native deposits.

Samples of Site soils and impacted media used in the Study were collected immediately adjacent to existing boring locations PASB-29 and SB-118. The approximate locations of the soil borings used to collect these samples are noted on Drawing C-103 (Appendix A). 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 were approximately 0 to 5.0 feet bgs at PASB-29, and 5.0 to 20.0 bgs at SB-118. Samples for the TS were collected from these respective depth intervals. During sampling, representative MGP-impacts were encountered in these intervals.

ADT provided the drilling services for the soil sampling. Samples were collected from March 19 and 20, 2012 using a direct-push drilling rig (GeoProbe® 6620 DT) equipped with a four-foot long Macrocore® soil sampling tool, although some of the samples from the shallower interval (0 to 5 ft bgs) next to the

PASB-29 location were also collected using a post-hole digger. Multiple borings were required at each location to obtain the volume of material required for the TS (approximately five to 15 gallons from each location). Following completion of drilling, the soil borings were filled to the ground surface with bentonite.

Soil from each sample interval was 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 USCS. Each sample was also field screened for MGP-related impacts, or other impacts, based on appearance, odor and/or organic vapor concentrations measured with a PID; in particular, the nature, distribution of degree of saturation of NAPL was described, where encountered.

The samples from the depth interval targeted for treatability samples were initially placed in five-gallon polyethylene buckets. The samples were mixed inside the buckets to homogenize them to the extent practicable. The samples were then removed from the buckets and placed in 1-gallon sealable polyethylene bags. The bags were then labeled to identify the following: sample identification name/number; sample location name; depth interval of sample and type of material (fill or native); date and time of sample collection; Site name; and name of sampler. Once filled, the sample bags were placed in a cooler with ice and cooled to approximately 4°C.

A chain-of-custody (COC) form was used to document the sample collection, sample handling, and custody of the samples. The COC form accompanied the samples from the time of collection to the receipt of the sample at the laboratory. The samples were shipped to the laboratory in clean coolers. The samples in the coolers were shipped with ice to maintain a temperature of approximately 4°C. Appropriate clean packing material was used in the cooler to cushion the samples and reduce the potential for breakage. The COC form was placed in the cooler with the samples. Once the coolers were filled, they were closed and a custody seal, signed by the samplers, was placed on the cooler such that the opening of the cooler would break the seal. The samples were shipped to the treatability laboratory at Kemron Environmental Services, Inc., in Atlanta, Georgia via Federal Express overnight delivery.

2.6.4 Laboratory Study

The samples were received by the laboratory and used to conduct the testing aimed at the identification of the design mix (or mixes). The laboratory study methods are identified, and the testing process is described in this section. Detailed descriptions of the means and methods are provided in the Laboratory Report (Appendix F).

This section describes the methodology of the TS. The results, analysis, and recommendations are addressed in the subsequent section.

2.6.4.1 Laboratory Study Methods

During the laboratory portion of the TS, untreated soils as well as potential mixtures of Site soil with cementitious grout containing varying amounts of other additives were tested for various parameters, such as soil physical characteristics, strength, volumetric expansion, hydraulic conductivity, and compatibility with Site conditions and contaminants. Following is the lists of tests/methods that were utilized during the study.

Table 2-4. Summary of Tests and Methods for Treatability Study

Analysis	Method
pH	EPA Method 9045C
Soil Classification	USC D2487
Moisture Content	ASTM D2216

Analysis	Method
Particle Size Distribution (with Hydrometer)	ASTM D422/D854
Bulk Density (w/dry density)	ASTM D2937
Atterberg Limits	ASTM D4318
Unconfined Compressive Strength	ASTM D2166
Pocket Penetrometer	NA
Loss on Ignition	ASTM D2947
Hydraulic Conductivity (falling head)	ASTM D 5084
Volumetric Expansion	NA
Immersion Test	NA

2.6.4.2 Sample Receipt and Untreated Material Characterization

Soil samples were received at the laboratory, appropriately logged in and placed into secure storage. Materials from each of the two samples (i.e., native soils and fill) were homogenized using stainless steel mixing instruments and gently mixed with low-energy mixing techniques to ensure a uniform material prior to treatability testing. Potential off-gassing from the samples was managed using standard laboratory health and safety procedures including proper handling of samples by trained personnel, the use of exhaust hoods, etc.

Characterization testing performed on the homogenized samples of untreated soils (native soils and fill) consisted of the following tests: pH, moisture content, particle size distribution, bulk density, Atterberg limits, and loss on ignition.

2.6.4.3 Solidification Treatment

Process Overview

The solidification investigation consisted of two parallel testing programs; one for each of the two material types identified previously – the native soils, and the fill. Testing was conducted on the MGP-impacted soils using a phased approach: preliminary evaluation, optimization evaluation, and repeatability evaluation.

The matrix detailing the tests applied at each stage of the solidification treatment as well as the cure periods is presented in Table 2-5.

Preliminary Evaluation

Based on the results of characterization of the untreated soil mixtures, the types of reagents and their approximate addition rates were identified that have been shown to be effective at improving the physical properties of hydraulic conductivity and UCS for soils similar to the Site materials:

- Portland cement at addition rates between 5% and 12.5% by wet weight (% w.w.) of the sample, and
- Bentonite at addition rates up to 1.5% w.w.

The relatively high addition rate of cement was dictated by the coarse nature of the soils, which consisted of more than 90% of sand and gravel.

Total of eight mixtures were developed, four using the native soil and four using the fill. The objective of the preliminary evaluation stage was to evaluate a relatively wide range of solidification reagents addition rates. Each mixture was developed by placing an aliquot of untreated soil into a blending chamber. Reagent(s) were added to the untreated soil and blended at a rate of approximately 60 revolutions per minute (rpm) until visually homogeneous, for approximately 60 to 90 seconds. Immediately following mixture development, unit weight of each mixture was measured and the mixtures were placed into cylindrical molds for curing. Each mixture was allowed to cure for a period of 28 days in

a humid environment maintained at a temperature of 18 to 24°C. Upon completion of the curing period, following quantitative tests were applied, using methods identified previously: pH, moisture content, bulk density, unconfined compressive strength, pocket penetrometer, hydraulic conductivity, and volumetric expansion.

Immersion testing was also performed. The purpose of the immersion test is to evaluate whether there would be a release of free product from the treated materials when in the presence of water. A release of free product is typically evident as an oily film or a significant release of odor from the water bath. The immersion test also gives an indication of the long-term integrity of the material by allowing for an examination of potential deterioration of the aliquots, such as presence of cracks or the release of significant amount of particles from the solidified mass. Immersion testing was performed by submerging a 28-day cured specimen into a beaker of deionized (DI) water and swirling continuously for a period of 7 days at approximately 150 rpm. Throughout the immersion testing, visual observations regarding the integrity of the treated specimen and the clarity and odor of the DI water were made.

Optimization Evaluation

Based on the results of preliminary solidification treatment evaluations, mix designs were identified for further optimization. The optimization evaluation focused on narrowing the ranges of reagent addition rates that were identified during the preliminary evaluation as most likely to result in the successful mix, based on two primary mix evaluation criteria: the soil strength and the hydraulic conductivity. Analyses were conducted to estimate the volumetric expansion (in order to evaluate the requirements for the disposal of the swell spoils), and to determine the integrity of each mix and its ability to prevent the source material from separating. In addition, the optimization evaluation attempted to identify the relative influence of each of the two reagents on these criteria.

Methods used to develop the testing aliquots were the same as those described for the preliminary evaluation stage. However, testing was conducted at either seven and 28-day cure times; or seven, 14 and 28-day cure times, depending on the aliquot. The analyses performed during the optimization evaluation stage were: pH, moisture content, bulk density, unconfined compressive strength, pocket penetrometer, hydraulic conductivity, volumetric expansion and immersion test.

Sixteen aliquots of the native soils and 16 fill aliquots were tested. The overall ranges of the reagent addition rates were between zero and 1.5% w.w. of bentonite, and between zero and 12.5% w.w. of Portland cement.

Repeatability Evaluation

Three mixtures used during the optimization stage were re-developed during the repeatability evaluation stage. These mixtures were re-analyzed to investigate the consistency of the results. Testing methods were the same as those identified previously for the optimization stage.

2.6.5 Treatability Study Results

This section describes results of the testing conducted during the TS, including testing of the untreated materials, testing of the treatment aliquots conducted during the preliminary evaluation stage and the optimization evaluation stage, as well as the repeatability stage.

2.6.5.1 Untreated Soil

As indicated previously, two types of Site soils were used during the TS: native soils and fill. Results of the characterization tests conducted on the homogenized untreated samples of these materials are shown in Table 2-6.

Both soils are relatively coarse, with the fraction of sand and gravel of approximately 90-95%. They are non-plastic. Of note is the high organic content of approximately 10-20%, indicating that a significant

portion of the samples consisted of the MGP source material. Typical organic content of native soils is .01 to 1.0%. Testing the design mixes of the soils containing the source material is consistent with the intent of the TS, as identified in the Work Plan.

2.6.5.2 Selection of Mixing Agents

The ISS mixture is intended to fulfill a dual function. The treated soil will be solidified to decrease the permeability, in order to reduce the flow of groundwater through the treated soils, and the strength of the soil needs to fall within an interval where it would be capable of bearing the anticipated loads, but also facilitate the overlap of columns or cells during installation. The reagents most commonly used to control these properties are Portland cement, bentonite, and ground granulated blast furnace slag. Although the effects of these reagents may vary, generally the increase in the cement or slag content decreases the hydraulic conductivity and increases the UCS, while the increase in the bentonite content decreases the UCS. The effect of bentonite on the hydraulic conductivity may be variable, depending on the properties of the treated soils.

The composition and properties of slag typically differ depending on the origin; therefore, for the consistency of results with the field application, the TS should be performed with the same materials as those that will be used during construction. Because of that, a source of the material would have to be identified at the very early stage in the project, prior to the TS. Properties of Portland cement are relatively consistent between different manufacturers; therefore, results can be extrapolated from the TS to the full-scale application with a significantly greater reliability, regardless of the origin of the reagent. Based on that, Portland cement was selected as the solidifying agent for the TS.

Bentonite was also used during the TS. If significant addition rates of cement turned out to be necessary to achieve low hydraulic conductivity, they may increase the UCS beyond the acceptable limits. Under those conditions, decreasing the UCS with the addition of bentonite may be required.

2.6.5.3 Preliminary Evaluation

The preliminary evaluation was conducted using soil material from homogenized samples of native soils and fill (aliquots designated as “N-“and “F-“, respectively). Four aliquots of fill and four aliquots of native soil were developed, combined with respective amounts of Portland cement of 5% w.w. and 10% w.w.; and 7.5% w.w. and 12.5% w.w., as well as either no bentonite or 1.5% w.w. of bentonite. The main purpose of the preliminary evaluation was to identify the broad range of reagent addition rates that would be able to achieve the approximate value of UCS of 50-100 psi, and to establish the approximate hydraulic conductivity values that could be achieved for the treated Site soils. The secondary objective was to evaluate the expected magnitude of the volumetric expansion, and the influence of each of the two reagents (Portland cement and bentonite) on the properties of the treatment aliquots.

Results are presented in Table 2-7. The UCS data are plotted on Figures 2-1 and 2-2 for the native soils and fill, respectively; while the respective data for hydraulic conductivity are presented in Figures 2-3 and 2-4. The volumetric expansion for the aliquots of native soil and fill is presented on Figures 2-5 and 2-6, respectively. Note that the table and figures also contain data from the later optimization and repeatability stages; however, data from the preliminary stage are clearly differentiated to indicate the information available at the time.

For both types of soil, the cement addition rates of 10-12.5% w.w. without the bentonite addition resulted in the UCS values of approximately 250-300 psi. These values were lowered to approximately 100 psi when 1.5% w.w. of bentonite was added. For cement addition rates of 5-7.5% w.w., the UCS of approximately 50-150 psi was obtained; this was lowered to approximately 25 psi with the addition of 1.5% w.w. of bentonite. As anticipated, the UCS of the mix can be adjusted by adding bentonite.

The preliminary objective with respect to the UCS is to achieve the UCS of approximately 50-100 psi. To account for the experimental error and the scatter of the laboratory data, the target range is expanded

by 20% of its respective low- and high-end values, to 40-120 psi. Based on the preliminary evaluation results, these values can be achieved either with low rates of Portland cement (5-7.5% w.w.) and no bentonite, or with the high rates of Portland cement (10-12.5% w.w.) and the bentonite content of 1.5% w.w. Therefore, the ranges of both Portland cement and bentonite addition used during the preliminary stage bracket the addition rates of these reagents that are likely to result in the development of the desired strength of the ISS mix.

It can also be noted that applying or exceeding the 1.5% w.w. bentonite content would result in a significant volumetric expansion. This expansion with 1.5% w.w. bentonite was approximately 45-50% for both types of soil. The expansion without the bentonite was approximately 15-25%.

Using the 5-7.5% w.w. cement addition rate, the UCS can be maintained in the target range of 40-120 psi without the addition of bentonite. Based on these results, it is anticipated that cement addition rates from approximately that interval, possibly with a minimum amount of bentonite, would create a mix where the objective of creating the solidified mass with the UCS of approximately 40-120 psi can be achieved, and where the volumetric expansion can be minimized.

The hydraulic conductivity for the fill aliquots was on the order of 10^{-7} to 10^{-6} cm/s for the entire range of the cement and bentonite addition rates. For the aliquots of native soils, the range of values on the order of 10^{-7} to 10^{-5} cm/s was obtained. There was no clear trend indicating the separate influences of either cement or bentonite.

Immersion testing was also performed. No sheen was observed on the water surface during the testing. The samples maintained their original consistency. Minor disintegration on the edges of each of the solidified samples was observed. Observations are summarized in Appendix F.

2.6.5.4 Optimization Evaluation

Results of the preliminary evaluation indicate that the target range of the UCS values can be achieved by the cement addition rates close to the range of 5-7.5% w.w., either by itself or with the addition of small amounts of bentonite; or by higher doses of cement (up to 12.5% w.w.) if approximately 1.5% w.w. of bentonite is added. The optimization evaluation was conducted to refine these results. Portland cement addition rates of between 3% w.w. and 8.5% w.w. were used, with the bentonite amounts of 0% w.w. and 0.5% w.w. In order to thoroughly evaluate the influence of bentonite, the 1.5% w.w. addition rate used during the preliminary evaluation was also applied, with the understanding that the 1.5% w.w. bentonite mix may result in relatively high volumetric expansion. Immersion testing was conducted in order to evaluate the integrity of the mixes and their ability to contain the NAPL source material.

Two bentonite-only aliquots were also prepared for each of the soil types. Bentonite-only mixes would not be selected for design, as they could not achieve the required UCS (in fact, these mixes collapsed during the UCS testing). However, the information was used to evaluate the separate influences of the cement and bentonite on the volumetric expansion, which was discerned from the preliminary evaluation data.

Results are presented in the table and parameter-specific figures identified in the description of the preliminary evaluation testing stage (Table 2-7, Figures 2-1 through 2-6). The summary table and the figures contain all quantitative data (optimization evaluation stage and the preliminary evaluation stage). Results of the immersion testing are summarized in Table 2-8.

The overall trends, using data that include the preliminary and optimization evaluations, can be summarized as follows:

- UCS consistently increases with the addition rate of Portland cement, and decreases with the addition rate of bentonite (Figures 2-1 and 2-2).

- Hydraulic conductivity appears to decrease with the Portland cement addition rate up to approximately 5-7.5% w.w. For higher cement contents, the conductivity values appear to stabilize. There is no clear trend related to the bentonite addition rate (Figured 2-3 and 2-4). The scatter of data is very low for the aliquots of fill, and higher for the aliquots of the native soil.
- The volumetric expansion is relatively stable across the entire range of Portland cement contents; however, it increases significantly with the successive addition rates of bentonite (Figures 2-5 and 2-6). Based on data from bentonite-only aliquots, the addition of bentonite contributes approximately 10% expansion at the level of 0.5% w.w., and approximately 15-20% expansion at 1.5% w.w.
- These trends are present in the results obtained for the aliquots of both soil types used in the TS: native soils and fill.
- The qualitative evaluation of the integrity of the mixes and their effectiveness in containing the NAPL source material was conducted through immersion testing. Details of the evaluation are presented in Appendix F; results are summarized in Table 2-7. Deterioration of aliquots was observed consistently for cement addition rates of up to 5% w.w. in native soils and 3% w.w. in fill, at all bentonite addition rates. Also, sporadic deterioration was observed for higher Portland cement doses when no bentonite was present, or the bentonite addition was 0.5% w.w. There was no deterioration in either the native soil or fill aliquots for Portland cement doses of 6.5% w.w. or greater when the bentonite addition rate was 1.5% w.w.

It can be observed by examining the data and interpolating between the successive data points that, for a given bentonite content, certain intervals of the Portland cement addition produced the target values of the UCS of 40-120 psi (Figures 2-1 and 2-2).

Table 2-9. Aliquots Achieving the Target UCS

Bentonite (% w.w.)	Cement Content (% w.w.) Resulting in Target UCS		
	Fill	Native Soil	Common to Native and Fill
0.0	4.0-6.0	5.5-8.0	5.5-6.0
0.5	5.5-7.5	6.5-10.0	6.5-7.5
1.5	6.5-10.0	8.0-12.5	8.0-10.0

Based on this, the following three bentonite/cement combinations would produce the UCS within the target range of approximately 40 to 120 psi. These combinations are derived by selecting the Portland cement content that is suitable for both soil types ("Common" column of the table above) for a given bentonite content.

- **Combination 1:** no bentonite; 5.5-6.0% w.w. Portland cement
- **Combination 2:** 0.5% w.w. bentonite; 6.5-7.5% w.w. Portland cement
- **Combination 3:** 1.5% bentonite; 8.0-10.0% w.w. Portland cement

Figure 2-7 combines the results of immersion testing and UCS testing discussed above. The immersion testing results identify cement/bentonite addition combinations that produced aliquots which did not show deterioration, while the UCS results (shown on Figure 2-7 as the product of interpolation using the three combinations discussed above) identify the cement/bentonite addition combinations that produced acceptable UCS values of 40-120 psi in both the fill and native soils. The cement/bentonite combinations that are within the common area satisfy both the UCS and immersion criteria.

The common area is located near the cement/bentonite addition rates identified above as Combination 3: 1.5% bentonite; 8.0-10.0% w.w. Portland cement. Therefore, these reagent addition rates are recommended.

Values of hydraulic conductivity and volumetric expansion corresponding to the mixture of 8-10% w.w. Portland cement and 1.5% w.w. bentonite are as follows:

Table 2-10. UCS and K of the Aliquots of 8-10 w.w. Cement and 1.5% w.w. Bentonite

Hydr. Conductivity[1] (cm/s)		Volumetric Expansion[2] (%)	
Native Soil	Fill	Native Soil	Fill
~$5*10^{-6}$	~$5*10^{-7}$	~40-50	~40-50

Notes:

1 – with an accuracy of half an order of magnitude, based on the scatter of data.

2 – with an accuracy of 10%, based on the scatter of data.

Combination of 1.5% w.w. bentonite and 8-10% w.w. cement would provide acceptable results with respect to both the strength and integrity of the solidified mass. The use of 8-10% w.w. of Portland cement also produces a mixture residing in the cement addition region where the hydraulic conductivity has stabilized at its lowest level, and the increase of the dose does not result in noticeable improvement. The use of these reagent addition rates may necessitate disposal of significant percentage of the treated soil. However, the extrapolation of laboratory volumetric increase results to field conditions is generally considered less reliable than for the remaining parameters.

2.6.5.5 Repeatability Evaluation

Three mixtures were selected for the repeatability evaluation – one fill aliquot (F-20), and two aliquots of the native soil (N-08 and N-15). Testing results are shown in Table 2-6, immediately below the results of the corresponding original samples. Comparison of the 28-day cure UCS, hydraulic conductivity and volumetric expansion is shown in Table 2-11.

Results of the duplicate volumetric expansion analyses for all three aliquots are within approximately 5-20% of the original results. All three duplicate hydraulic conductivity values were within half an order of magnitude of the original results. Two of the three duplicate UCS analyses are within a range of approximately 0-25% of the original results; one analysis provided an approximately 40% difference. As shown on Figures 2-1, 2-2, 2-3, 2-4, 2-5, and 2-6, replacing the original samples with their duplicates would not change the conclusions of the analysis described previously.

2.6.5.6 Temporal Effects

As shown in Table 2-7, certain properties of the mixes were obtained at different curing times of the treatment aliquots. Depending on the sample, the cure times when tests were performed were either 7 and 28 days; or 7, 14, and 28 days. The discussion of results presented above focused on the 28-day cure, which is considered to be the most representative of the final mix properties. Testing at shorter cure times was performed as a quality assurance (QA) measure, and to identify potential issues that may arise during construction.

The greatest significance of the temporal changes is for the UCS, as it affects the installation of the ISS columns or cells. The short-term UCS should be either approximately the same as, or lower than, the 28-day UCS; much higher short-term UCS could affect the ability to mix within the already-set areas to overlap the ISS columns or cells. As indicated previously, the optimum range of the addition rates is 8-10% w.w. of cement and 1.5% w.w. bentonite. The temporal trends in the value of UCS of the aliquots developed using 8.5% w.w. cement and 1.5% w.w. bentonite are available for one aliquot of native soil (N-20) and one aliquot (and its duplicate) of fill (F-20 and F-20DUP). Results, illustrated on Figure 2-8, show that the 7-day UCS is approximately 55-65% of the 28-day UCS. Lower short-term UCS will facilitate the overlap of the columns or cells during installation.

The temporal variability in volumetric expansion is negligible, as shown on Figure 2-9, indicating that the solidified mass will reach its final volume during installation.

Only the 28-day cure hydraulic conductivity was obtained for the relevant aliquots; therefore, temporal trends cannot be illustrated. However, it is expected that the permeability of the solidified mass would decrease during curing and reach its ultimate and lowest value following the setting of the cement, similarly to the UCS.

2.6.5.7 Evaluation of Dissolved-Phase Impact Following Completion of ISS

The ISS remedy is intended to address the dissolved-phase impacts by reducing the mass flux of the MGP-related contaminants from the source materials into the groundwater (i.e., the source strength). As indicated previously, the source strength reduction and the subsequent reduction in the dissolved-phase concentrations downgradient of the source are related to the rate of groundwater flow through the source zone, which primarily depends on the hydraulic conductivity of the source-zone soils. Therefore, the reduction in the dissolved-phase impacts can be related to the reduction in the hydraulic conductivity from the undisturbed source-zone soils to the post-ISS solidified mass.

In-situ hydraulic conductivities were obtained from several slug tests performed in piezometers installed within the water-bearing zone at the Site (see Section 2.5.3). Six of those piezometers are located within the ISS area: PZ-1A, -2A, -3A, -1B, -2B, and -3B (see Drawing C-103, Appendix A). The range of hydraulic conductivities obtained from tests performed in these piezometers is approximately $3*10^{-3}$ to $3*10^{-2}$ cm/s (Table 2-3). As shown on Figures 2-3 and 2-4, hydraulic conductivities of the ISS treatment aliquots containing approximately 8-10% w.w. of Portland cement are approximately three to five orders of magnitude lower. Such reduction in conductivity, and consequently in the strength of the source, will result in a negligible potential for the development of any dissolved-phase impacts downgradient of the ISS area.

2.6.6 Summary and Recommendations

Based on the results of the TS, the mix applicable to the types of soil encountered at the Site is 8-10% w.w. Portland cement and 1.5% w.w. bentonite. Mixes in that range have been shown during the TS to achieve the target values of UCS of 40-120 psi, to maintain their integrity, and to lower the hydraulic conductivity of the solidified mass by approximately 3 to 5 orders of magnitude as compared to the in-situ soils. These features would facilitate the constructability of the ISS portion of the remedy, will provide soil strength and integrity of the solidified mass sufficient for the anticipated future use of the Site, and will create conditions where the dissolved-phase concentrations of Site constituents downgradient of the ISS area will be negligible.

2.7 Supplemental Geotechnical Investigation

A supplemental geotechnical investigation was conducted in 2012 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 excavation activities at the Off-Site Property. As indicated previously, excavation was specified as part of the remedy in the ROD; however, an ESD was issued in 2017 that modified the Off-Site Property remedy from excavation to ISS. The results of the 2012 geotechnical investigation of the former proposed excavation area are described in this section for completeness; however, they were not used for its original purpose following the remedy modification. Results were subsequently used to evaluate the embankment protection for the portion of the ISS implementation area adjacent to the Patchogue River during construction, as described in Section 3.4.3.

The Supplemental Geotechnical Investigation included the drilling and sampling of three soil borings at the Off-Site Property. These borings were located near the alignment of the proposed shoring system that, prior to the remedy modification outlined in the ESD, would have been required to facilitate the Off-Site Property excavation. Three borings were also drilled and sampled in the areas proposed for ISS

treatment as depicted in the RDWP. The borings were installed using a CME 1500 drill rig equipped with hollow-stem augers. ADT provided the drilling services for these borings. Following completion of drilling, the soil borings were filled to the ground surface with a cement/bentonite grout.

Soil samples were collected from the borings and analyzed for geotechnical parameters, and the Standard Penetration Testing (SPT) pursuant to ASTM D1586 was conducted as part of sample collection. In order to keep the borehole stabilized and reduce the potential for the overburden sand deposits to enter into the inside of the hollow-stem augers prior to split-spoon sampling, a column of water was maintained within the augers, with the top of the column at or above the ground surface.

2.7.1 Soil Borings

A total of six soil borings were drilled and sampled at two areas of the Site: three borings near the perimeter of the formerly proposed Off-Site Property excavation area (following the issuance of the ESD in 2017, this area will be addressed by ISS) and three borings within the On-Site ISS area.

Borings in the Formerly Proposed Excavation Areas

In order to evaluate the subsurface conditions along the alignment of the proposed sheeting/shoring system that would have been utilized to support the integrity of the excavation sidewalls (prior to the modification of the remedy from excavation to ISS outlined in the ESD), three soil borings were drilled and sampled. The three borings, designated GI-4, GI-5, and GI-6, were spaced near the limit of the proposed shoring system to evaluate variations in the composition of the soils comprising the subsurface. The approximate locations of the borings are depicted on Drawing C-103 (Appendix A). The borings were drilled to a depth of approximately 30 feet bgs. The drilling took place on May 24 and May 25, 2012, following receipt of permission from the property owner. The logs for these soil borings are provided in Appendix G.

Borings in the Site ISS Area

Three soil borings were drilled on March 23 and March 27, 2012 in the area initially depicted in the RDWP for ISS treatment to evaluate the subsurface conditions in support of the selected installation method. The borings were drilled to a depth corresponding with the deepest anticipated ISS treatment (23 feet bgs). These borings are designated GI-1A, GI-2, and GI-3. The approximate locations of the soil borings are depicted on Drawing C-103 (Appendix A). Logs for these soil borings are provided in Appendix G. Note that boring GI-3 was drilled in the northwest part of the Site where ISS was initially planned. However, this area was remediated via excavation as part of the preparation of a utility corridor, as discussed in Section 1.1.4.

2.7.1.1 Collection of Soil Samples

Continuous SPT sampling was performed in all the borings drilled near the horizontal alignment of the shoring system that would have been utilized to support the excavation at the Off-Site Property (prior to the remedy modification) area as well as within the On-Site ISS Area.

2.7.1.2 Sample Analysis (Geotechnical)

To supplement the SPT data and visual descriptions of the samples, representative samples of the soils obtained from the borings drilled along the anticipated alignment of the shoring system were submitted for laboratory testing for grain size distribution and moisture content. Direct shear and Atterberg limits tests were not conducted as only disturbed granular samples were obtained and were considered to be non-plastic based on visual evaluation.

Inferred field relative densities were estimated based on the SPT blow counts performed as part of the test borings.

Selected representative soil samples obtained from the borings were analyzed by the geotechnical laboratory at Geotesting Express, Inc. for grain size and moisture Content. The results of the geotechnical analyses are provided in Appendix H and are summarized in Table 2-12. The results of the SPT tests are provided on the soil boring logs in Appendix G.

Table 2-12. Geotechnical Testing Summary

Boring	Depth (ft)	Moisture Content (%)	Gravel (%)	Sand (%)	Silt & Clay (%)
GI-4	8-10	17	10.0	86.3	3.7
GI-4	20-22	20	9.6	89.5	0.9
GI-5	2-4	40	12.5	69.3	18.2
GI-5	16-18	18	0.3	96.2	3.5
GI-6	8-10	17	17.1	81.3	1.6
GI-6	26-28	20	0.4	97.9	1.7

2.7.2 Summary and Recommendations

The soils in the area that was considered for excavation prior to the remedy modification outlined in the 2017 ESD consist of 11 to 14 feet of fill overlying native sands. The fill is very loose to medium dense sand with varying amounts of silt and gravel. The native soils are loose to medium dense sand with trace silt and trace to little gravel. Below a depth of 18 feet, the native sand layer is occasionally very dense.

Because the upper fill layer is very loose at some locations, care should be taken to avoid heavy vibration during construction that may cause differential settlements beneath the nearby building.

2.8 Limited Field Investigation for Utility Corridor Implementation

A draft UCWP was submitted to the NYSDEC on November 7, 2011. Based on discussion of comments generated during the NYSDEC's review of the initial November 2011 draft of the UCWP, the following additional investigation activities were requested:

- Drilling and sampling (for descriptive purposes) of two additional soil borings (SB-139 and SB-140) to confirm the western limit of the MGP impacts to be addressed by In-Situ Solidification (ISS) in the central/core area of the Site.
- Drilling and sampling (for descriptive purposes) of two additional soil borings (SB-137 and SB-138) to further evaluate the limits of the excavation in the northwestern corner of the Site.

A figure depicting the locations of the proposed borings was provided to NYSDEC in an email dated December 16, 2011; NYSDEC subsequently approved the locations in an email on December 20, 2011. On January 6, 2012, BC and the drilling Contractor, ADT, mobilized to the Site to implement the additional soil investigation requested by the NYSDEC.

At each boring, the interval from the ground surface to a depth of three feet bgs was "hand cleared" using a post-hole digger and hand auger as a precaution to reduce the potential of drilling into subsurface utilities. This is in addition to the other measures taken to address potential utilities, as described in Section 2.2. Typically, the soils were saturated with groundwater at a depth of about three feet bgs. The borings were then drilled and sampled via direct-push methods using a track mounted GeoProbe® 6620 DT equipped with a Macrocore® soil sampler. Soil samples were collected using the soil sampler from a depth of approximately three feet bgs to the target depth designated for each location as described below. The soils retrieved during the hand clearing as well as from the soil sampler at each boring location were logged by a BC geologist in accordance with the Burmister Soil

Classification System and the USCS. In addition, soil samples were screened in the field using a PID and observations of odors, NAPL, staining and/or sheens were recorded.

Soil borings SB-139 and SB-140 were drilled and sampled at locations west of the central/core area where implementation of ISS is currently planned. These borings were drilled and sampled to a depth of 23 ft bgs, which represents a depth below the deepest NAPL encountered at the Site in previous investigations. No visible NAPL was observed in soil samples from these borings. Within the upper 5 feet of soil, black stains with weak to moderate mothball-like odor were observed. Refer to the soil boring logs in Appendix G for further details.

Soil borings SB-137 and SB-138 were drilled and sampled through a concrete slab to a depth of 10 feet bgs. Specks of tacky, solidified NAPL and gravel-sized pieces of brittle solidified NAPL with a moderate odor were observed in the soils within a very discrete depth interval (4.7 to 5.4 feet bgs) at SB-137. At boring SB-138, a stringy and tacky NAPL with a faint mothball-like odor was observed within a two-inch interval at a depth of 4.8 feet bgs. No measurable PID readings were noted from the soils retrieved from either of the boring locations.

To further evaluate the lateral extent of the solidified NAPL noted in SB-137, an additional soil boring, SB-141, was drilled approximately 18 feet to the southeast of SB-137. This boring was drilled and sampled to a depth of 13 feet bgs. Three attempts were made to drill SB-141; the first two encountered drilling refusal at a depth of 0.5 feet bgs. At the location of SB-141, thin bands of black NAPL coated sand grains were observed from 2.6 feet to 3.0 feet bgs. Below 3.0 feet bgs, the soil was noted to be heavily coated with NAPL and exhibited strong mothball-like odor. NAPL was observed to extend to a depth of 4.9 feet bgs at SB-141 with mothball-like odors decreasing with depth. Beyond a depth of 4.9 feet bgs, to the end of the boring at 13 feet bgs, no NAPL was encountered. Please refer to the boring logs in Appendix G for further details on NAPL observation and soil descriptions.

Following the completion of each boring, the borehole was backfilled with bentonite pellets to the ground surface. Soils with staining, mothball-like odors and NAPL were containerized in a 55-gallon DOT-approved steel drum for off-Site disposal. Each soil boring location was surveyed for horizontal location and vertical elevation by a New York State licensed surveyor form Bertin Engineering before the implementation of the UCWP.

The locations of borings SB-137, SB-138, SB-139, SB-140, and SB-141 are depicted on Drawing C-103 (Appendix A). Logs for these soil borings are provided in Appendix G.

This information was used to revise the UCWP. The document entitled “Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182” was finalized by BC and submitted to the NYSDEC on February 8, 2012. The NYSDEC approved the draft UCWP in a letter dated February 9, 2012. Implementation of the UCWP occurred during June and July 2012 and was documented in the “Construction Completion Report, Utility Corridor Work Plan Implementation, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York” (Brown and Caldwell Associates, December 2012). This document was approved by the NYSDEC in a letter to National Grid dated March 11, 2013.

2.9 Off-Site Investigation

In a letter to National Grid dated June 12, 2013, the NYSDEC provided a comment associated with the report entitled “Remedial Design Report, 50-75% Submission, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York” (BC, December 2012). Specifically, the NYSDEC stated that “A clean line must be established for the excavation limits of the off-Site excavation” and requested that, due to the impacts observed at recent geotechnical soil borings located proximal to the excavation limits shown in the 50-75% Remedial Design Report (i.e., GI-5 and GI-6), modifications to the southern and

eastern limits of the off-Site excavation are necessary. The NYSDEC specifically requested to either extend the southern and eastern excavation limits to soil boring locations that are considered to be un-impacted (e.g., PASB-35 and PASB-44), or conduct additional delineation of the Off-Site Property impacts. National Grid elected to perform additional delineation of the observed impacts, which were proposed in a letter work plan dated August 8, 2013. The letter work plan was approved by the NYSDEC. in a letter dated August 20, 2013.

The NYSDEC comment letter, as well as the letter work plan, were issued before the remedy was modified as outlined in the October 2017 ESD. As previously described, the ESD states that, instead of the excavation specified in the ROD, ISS will be implemented on the Off-Site Property. Therefore, for the final remedy, the "limits of the excavation" mentioned in the NYSDEC comment letter become "limits of the ISS".

A total of 11 soil borings were completed during a two-day field effort conducted on May 8 and 9, 2014. The soils borings completed included SB-201 through SB-211. The results of the investigation included indications of MGP-related impacts including stringy, tacky viscous NAPL was observed in the subsurface soils during the field activities. Table 2-13 provides a summary of the visual/olfactory observations recorded during the soil boring program. A figure depicting the locations of the soil borings is provided in Appendix A (Drawing C-103) and a geological cross-section depicting the vertical position of the observed visible MGP-related source material on the Off-Site Property is presented in Appendix A (Drawing C-104, C-105, and C-106).

Based on the observations documented during the completion of the above described soil boring program, National Grid recommended that additional delineation efforts be conducted on the Off-Site Property to further define the extent of the visible MGP-related source material pursuant to the March 2011 ROD. Accordingly, additional off-site investigation activities were proposed to the NYSDEC in the off-Site investigation work plan addendum letter dated February 1, 2016. The work plan proposed the installation of three additional borings on the Off-Site Property in order to further define the limits of ISS. The NYSDEC approval of the work plan addendum was received in an email to National Grid dated February 5, 2016. In accordance with the February 1, 2016 work plan addendum, the three additional borings were completed on March 17, 2016. This program included the installation of borings SB-212, SB-213, and SB-214. Based on the observations documented during the implementation of the off-Site investigation activities, the extent of the visible MGP-related source material on the Off-Site Property has been defined.

2.10 Community Air Monitoring

The Community Air Monitoring Plan (CAMP) included in Appendix I of the RDWP and as part of the UCWP was implemented during the pre-remedial design activities to monitor, record, and document air quality at the Site leaving the work zone(s). The CAMP, in conjunction with the air monitoring requirements of the HASP, included in the RDWP as Appendix J, provide for:

- Establishing background levels of target compounds in ambient air prior to initiation of remedial construction;
- Monitoring and documenting perimeter ambient air levels of target compounds during the implementation of the remedy;
- Providing an early-warning system to prevent the potential exposure to elevated concentrations on adjacent properties 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;

- Evaluating ongoing effectiveness of, and the 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,
- Using real-time perimeter monitoring results in conjunction with confirmatory air sampling.

Perimeter monitoring was conducted both downwind as well as upwind of work zones. Air monitoring stations were adjusted, as necessary, based on the location of work activities and wind direction, such that a minimum of one station was located upwind and one station was located downwind of the work zone. The perimeter air monitoring data indicated no exceedances of the action levels for total organic vapors or PM-10 particulates occurred.

During installation of the environmental cap within the utility corridor, there were several occasions when visible dust was observed. Corrective actions were immediately implemented to eliminate the generation of dust and mitigate impacts at the perimeter of the Site. Work continued when dust was no longer observable. No stop work conditions occurred.

The provisions in the CAMP presented in the RDWP and UCWP are considered effective for monitoring the type of activities planned during remedy implementation and will be utilized in the development of a CAMP for this RDR.

Section 3

Remedial Components

The following sections detail the components of the remedy selected to address the impacts at the Site and the Off-Site Property in accordance with the requirements of the ROD and the ESD. In general, the work will be implemented in the following sequence of events:

1. Pre-Mobilization Submittals
2. National Grids Process Hazard Analysis (PHA Activities).
3. Mobilization.
4. Site Preparation Activities.
5. Remedial Activities.
6. Post-Remedial Action Activities.

In addition, this section presents a detailed discussion of specific activities that will occur during the implementation of the Remedial Activities as follows:

- Air Monitoring;
- Odor Control and Vapor Management;
- Decontamination; and
- Waste Management.

3.1 Pre-Mobilization Submittals

The Remedial Contractor will be responsible for the preparation of submittals for review and approval by National Grid and/or its duly authorized representative. The submittal schedule is included in the Technical Specifications (Appendix K). The major submittals will include a Construction Management Plan, a Site-Specific Health and Safety Plan, and a Site-Specific Construction Quality Control Project Plan (CQCPP).

The Remedial Contractor will be required to prepare a Construction Management Plan (CMP) that will detail the proposed means and methods for achieving the remediation goals in accordance with the Design Drawings (Appendix A) and the Technical Specifications (Appendix K). In addition, the CMP will also be prepared in accordance with the requirements in the CQAPP (Appendix B), CAMP (Appendix I), MPTP (Appendix L), SPPP (Appendix M), WMT (Appendix P), and CPP (Appendix Q). This CMP will be submitted to National Grid for review and acceptance prior to the implementation of the remediation. The CMP will include a detailed description of work activities and the proposed sequencing/schedule for completing the major remedial activities. Stockpile and staging areas for clean materials, waste handling and disposal, soils designated for re-use, and waste materials will be identified on a Site plan drawing prepared by the Remedial Contractor. The CMP will also include procurement of all applicable permits in advance of starting field work, additional drawings (i.e., ISS sequence, design of measures to ensure the stability of embankment during the ISS implementation in the area adjacent to the river, Site layout of support/exclusion/contaminant reduction zones, batch plant operations, office trailer location(s), parking areas, Site ingress/egress, Site and Off-Site Property traffic patterns, and any other information pertinent to the Remedial Construction). The CMP will describe surveying requirements for the remediation and as-built record drawings to be prepared to document the remediation. All

engineering drawings developed by the Remedial Contractor will be required to be prepared and stamped by a Professional Engineer, retained by the Remedial Contractor, who is licensed in the State of New York. Survey documents will be signed and stamped by a Professional Surveyor, retained by the Remedial Contractor, who is licensed in the State of New York.

In addition to the Design Drawings, Technical Specifications and plans specified above, a HASP has been prepared by BC for use by its employees as Design Engineer during the remedial activities and is included as Appendix J. The Remedial Contractor will be required to provide a Site-Specific Health and Safety Plan (Site-Specific HASP) to coordinate with Contractor's means and methods of construction. A third-party health and safety officer will be supplied by the Remedial Contractor. The Site-Specific HASP will be submitted for review by National Grid, their duly appointed representative(s) and the NYSDEC. National Grid will verify that the Site-Specific HASP includes National Grid's Site-specific requirements as outlined in the HASP included as Appendix J of the RDR. The Contractor Site-Specific HASP may be more stringent than the BC HASP. The Site-specific HASP will detail any revisions and/or updates required by the Remedial Contractor to the approved HASP included with this RDR. The Remedial Contractor's Site-specific HASP will be required to identify the personnel and their credentials, for the approval of National Grid, that will provide health and safety services. All Remedial Contractor personnel working on the Site will also be required to provide health and safety credentials including OSHA training certificates and applicable medical records.

The Remedial Contractor's Site-specific CQCPP will be required to set forth the general framework and specific details of the methods and procedures that will be implemented to demonstrate that construction activities have been performed pursuant to the Contract Documents. The Site specific CQCPP will describe the quality control organization of the Remedial Contractor and the allocation of responsibilities for performing quality control activities.

The Contractor will also be responsible for developing a contingency plan in accordance with the Technical Specifications. The plan will include, at a minimum:

- A Pollution Prevention Plan for all materials brought to the work Site and spills related to batch plant operation that includes methods to address spills, should they occur;
- Emergency vehicle access/egress;
- Procedures for evacuating personnel from the work Site;
- A Flood Event Contingency Plan with measures to protect the Site from the effects of a flood; and
- A list of all personnel that may be contacted in case of an emergency.

3.2 Mobilization

The Remedial Contractor will be responsible for mobilizing all necessary personnel, equipment including but not limited to temporary facilities and materials to the Site required for implementation of this RDR. National Grid will provide use of the existing building for temporary offices, as described below.

The temporary facilities will include, but are not limited to, establishing equipment staging areas, material staging areas, decontamination areas and pads, and ingress/egress to the Site as further described below in Section 3.3. The proposed locations of these features are shown on Drawing C-111 (Appendix A).

National Grid will provide use of the existing building, including water, sanitary facilities, heating and cooling, for the existing building for use by the Remedial Contractor. The Remedial Contractor shall assist National Grid with maintaining heating and cooling in the building. The Remedial Contractor will also be responsible to maintain a clean environment in the building and protect the floors and other existing features. The Remedial Contractor will subcontract a cleaning service for the building for duration of the project.

In addition, National Grid will allow the Remedial Contractor to use the existing electrical service in the building. The Remedial Contractor must document that the existing electrical service and water in the building meets the demands for the work required by the Remedial Contractor to implement the remedy.

The Remedial Contractor will be responsible for providing temporary utilities at the Site which are not provided by National Grid. These utilities include but are not limited to: telephone service and internet service including wireless internet access for use by all personnel on-Site; and any other utilities required by the Technical Specifications (Appendix K).

3.2.1 Office Space

The Remedial Contractor will maintain office space, utilizing the existing building space, and mobilizing temporary office trailers, as needed, at the Site for the duration of construction activities. Office space will be provided and maintained for the NYSDEC, National Grid, National Grid's Duly Appointed Representative(s), the Design Engineer and the Remedial Contractor. The organization of the office space, such as the portion of the existing buildings occupied for the office space or the number of trailers and their locations, will depend on the Site logistics. Prior to its use, a pre-, interim, and post-survey must be performed by the Remedial Contractor to document the condition of the existing building. National Grid will also conduct a pre-, interim, and post- survey to document the conditions of the building during remedial work. The office trailers (if needed) and the office contents will comply with requirements of the Technical Specifications (Appendix K) of this RDR.

3.3 Site Preparation

The Site will be prepared, as needed, to facilitate the implementation of the proposed remedial activities. Site preparation activities performed by the Remedial Contractor will include, but will not be limited to, the following:

- Recording existing conditions at the Site and the Off-Site Property (including the exterior and interior of the existing building by photo documentation and surveying;
- Establishment of vibration control points within the existing building located on the Off-Site property;
- Provide security personnel at the entrance gate during normal working hours and, site security during non-working hours;
- Establishing a secure Site perimeter;
- Establishing stabilized construction entrances and widening ingress/egress gates, if required;
- Establishing/upgrading Site haul roads/truck routes;
- Clearing and grubbing including the removal of vegetation, concrete, former MGP structures, rail road ties/spurs, and any debris within the limits of the Core/Central Area, as required;
- Establishing equipment and material staging areas;
- Establishing the decontamination area(s);
- Conducting selective demolition;
- Locating and isolating work area and perimeter utilities, if any;
- Managing, protecting and supporting existing utilities in the work area;
- Establishment of locations for air monitoring by a third-party CAMP consultant;
- Establishing locations for vibration, settlement, and crack monitoring;
- Decommissioning of selected groundwater monitoring wells within the Core/Central Area; and
- Establishment of soil erosion and sedimentation controls.

Major activities are further described in the following subsections of the RDR.

3.3.1 Site Security

The Site perimeter fence will be inspected and maintained during the remedial activities. As needed, the Remedial Contractor will install temporary fencing with lockable gates to secure the Site. The perimeter of the Site will be secured and locked during non-working hours. Perimeter security checks will be performed daily by Brown and Caldwell and conditions will be noted and logged. National Grid will maintain access to the Site at all times by "double locking" the gates.

Twenty-four-hour security is anticipated for this work. During normal working hours, an employee of the Remedial Contractor will be assigned to the main entrance gate to control access to the Site. The employee will be equipped with a two-way radio with phone service to ensure constant contact with Site personnel. This employee will keep track of a daily visitor sign in book and will check IDs prior to visitors entering the Site.

All workers, Subcontractors and visitors will be required to sign a daily log. A list of persons authorized for Site entry will be maintained at the Site entrance.

3.3.2 Settlement, Vibration, and Noise Monitoring

The Remedial Contractor will submit a Settlement and Vibration Monitoring Plan (SVMP) in accordance with the Site's technical specifications. The SVMP will identify the relevant damage criteria, the proposed monitoring locations, and the mitigation procedures for responding to observed exceedances of the vibration and settlement thresholds. The SVMP will include requirements for the following:

- Vibration monitoring.
- Crack monitoring.
- Settlement monitoring.
- Noise monitoring.

A pre-construction vibration survey will be undertaken for two or more days prior to the initiation of the remedy implementation to serve as a baseline for background levels for the Site.

3.3.3 Stabilized Construction Entrance/Exit

A stabilized construction entrance/exit consisting of smoothly graded areas of sufficient area to accommodate equipment and truck traffic will be constructed. The stabilized construction entrance/exit will consist of crushed coarse aggregate stone underlain by non-woven geotextile fabric and will be maintained and redressed while in use. Tires of transport trucks entering/exiting the Site will travel across these stabilized entrance/exit and can be further inspected at these points. A decontamination pad will be in placed along the exit route for the Site. Routes on- and off-Site will be routinely monitored for build-up of excessive Site soils and dust. The Remedial Contractor is responsible for maintaining the street free of visible dust.

One ingress/egress point is proposed for the remediation activities and will require stabilized construction entrance/exit. The ingress/egress point to the Site will be from West Main Street. The proposed ingress/egress location is indicated on Drawing C-111 (Appendix A). The necessary municipal permits, if any, to maintain a construction entrance/exit will be obtained for the duration of the project by the Remedial Contractor. These permits will be obtained by the Remedial Contractor prior to mobilization to the Site.

A Maintenance and Protection of Traffic Plan (MPTP, Appendix L), has been prepared to support the implementation of the remedial activities at the Patchogue Former MGP Site. The MPTP describes the procedures that will be followed to maintain vehicular and pedestrian traffic and preserve the safety of motorists, highway workers, and pedestrians during implementation of the remedial construction.

3.3.4 Clearing and Grubbing

Vegetation and debris will be removed from work areas where remedial activities will occur. Debris, stumps, roots and other vegetation that are generated during clearing operations will be stockpiled, characterized and disposed of off-Site at an appropriate disposal facility.

3.3.5 Utility Clearance

During intrusive activities near utility structures, the clearance of subsurface utilities will be confirmed by physical means (i.e., soft digging). Physical clearance will be used to remove the soil at boring and excavation locations to a depth below where utilities would be expected to be encountered. A geophysical radar survey will be conducted by a survey Contractor to confirm utility structures prior to intrusive work. In addition, signage will be incorporated during remedial work to remind personnel at the Site to be cautious of low clearance and working under overhead lines. The locations of the underground utilities and overhead lines are shown on Drawings C-101 (Appendix A).

3.3.6 Equipment and Material Staging Areas

Equipment staging areas will be located to facilitate equipment ingress and egress and allow for proper sequencing of the remedial construction work. The construction equipment necessary to implement the remedial construction activities will be mobilized to the Site.

Material staging areas will be established for excavated material, debris, clean backfill, and liquid wastes (if generated). Staging areas will be underlain by plastic sheeting with perimeter berms to contain run-on and run-off. Forty-mil HDPE liners will be placed beneath the stockpiles and will be used to cover stockpiles to minimize rips caused by debris and/or the movement of materials and to be protective from the elements. Damaged or ripped liners/sheeting will be repaired or replaced, as necessary. The staging areas will be physically segregated to prevent cross contamination or commingling of materials. To the extent feasible, materials intended for off-Site transportation and disposal will be staged in areas of the Site that are not proximate to existing off-Site roadways in order to minimize the potential for off-Site impacts. Staging areas for materials destined for off-Site disposal will be principally located in the remaining areas of the Site subject to excavation.

ISS spoils and impacted debris will be covered with plastic to minimize odors as well as the effects of weather. A construction detail for the temporary waste containment area is included on Drawing C-500. Odor suppressing foam will be applied to stockpiles, as necessary, to minimize the potential for odors generated by the impacted soils.

The locations of the staging areas are shown on Drawing C-111 (Appendix A).

3.3.7 Decontamination Area

During the implementation of the remedial construction activities, the Site will be divided into three primary zones: the exclusion zone, the contamination reduction zone, and the support zone. These locations will be identified in the field during the implementation of the remedial activities based on the location of the work zones. The decontamination area will be located within the contamination reduction zone along the exit route and will include the personnel decontamination station and the equipment decontamination pads. Heavy machinery, trucks, equipment and personnel exiting the exclusion zone will be subject to the decontamination procedures. A construction detail for the decontamination pad is included on Drawing C-500 (Appendix A).

The location of the decontamination area is shown on Drawing C-111 (Appendix A).

3.3.8 Monitoring Well Decommissioning

Protection of the existing groundwater monitoring wells within the Central/Core area would be difficult and impractical. These monitoring wells depicted on Drawing C-108 (Appendix A) will be decommissioned prior to excavation and ISS activities. Each well will be decommissioned in accordance with "CP-43: Groundwater Monitoring Well Decommissioning Policy" (NYSDEC, November 2009) by grouting in-place. Prior to decommissioning, wells will be monitored for NAPL. Any observed NAPL will be recovered before decommissioning.

To decommission the groundwater monitoring well, a tremie pipe will be lowered to the bottom of the well and cement-bentonite grout pumped through the tremie pipe so that the well is grouted from the bottom to the top. Water displaced from the well 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 polyvinyl chloride (PVC) casing that is above grade. The area where the protective cover/casing was removed will be backfilled with clean soil to grade.

Over-drilling and extraction rather than grouting in place will not be used at the Site for well decommissioning. The guidance document, "CP-43: Groundwater Monitoring Well Decommissioning Policy" (NYSDEC, November 2009), permits grouting in place as long as the well does not penetrate a confining layer and the well is intact. The wells at the Site do not penetrate a confining layer and the wells are in intact (i.e., the wells are sealed above the sand pack).

Monitoring wells located outside of the ISS area that are to remain will be protected by either wooden fences/barricades, orange construction fencing and/or applicable signage. Site personnel will be made aware of these areas in the daily safety discussions; the Remedial Contractor will be responsible for any damages incurred at the Site.

3.3.9 Soil Erosion and Sediment Control

Prior to commencement of the remedial activities, temporary soil erosion and sediment control (SESC) measures will be installed to prevent and minimize the potential of soil and sediment from entering the Patchogue River and the wetland areas. The elements of the proposed SESC measures will be designed and installed in accordance with the New York State Standards and Specifications for Erosion and Sediment Control. In addition, remedial activities will be implemented to minimize erosion and silting and the potential for fugitive odor and dust emissions.

SESC measures will be employed utilizing Best Management Practices (BMPs) including silt fencing, hay bale dikes, storm drain inlet protection, stabilized construction entrances/exits and dust control measures. At a minimum, silt fence/hay bale dikes will be installed to delineate the limit of the remedial work area (installed on the down slope side) and around the perimeter of any stockpile areas. The SESC measures will be installed as shown on Drawing C-800 (Appendix A) and in strategic locations based on visual observation of flow patterns and the topography of work areas to control sediment entrained storm water from exiting and entering work areas. Details for each type of SESC measure are presented on Drawing C-801 (Appendix A).

During remedial construction, SESC measures will be inspected and maintained daily and following precipitation events. Inspection and maintenance activities will be documented in the field logs. Accumulated sediment will be removed from the erosion and sediment controls, as needed. Sediment that originates from the remedial work areas will be added to the stockpile(s) for off-Site disposal. Sediment will be removed from behind the silt fence and hay bales when it accumulates to a depth greater than 0.5 feet deep behind the barrier.

3.3.10 Storm Water Pollution Prevention Plan

A Storm Water Pollution Prevention Plan (SWPPP), included as Appendix M of this RDR, has been prepared to support the implementation of the remedial construction activities. During the implementation of the remedial actions, storm water management practices will be implemented to control potential impacts (i.e., erosion and sediment loading) to Site-related storm water runoff and achieve the following objectives:

- Minimize potential erosion of existing soil/sediments within active work areas;
- Minimize the potential for the conveyance of sediment-laden storm water beyond the project work limits;
- Minimize potential for stormwater to enter Patchogue River; and
- Minimize accumulation of water within active work areas.

After a rain event, the water table at the Site may become elevated and result in localized flooding that will require management in accordance with the SWPPP.

3.4 Remedial Activities

The remedial activities will include the following:

- Selective Demolition (removal of all former MGP structures and rail road ties/spurs);
- Excavation;
- Embankment Protection (sheet piles);
- In-Situ Solidification
- Backfilling and Compaction;
- Construction of Environmental Cap; and
- Site Restoration.

These activities are further described below.

3.4.1 Selective Demolition

Remnants of former structures (i.e., concrete pads, pipes, rail road ties/spurs), if encountered, will be demolished utilizing a hoe ram, hydraulic hammer or equivalent attachment mounted on an excavator, backhoe or other conventional excavation equipment. After demolition, the debris will be prepared and decontaminated, as necessary, to meet the acceptance criteria of the selected disposal or recycling facility. Preparation will consist of demolishing the structural materials into pieces that are manageable and meet facility acceptance criteria. Decontamination of concrete debris will consist of pressure washing using a high pressure, low volume power washer. In addition, physical/mechanical agitation (scraping with hand tools) of soil adhered to debris may be utilized to minimize wastewater generation. Generated decontamination fluids will be containerized on-Site where it will be characterized for off-Site disposal.

3.4.2 Excavation

In accordance with the requirements of the ROD and the ESD, excavation by the Remedial Contractor will be conducted for the following purposes:

- On-Site Soil Excavation;
- Removal of former MGP structures; and
- Management of ISS spoils.

Excavated soils will be visually inspected for impacts. Impacted soil above the existing groundwater table will be directly loaded and transported to the material staging area. Impacted soils generated below the groundwater table will initially be placed in a stockpile in a temporary staging area constructed near the edge of the excavation. This temporary staging area will be sloped towards the excavation. Entrained water will be allowed to gravity drain back into the excavation. The gravity drained excavated saturated soils may also be mixed with excavated unsaturated soils or amending materials to reduce moisture content while located within the temporary staging area. Amending of the soil will be for the purposes of improving handling characteristics and for meeting disposal facility acceptance criteria. The amended soil will then be placed in the material staging area pending characterization and off-Site disposal.

3.4.2.1 Truck Traffic

To maintain vehicular and pedestrian traffic and to preserve the safety of motorists, highway workers, and pedestrians during remedial construction activities on West Main Street, traffic control measures will be implemented in accordance with the MPTP (Appendix L). Appropriate warning and guidance devices will be installed and maintained by the Remedial Contractor throughout the implementation of the remedial action in accordance with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD). Warning and guidance devices, such as dedicated flaggers, will be selected in order to appear visible to both pedestrian and vehicular traffic at all times, including evening or low-light times.

3.4.2.2 On-Site Excavation

Based on the observations of NAPL during the installation of the investigation borings, the Site area containing NAPL impacted soils was broken into six sub-areas based on the depth of observed NAPL impacted soils as depicted on Drawing C-400 (Appendix A). Of these six (6) areas, a single area, approximately 40 feet long by 20 feet wide, located along the west-southwest portion of the Site remedial area is anticipated to be excavated. The depth of NAPL impacted soils in this area is four (4) feet bgs. The excavation of this area will occur after the ISS of the remaining five (5) areas. This area will not be dewatered during the excavation.

Also, as stated in the notes on Drawing C-112 (Appendix A), two feet of materials will be excavated over the entire Central/Core Area in order to facilitate installation of the environmental cap.

3.4.2.3 Removal of Former MGP Structures

Removal of former MGP-related structures will be performed within the ISS and excavation areas if encountered. Structures identified during remedial action implementation will be fully removed even if it extends beyond the limits of the remedial action, as shown on Drawing C-110 (Appendix A). Any structure that may be encountered during the remedial action implementation will be removed in its entirety.

3.4.2.4 Management of ISS Spoils

Prior to ISS implementation, a pre-excavation is frequently conducted to accommodate the increase in volume of soil which occurs during the ISS. At the Patchogue Site; however, the water table at the Site has been observed at times to be very close to, or at, the ground surface. The Remedial Contractor will perform some initial excavation to facilitate the mixing and use the excavated soils to construct a berm to contain the swell material.

Following the completion of the soil mixing in the ISS footprint, ISS spoils will be excavated. The excavation and handling of the ISS spoils is described in Section 3.4.3. The ISS spoils will be excavated to the depth allowing for the installation of a 4-foot cover over the ISS area.

3.4.3 In-Situ Solidification

ISS performed as part of the Site remedy will involve mixing of treatment agents (Portland cement and bentonite) with the MGP NAPL impacted soils within the Central/Core area and the adjoining area on the Off-Site Property. The ISS will be performed by BMM. The BMM solidifies rectangular cells. The cells are overlapped to provide complete coverage for the area to be solidified. The desired changes to the impacted soil include:

- Decreasing the hydraulic conductivity of impacted soils; and
- Achieving soil strength compatible with the anticipated Site use.

ISS is specified in the ROD as the element of the remedy that will address the source of the NAPL impacts. Per the ROD as amended in the ESD, ISS shall be implemented within the volume of the Central/Core Area and the adjoining area on the Off-Site Property where MGP-related NAPL and associated soil is located. The ISS area is based on the location of MGP-related NAPL and associated soil. The ISS area is depicted on Drawings C-110, C-400, and C-401 (Appendix A).

The depths and the area of the ISS application were selected based on the observations of intervals of NAPL saturation encountered during the drilling and sampling of soil borings, results of soil sample analyses from these borings (concentrations of MGP-related constituents above SCOs associated with NAPL occurrence), and observations of NAPL in monitoring wells. Accordingly, ISS will be performed from the ground surface to the deepest NAPL horizon encountered. The depth to which NAPL intervals were encountered varies throughout the targeted ISS area; the deepest that NAPL was encountered in the soil was 23 feet bgs. The volume of subsurface soil that will be treated using ISS is estimated to be 7,500 cubic yards (cy). Corresponding calculations are presented in Appendix N.

A Treatability Study has been performed to identify the mix (See Section 2.6). A pilot study will be conducted prior to the full-scale implementation by the Remedial Contractor. Verification sampling will be performed during the pilot study and during full-scale ISS implementation. Coring will be performed after the completion of the ISS to confirm that the mix has achieved the above-mentioned objectives. The overall effectiveness of the ISS portion of the remedy will be verified by sampling of groundwater to confirm that the appropriate groundwater quality standards are being achieved. These topics are discussed below.

ISS Treatability Study

A TS has been performed to identify the design mix. The study is described in Section 2.6. Results indicate that a mix containing 8-10% w.w. Portland cement and 1.5% w.w. bentonite would be able to achieve the performance objectives.

Site-Specific ISS Performance Standards

Based on results of the TS, remedial objectives, and geotechnical considerations, the Site-specific performance standards were developed for ISS and are as follows:

- Achieving an UCS of 30 to 150 psi, with the arithmetic average of all verification samples equal to, or greater than, 50 psi; and
- Achieve target geometric mean hydraulic conductivity of all individual samples as well as the maximum hydraulic conductivity for the individual samples, as specified by the Design Engineer and approved by the NYSDEC following the completion of the pilot-scale study described below. The goals for the mean and maximum values are $1x10^{-6}$ cm/s or less and 1×10^{-5} cm/s, respectively, as feasible.

ISS Pilot Study

As required by the ROD, a pilot-scale study will be performed by the Remedial Contractor prior to the implementation of the ISS. Since the ISS area is relatively small, it was determined that a separate mobilization for the study is not warranted, and that the pilot study would be conducted as part of the mobilization for the full-scale ISS as the initial stage of the ISS implementation. The pilot study will consist of ISS cells for each mix design (various Portland cement and bentonite ratios) considered for use during the full-scale implementation, in order to document that one or more can achieve the performance standards.

The pilot study will be conducted in an area with high MGP impacts and deeper ISS mixing. A pilot study location in the area located between well MW-6 and borings SB-122 or SB-123 would satisfy the criteria above. NAPL was observed MW-6, while deep and significant NAPL impacts in soil were observed in the two borings. The cells will be installed in a manner that if the performance testing results from some of the cells completed during pilot study do not meet the ISS performance standards, those cells can be surrounded by additional cells that meet the performance standards during full-scale implementation.

Full-scale ISS will not commence until after the pilot study is completed and satisfactory results are obtained that support a mix design capable of achieving the performance standards (refer to Section 2.6).

ISS Spoils Management

As part of the implementation of the ISS, spoils are generated and disposed of off-Site. The total volume of the spoils is based on the amount of swell of the treated soil generated as a result of the ISS, and the need to accommodate the surface cover above the top of the solidified mass. At the Site, the top of the solidified mass will be four feet below the finished grade. Based on the results of the TS, the swell amount is expected to be within the 40-50% range. Based on that, the volumetric quantity of spoils is estimated at 5,800 CY (Appendix N).

This is the sum of the potential pre-excavation volume and the ISS swell. The actual volume of the spoils generated will depend on the groundwater conditions, weather, and amount of pre-ISS excavation performed and, therefore, may differ from the estimate presented here.

The waste management for ISS spoils will be as follows:

- ISS spoils will be removed from the ISS area. The Contractor will be required to take precautions to avoid the spoils solidifying into unmanageably large blocks.
- Waste characterization samples will be collected before the ISS spoils set up. Samples will be cured and conveyed to the laboratory. Sampling and analysis of waste characterization samples will be conducted in accordance with procedures identified in the Technical Specifications (Appendix K).
- After receiving the final waste characterization results and obtaining approval from the disposal facility, the waste materials will be transported to a permitted non-hazardous treatment, storage, or permitted and approved NG/NYSDEC disposal (TSD) facility.

ISS near Sensitive Features

ISS will occur in the vicinity of sensitive features (i.e., the Off-Site Property masonry building, the Patchogue River bank) that will require the use of alternate ISS methods incorporating special precautions. The stability of the bank of the Patchogue River was evaluated (Appendix N) and found to be adequate. However, as a precaution, the special ISS procedures discussed below will be used to ensure that ISS grout is not spilled into the river and/or wetlands.

Adjacent to sensitive buildings/structures at the locations shown on Drawing C-401, ISS implementation will be modified to maintain the structural integrity of the building/structure. The pre-excavation depth

will be limited to a depth of 2 feet to prevent undermining of structures or sloughing of soils. The ISS mixing will proceed sequentially in small, alternating sections adjacent to the sensitive structure as shown on Drawings C-401 and C-500. The ISS cells will be sequenced so that every fourth cell is completed. After the ISS-treated material is sufficiently cured in the initial cells, the intervening secondary and tertiary cells will be completed in the sequence shown on Drawing C-500, until soil around the sensitive structure is remediated to the target depth.

Along the Patchogue River, steel sheet piling as depicted on Drawings C-301 and C-401 (Appendix A) will be used in addition to the sequenced ISS described above. The purpose of the sheet piling is to prevent potential piping of the ISS grout through the river bank before the grout has set.

Verification Sampling and Coring

To document that the ISS achieves the established performance standards, verification sampling will be conducted during the ISS pilot study and during full-scale implementation. Samples will be collected from the ISS mass immediately after the mixing of reagents into the subsurface and before the ISS cell cures. Sampling frequency will consist of the following:

- During the pilot study, samples will be collected from each ISS cell as well as the overlap between cells. Samples will be collected at several discrete depths from each sampling location.
- During full-scale implementation, a primary sample and a secondary sample will be collected from a discrete depth from two ISS cells, based on the following frequency:
  - One pair of samples (primary and secondary) per 500 cubic yards (on an average weekly basis) of solidified soil (up to 2,000 cubic yards of treated soil);
  - One pair of samples (primary and secondary) per 1,000 cubic yards of solidified soil (after 2,000 cubic yards of soil have been treated);
  - One pair of samples (primary and secondary) per day (minimum); and
  - One pair of samples (primary and secondary) if visual observations of the solidified soil note significant changes to the solidified material.

Approximately 6 cylinders will be made from each sample in order to have samples for possible retesting at later curing periods.

The primary sample will be cured for seven to 14 days and submitted to the laboratory where they will be tested for hydraulic conductivity and UCS. Sampling and analysis of ISS performance samples will be conducted in accordance with procedures identified in the project specifications (Appendix K).

Core samples shall be collected from the ISS mass for quality control purposes, in accordance with the NYSDEC Guidance for Quality Control Coring on In-Situ Solidification Projects. Cores shall be completed using direct-push sampling methods, HQ wireline coring methods or an equivalent method. Cores will be taken at a rate of one core borehole for every 5,000 square feet of ISS, but not less than two (2) bore holes. Core samples will be visually inspected for the following criteria, and results recorded:

- Visible NAPL
- Non-mechanically induced cracking within the core
- Percent of core sample recovered
- NAPL coating on drilling tools
- NAPL in drill wash tub

Additional details regarding verification sampling and coring are provided in Specification Section 31 80 00.

Corrective Action

Results of the sample testing and coring will be compared to the project-specific hydraulic conductivity, UCS and NAPL-encapsulation performance standards. If results do not comply with the performance standards, the NYSDEC will be consulted regarding the need for and the type of corrective action. The corrective actions may include:

- Completion of additional cores borings around the area of concern to determine if the identified NAPL within the ISS mass is encapsulated;
- Analysis of additional cylinders formed from the same sample at a longer cure time
- Analysis of the secondary sample obtained from the same batch of solidified soil to determine if the result from the failing sample is anomalous and isolated;
- Modification to the mix design;
- Installing new cells to surround the cell(s) represented by the failing sample; and
- Re-working (e.g., re-mixing) the cell(s) represented by the failing sample with additional grout, if possible.

Additional details regarding corrective action are provided in Specification Section 31 80 00.

3.4.4 Backfilling and Compaction

Backfill must meet the requirements of 6 NYCRR 375-6.7(d) and meet the following criteria in accordance with Division of Environmental Remediation, Technical Guidance for Site Investigation and Remediation (DER-10):

- Comply with Remedial Action Objectives;
- Be free of extraneous debris or solid waste;
- Be recognizable soil or other unregulated material as set forth in 6 NYCRR Part 360 and materials for which NYSDEC has issued a beneficial use determination;
- Not exceed the allowable constituent levels for imported fill or soil; and
- Be tested as described below.

Sampling is required for all imported soil for use as backfill or cover material and must be approved by NYSDEC in advance. In addition, on-Site material re-use forms must be submitted and approved by the NYSDEC prior to soil re-use. Characterization samples of the material will be a minimum of one sample analyzed from every new source (virgin mine/pit or material sources other than a virgin mine/pit) and the sampling frequency will be determined in accordance with the DER-10 Table 5.4(e)10 presented below:

Table 5.4(e)10
Recommended Number of Soil Samples for Soil Imported To or Exported From a Site

Contaminant	VOCs	SVOCs, Inorganics & PCBs/Pesticides	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
➢ 1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

Documentation of the source of fill must be provided to National Grid for approval of the source of the material before it is used on the Site, which should include:

- The name of the person providing the documentation and relationship to the source of the fill;
- The location where the fill was obtained;
- Identification of any state or local approvals as a fill source; and
- If no prior approval is available for the source, a brief history of the use of the property which is the source of the fill.

Bills of lading will be provided to Nation Grid for inclusion into the Final Engineering Report (FER) to document that the fill delivered was from a NYSDEC-approved source(s).

3.4.4.1 Backfill Materials

Backfill at the Site will be a coarse crushed stone aggregate with a NYSDOT Standard Specifications for Coarse Aggregate size designation Type 1 or Type 2 (or approved equal). These NYSDOT designations include the following gradations:

Table 3-1. NYSDOT Coarse Aggregate Material Designations

Sieve Size	Type 1 Percent Passing	Type 2 Percent Passing
1 ½ inch		100%
1 inch	100%	90% - 100%
½ inch	90% - 100%	0% - 15%
¼ inch	0% - 15%	

3.4.4.2 Backfill Placement and Compaction

Backfilling on Site will occur over areas treated with ISS, within the four (4) foot excavation area (located along the west-southwest portion of the on-Site remedial area), areas receiving the environmental cap (Section 3.4.5) and areas receiving crushed stone surface treatment.

Within the water table, backfill will be placed in loose layers and tamped in-place using excavation equipment. Above the groundwater table, all backfill will be placed in 12-inch thick lifts (maximum) and mechanically compacted. The top surface will be finished using a smooth-drum roller.

3.4.5 Construction of the Site Covers

Following excavation and ISS activities, Site Covers will be installed to allow for restricted-residential use. Drawing C-112 (Appendix A) identifies the cover areas. The cover at the Site will consist of a demarcation layer and two-foot thick layer of clean crushed stone (NYSDOT Coarse Aggregate Type 1 and Type 2). The crushed stone cover will require minimal maintenance, will allow for stormwater infiltration, and will limit surface exposure to residually impacted soils. The Site Cover on the Off-Site Property will consist of a demarcation layer followed by 18 inches feet clean crushed stone and 6 inches of new asphalt pavement. The details of the covers are shown on Drawing C-501 (Appendix A).

3.4.6 Stormwater Management System

The central portion of the Site and the adjacent Off-Site property will be graded to direct surface water to a swale that will flow south to a wet meadow to be constructed on the southern end of the Core/Central Area of the Site. The wet meadow will be designed to collect stormwater which will overflow a weir structure along the southern side of the wet meadow to a vegetated area which drains to the Patchogue River. The construction activities will include surface grading, construction of a concrete swale and a wet

meadow with an outlet weir. A technical memorandum presenting the design and calculations of the stormwater management systems is presented in Appendix R.

3.4.7 Restoration

Restoration activities will consist of re-establishing chain link fencing, removing soil erosion and sediment control measures, a post survey of the building, and general clean-up activities including the interior of the building at the Site. Any areas outside of the remediation footprint that were disturbed during the remedy implementation will be restored with the coarse stone layer or asphalt pavement as shown on Drawing C-112 (Appendix A) similar to that described for the Site Covers (but without a demarcation layer).

3.5 Post-Remedial Action Activities

As per the requirements of NYSDEC DER-10, Chapter 5, Section 5.8, the implementation of the remedy proposed in the ROD and as amended in the ESD and described in this RDR will be documented in a Final Engineering Report (FER). The FER will be certified by a Professional Engineer (BC) licensed in the State of New York and will include, but not be limited to, the following:

- Description of the remedy as constructed pursuant to the approved remedial design;
- Description of problems encountered during construction and a discussion of their resolution;
- Listing of the waste streams, quantities of materials disposed off-Site and the facilities used for disposal;
- Boundaries of property subject to be subject to an environmental easement and/or other institutional controls;
- Restoration activities;
- Tables and figures depicting pre- and post-remediation data;
- A summary of costs;
- As-built drawings;
- Identification of applicable engineering and institutional controls;
- Bills of Lading; and
- Site Management Plan.

3.5.1 Environmental Easement/Site Management Plan/Operations, Maintenance, and Monitoring (OM & M) Plan

This section discusses the Environmental Easement (EE), the Site Management Plan (SMP) and the Operation, Maintenance and Monitoring Plan (OMMP) that will be implemented at the Site as part of the remedy.

3.5.1.1 Environmental Easement

An EE will be established for the Site and the Off-Site Property since environmental media impacted by concentrations exceeding applicable regulatory standards will remain in-place after the completion of the remedial activities. The EE will serve to:

- Implement, maintain and monitor the ECs;
- Prevent exposure to the remaining MGP-related impacts; and
- Limit the future use and development of the property to restricted residential, commercial and industrial, or as defined in 6 NYCRR Part 375-1.8(g) subject to local zoning laws;
- Require compliance with the Site Management Plan;

- Restrict the use of groundwater as a source of potable or process water without necessary treatment as determined by the NYSDEC, NYSDOH, or Suffolk County DHS; and
- Require the property owner to complete and submit a periodic certification of the institutional and engineering controls to the NYSDEC.

3.5.1.2 Site Management Plan

An Interim Site Management Plan (ISMP) was prepared for the Site and the Off-Site Property. The ISMP was submitted to the NYSDOH in January 2016 and is currently in place. It describes Site and Off-Site property institutional and engineering controls and the inspections, monitoring, maintenance, and reporting of intrusive activities required. The ISMP is attached in Appendix O.

Following the completion of the remedial construction activities, a detailed post-remediation SMP will be submitted to the NYSDEC for review and approval. This SMP will detail the proposed initial and continuing monitoring and maintenance activities for the Site. The SMP will be developed to:

- Address residually contaminated soils that may be excavated from the Site during future redevelopment. The plan would require soil characterization and, where applicable, disposal/reuse in accordance with NYSDEC regulations;
- Provide for the operation and maintenance of the components of the remedy; and
- Identify any use restrictions to on-Site development or groundwater use.

3.5.1.3 Operations, Maintenance and Monitoring Plan

An OM&M Plan will be included as part of the SMP. The OM&M Plan will detail the operations and maintenance of the physical components of the remedy (i.e., the stream bank, cover, ISS formation, etc.). The OM&M Plan will be prepared in accordance with Section 6.2.3 of NYSDEC DER-10; and include, but not be limited to, the following tasks:

- Manage the final cover system to restrict excavations below the soil cover, pavement, or buildings;
- Continued evaluation of the potential for vapor intrusion for any buildings developed on the Site, including a provision for mitigation of any identified impacts or exposures;
- Monitoring of the stream bank restoration, groundwater and sediment quality;
- Identification of use restrictions on the Site and adjacent properties; and
- Continued operation and maintenance of the components of the remedy.

3.6 Air Monitoring

Air monitoring will be performed during the implementation of the remedial actions to protect the health and safety of Site workers and to confirm that air impacts from Site-related activities are not migrating off-Site. The monitoring program will include monitoring for vapor, odors, and dust.

3.6.1 Vapors

Vapors will be monitored continuously during the construction activities in accordance with the CAMP and the HASP. The CAMP and HASP are included as Appendices I and J, respectively of this RDR.

Real-time air monitoring devices will be used to analyze airborne contaminant concentrations within the exclusion zone or when tasks being conducted, or exposure conditions change (whichever air monitoring frequency is less). If elevated concentrations are indicated, suitable mitigation measures will be taken in accordance with the CAMP (Appendix I) and the HASP (Appendix J).

3.6.2 Odors

In the event that objectionable odors are detected, temporary controls will be implemented. Odors will also be controlled by sequencing excavation in a manner that will result in minimizing areas of open excavation or ISS. Odors will be mitigated, if necessary, by placing a layer of non-odorous soils or plastic sheeting over the excavation area or stockpile (overnight and off-hours). In addition, foam application equipment and an adequate supply of odor reducing foaming agent will be on Site and available for application to the excavation area or stockpiles, as needed. Further, Biosolve®, Rumsar®, or an approved equal may be sprayed during excavation and waste handling and management activities.

3.6.3 Dust

Dust and air quality will be monitored continuously during the construction activities in accordance with the CAMP and the HASP included as Appendices I and J, respectively to this RDR.

Dust control measures will be implemented, as necessary, to control airborne dust during implementation. The Remedial Contractor will be required to proactively implement dust suppression measures during construction activities which include, but are not limited to:

- Wetting equipment and excavation faces during excavation activities and structures or hard surfaces during demolition with water or amended water solutions;
- Spraying water or amended water on buckets during excavation and loading/unloading;
- Spraying water or amended water on un-paved construction access roads and paved access roads;
- Limiting the area of disturbed ground surface;
- Covering stockpiles when active loading or unloading is not being performed;
- Hauling earthen materials and waste materials in properly tarped or watertight containers; and
- Covering disturbed areas (e.g., with geotextile fabric) when active excavation is not occurring to minimize dust generation.

The dust control measures identified above include applicable BMPs for dust control, as defined in the USEPA's Dust Control BMP guidelines.

The Contractor will be required to provide and maintain a supply of water and appropriate equipment (e.g., hoses, misters) in the event that it is necessary to control dust generation. In addition, the Contractor will be required to contain excess water and control runoff. Excess water will be managed in accordance with applicable regulations.

3.6.3.1 Work Zone Air Monitoring

Work Zone Air Monitoring will be performed in compliance with the HASP included in Appendix J of this RDR by the Remedial Contractor. 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 air monitoring 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 workers with the greatest exposure potential in each active work area. Real-time measurements may cease being

collected when sufficient historical data is generated to warrant its cessation. Air monitoring will be reinstated if potential exposure conditions change.

Air monitoring equipment will be calibrated daily with the results being recorded for project files. The results of air monitoring will be recorded on an Air Monitoring Form and will be retained in the project files following completion of field activities. A copy of the Air Monitoring Form is included in the HASP.

3.6.3.2 Community Air Monitoring

A CAMP has been developed and is included in Appendix I of this RDR. The CAMP has been developed in accordance with the requirements of the NYSDOH "Generic Community Air Monitoring Plan, Revision 1, June 2000" guidelines and the requirements of "Fugitive Dust and Particulate Monitoring" guidelines as presented in Appendix 1A and Appendix 1B, respectively, of the NYSDEC, Final DER-10, "Technical Requirements for Site Remediation", dated May 2010. The CAMP serves to provide specific procedures for measuring, documenting, and responding to potential airborne contaminants during the remedial construction activities. The CAMP will be implemented to reduce risk of potential exposure of Site contaminants to neighboring residents. Prior to its implementation, the final CAMP will be reviewed and revised as necessary by an independent third-party CAMP consultant.

The CAMP is designed to:

- Provide monitoring, Action Levels, Alert Levels, and contingency procedures to prevent exposure of Site workers and nearby residents to potential volatile contaminants; and
- Provide a contingency plan that prevents significant airborne contaminant release from the Site.

During the implementation of remedial construction activities, work zone and fence line perimeter air monitoring will be conducted by an independent third-party CAMP consultant using a combination of real-time continuous air monitoring at fixed locations and walk around perimeter and work zone monitoring using hand-held instruments.

A Contingency Plan with defined, specific response actions will be implemented if 75% of the Action Level for any contaminant is exceeded. The response actions, potentially including work stoppage, will prevent or significantly reduce the migration of airborne contaminants from the Site.

3.7 Odor Control

Odor will be monitored during excavation, soil mixing and handling of impacted soils from the Site. In the event that excessive odor emissions are detected, controls will be implemented. Odor controls will include the use of odor suppressing foam and foaming devices or tarps to cover open ISS areas or stockpiles. Odors will also be controlled by sequencing the work in a manner that will result in manageable areas of open excavation. Odors will be mitigated, if necessary, by placing a layer of non-odorous soils or polyethylene sheeting over the remediation area or stockpile (overnight and off-hours). In addition, foam application equipment and an adequate supply of odor reducing foaming agent will be available for application to during waste handling and management activities or stockpiles, as needed. Odor control may also be performed through the use of odor suppressant sprays (e.g., Biosolve®) during remedial construction and waste handling activities. Equipment and supplies required to implement the odor control measures will be maintained at the Site throughout the entire duration of the remedial activities. The Remedial Contractor will be prepared to implement the odor control measures at any time during the excavation.

3.8 Vapor Management

Vapor management technologies and processes have been evaluated to mitigate or eliminate potential impacts during the remedial activities. A contingency plan is included as part of the CAMP. The purpose

of the contingency plan is to identify potential control measures that may be implemented in response to elevated levels of target compounds. In general, a tiered warning Action Limit and response action will be implemented during the air monitoring program. Tiered warning Action Limits are defined as:

- **Action Limit 1 (Green)** – Normal or ambient air conditions where all target concentrations are less than 50% of the NYSDOH Generic CAMP Action Limit.
- **Action Limit 2 (Yellow)** – Concentration of at least one target is equal to or greater than 50% of the Action Limit, but less than 75% of the NYSDOH Generic CAMP Action Limit.
- **Action Limit 3 (Orange)** – Concentration of at least one target is equal to or greater than 75% of the Action Limit, but less than the NYSDOH Generic CAMP Action Limit.
- **Action Limit 4 (Red)** – Concentration of at least one target is greater than the NYSDOH Generic CAMP Action Limit.

The contingency plan will rely on real-time data generated from the fixed-station monitoring locations. These data sources will be evaluated together in order to make appropriate decisions concerning Site conditions and potential control measures.

3.9 Decontamination

During the implementation of the remedial construction activities, the Site will be divided into three primary zones: the exclusion zone, the contamination reduction zone, and the support zone. These locations will be identified in the field during the implementation of the remedial activities based on the current work area(s). Equipment and personnel decontamination will take place within the contaminant reduction zone at dedicated decontamination stations/pads. Heavy machinery, trucks, equipment and personnel exiting the exclusion zone will be subject to the following decontamination procedures.

3.9.1 Equipment Decontamination

Decontamination activities will include the removal of contaminated soil, debris and other miscellaneous materials from all construction equipment and tools utilized within the exclusion zone using a combination of high-pressure water sprays, low pressure hoses, and detergent washing. In addition, physical/mechanical agitation (brushing/scraping with hand tools) of soil may be utilized to minimize wastewater generation.

The decontamination pad(s) will be constructed to adequately facilitate decontamination of the largest mobile construction equipment and to withstand the anticipated traffic loads throughout the duration of the project. The decontamination pad(s) will be an area with a bermed perimeter lined with crushed stone and underlain by a geotextile layer and two 40-mil. HDPE sheets. The decontamination pad(s) will be constructed to meet the following requirements:

- The area facilitating the decontamination pad(s) will be modified as needed to accommodate the pad(s). Large rocks, stones and other obstructions will be removed from the prepared subgrade to prevent damage to the overlying decontamination pad containment system;
- Berms will be installed along both sides of the decontamination pad;
- The pad area and berms will be covered with a thin layer of sand or stone dust;
- The pad area and berms will then be lined with two layers of 40-mil. HDPE sheeting (thick enough to withstand daily use) and a non-woven geotextile and covered with crushed stone in a manner that allows rinsate water to freely drain and collect in a sump for removal and disposal;
- The 40-mil. HDPE sheeting will be installed in one continuous piece and the geotextile layers will be overlapped a minimum of 12 inches;

- An eight-inch layer of three-quarter inch clean stone will be placed on top of the two geosynthetic layers. Wood planks or mats may be placed on top of the eight-inch stone layer to provide a stable traveling surface for vehicle wheels and tracks;
- The pad area(s) will be graded for easy entrance and exit to vehicles and equipment;
- The pad(s) will be able to hold a minimum of four inches of standing water at the shallowest point within the containment. It will be sized sufficiently to prevent splashing and spraying from decontamination activities from contacting the surrounding unprotected surfaces;
- The decontamination pad will be graded to a sump to allow decontamination rinse water to be captured and either be containerized and transported off-Site for disposal at an approved facility or be transferred to the temporary on-Site plant for treatment and discharge. Collected rinse water will be managed in accordance with the requirements of the Technical Specifications (treated on-Site and discharged to the Patchogue River under a NYSDEC-approved State Pollutant Discharge Elimination System (SPDES) Equivalency Permit);
- In the event that the size of the pad is limited by Site constraints, a curtain or 10-mil sheeting will be constructed around the pad to eliminate the possibility of wash water and/or sediment leaving the decontamination area;
- The pad(s) shall be kept empty and protected from rainwater when not in use;
- Material that does not infiltrate into the spaces between the crushed stone will be manually consolidated and transferred to a disposal vehicle;
- Residual soil or waste materials generated during decontamination will be collected and managed with the excavated impacted soils; and
- Upon completion of the remedial activities, the components of the decontamination pads (i.e., sand or stone dust, HDPE sheeting, the non-woven geotextile and the clean stone) will be managed as contaminated materials. These materials will be characterized and disposed of at an off-Site facility permitted to accept the various types of waste.

3.10 Waste Management

Waste materials intended for off-Site transportation and disposal will be staged in areas of the Site that are not proximate to existing off-Site roadways in order to minimize the potential for off-Site impacts. All staging of excavated soil and impacted debris will be performed on staging areas that are underlain by plastic sheeting with perimeter berms to contain run-on and run-off. Excavated soils and impacted debris will be covered with plastic to minimize impacts from odors as well as the effects of weather. Odor suppressing foam will be applied to stockpiles, as necessary, to minimize the potential for impacts from odors generated by the impacted soils.

3.10.1Transportation

During the implementation of remedial construction activities, the Remedial Contractor will coordinate and manage transportation and disposal of generated wastes to National Grid-approved disposal facilities. The anticipated wastes to be generated during the remedial construction work consist of soil, wastewater, construction debris, miscellaneous debris and PPE. All wastes designated for off-Site disposal will be transported in vehicles that will be lined and covered with solid covers with safety latches on the gates to prevent spills and/or releases to the environment. All transporters will be reviewed for permitting requirements and licensing.

All wastes designated for off-Site disposal will be transported to solid, liquid, and hazardous waste treatment/disposal facilities that have been approved by National Grid. All disposal facilities have been reviewed for permitting and licensing requirements, licenses and regulatory enforcement status.

National Grid will be identified as the generator of all solid wastes transported from the Site. A Manifest and/or Bill of Lading corresponding to each shipment of solid waste will be completed and a representative of National Grid will sign the waste documents.

3.10.2 Waste Management Plan

A Waste Management Plan (WMP), included as Appendix P to this RDR, has been prepared to describe the characterization, handling, treatment/disposal, and re-use requirements for the waste streams anticipated to be generated during the work.

Former MGP Structures

Former MGP structures which may be encountered during the remedial activities are likely to consist of concrete, brick, and have and below grade piping. The former MGP structure will be broken, crushed, or otherwise prepared into maximum size 2-foot pieces. The prepared pieces will be placed into and incorporated into the ISS mass or disposed of off Site. Generated decontamination fluids will be containerized on-Site where it will be characterized for off-Site disposal.

Debris

Personal protective equipment and miscellaneous debris will be generated at the Site. These materials will be placed in DOT-approved 55-gallon drums or similar containers during the work, and will be removed from the Site, as soon as is practicable. Construction debris such as industrial piping and structural materials will be segregated, decontaminated and prepared as necessary, and placed within roll-off containers for off-Site disposal.

Soils

Removed soils are not expected to be classified as hazardous waste for disposal during the implementation of remedial construction activities. Soils removed from excavation areas destined for off-Site disposal will be either characterized in-situ prior to excavation activities or from samples obtained from stockpiled soils once removed. The Remedial Contractor will be responsible to coordinate with off-Site disposal facilities, approved by National Grid, to profile soils per their requirements of the individual facilities.

Wastewater

Wastewater is anticipated to be generated from decontamination activities, as well as in the form of contact water from the ISS implementation or odor/dust suppression. The wastewater may be potentially contaminated with chemical constituents from on-Site sources and may contain NAPL. The wastewaters will be collected, containerized, and taken off-Site for disposal at a licensed and permitted facility.

Section 4

Schedule

The project schedule for the remedial design and construction is presented below. This schedule tracks the remedial design tasks from preparation of this RDR through implementation of the remedial construction activities.

Milestone	Milestone Date
Contractor Procurement	
Prepare Request for Proposal (RFP) and Bid Documents	February 2018 – April 2018
National Grid Procures Remedial Contractor	April 2018 – December 2018
Contract Award	January 2019
100 % Remedial Design Report	
Response to NYSDEC Comments on RDR (90-95% Submission)	December 2018
Submit RDR (100% Submission)	February 2019
NYSDEC Review of RDR (100% Submission)	February 2019 – March 2019
NYSDEC Approval of the RDR	April 2019
Remedy Implementation	
Mobilization to the Field	June 2019

Section 5

Identification of Federal, State, and Local Permits and Approvals

This section describes the federal, state and local permits and approvals required for implementation of the remedial construction described in this RDR. In addition, it discusses the agreements that will be necessary to access properties that are not owned by National Grid.

5.1 Property Access Agreements

National Grid currently owns the Site subject to the remedial activities described in this RDR.

The Off-Site Property subject to the remedial activities is owned and/or operated by outside entities. National Grid has established a lease of the property for the purpose of completing the Remedial Action. As part of the lease agreement, the Off-Site Property and the building located there will be vacant during the implementation of the Remedial Action. As part of the pre-remedial work, National Grid has removed the fence that previously separated the two properties and constructed a fence around the entire remediation area encompassing both properties.

5.1.1 Citizens Participation Plan

Citizen participation is an integral component of remedial programs in New York State. Input from affected or interested individuals and organizations on the remedial program helps ensure outcomes that account for both technical and human concerns for protecting public health and the environment. A project-specific plan is a mechanism to inform and involve community residents, public and private leaders, and other stakeholders. Therefore, a Citizens Participation Plan (CPP), included as Appendix Q to this RDR, has been prepared to document the planned project-specific public outreach activities and resources organized for the remedial program associated with the Patchogue Former MGP Site.

The primary purpose of the CPP is to outline a variety of communication methods that, based on applicable New York State law and NYSDEC regulations and guidance, provide for constructive communication of program activities between the stakeholders and other interested parties. The CPP includes methods intended to inform interested parties of program developments, elicit responses and public involvement, and provide a central point of contact for inquiries regarding the remedial program for the Patchogue Former MGP Site. The CPP presents the planned communication and outreach activities, describes how interested individuals and groups can participate in the remedial program, and provides a variety of reference materials to facilitate gaining access to project-specific information and management personnel.

5.2 Federal, State, and Local Permits

5.2.1 Federal Permits

Due to the proximity of the Site to the Patchogue River, an evaluation of regulations related to flood plains has been performed. According to Part II, Chapter 210 (Flood Damage Prevention), Article V, section 210-14 C(2), on streams with a regulatory floodway, as shown on the Flood Boundary and Floodway Map or the Flood Insurance Rate Map adopted in § 210-6, no new construction, substantial

improvements or other development in the floodway (including fill) shall be permitted unless a technical evaluation by a licensed professional engineer shows that such an encroachment shall not result in any increase in flood levels during occurrence of the base flood. The remedial activities have been designed such that the excavation areas will be returned to pre-remedial grades thus there is no loss of flood plain area and an increase in flood levels during occurrence of the base flood would not be anticipated.

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S. C. 403) prohibits the obstruction or alteration of navigable waters of the United States without a permit from the Corps of Engineers. Section 404 of the Clean Water Act (33 U. S.C. 1344) prohibits the discharge of dredged or fill material into waters of the U.S. without a permit from the Corps of Engineers. The term "waters of the United States" includes navigable waters and non-navigable waterbodies, perennial and intermittent streams, wetlands, mudflats and ponds. The Corps of Engineers would likely take jurisdiction over wetlands directly connected to the Patchogue River, as well as wetlands that that are not directly connected but could be considered "hydrologically connected." Given the proximity of the Patchogue River, and the generally shallow groundwater at the Site, the Corps may assume jurisdiction over On-Site wetlands not directly adjacent to the river. Types of federal wetlands permits include Individual, Nationwide and Regional. For remediation work conducted within wetland areas, Nationwide Permit 38 would apply. The permittee must submit a pre-construction notification (PCN) to the district engineer prior to commencing the activity. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and if the PCN is determined to be incomplete, notify the prospective permittee within that 30-day period to request the additional information. The PCN must include a description of the project, potential impacts to wetlands and waterways, a delineation of wetlands/streams and, if disturbance is greater than 1/10-acre of wetlands, a statement describing how the mitigation requirement will be satisfied.

Other federal permits are not required for the remedy implementation described in this RDR. Should other permits be required, they will be obtained as necessary. The Remedial Contractor will be responsible to conduct all remedial activities in accordance with the substantive requirements of the federal regulations and to obtain and verify any and all permits are accounted for.

5.2.2 State Permits

Since the activities at the Site are being performed under Order on Consent A2-0552-0606 signed by KeySpan (d.b.a., National Grid) and the NYSDEC on March 4, 2007, state permits would not be required unless the construction activities would result in discharge of water into the Patchogue River. Dewatering is not anticipated as part of the implementation of the remedy. Other anticipated construction activities will not result in discharge to waters of the Patchogue River. Therefore; a State Pollutant Discharge Elimination System (SPDES) permit will not be required. It is up to the Remedial Contractor to verify that all permits have been obtained.

New York State requires coverage under the general SPDES permit for construction activities disturbing one or more acres. However, for remediation projects being performed under DEC oversight and in accordance with DEC-approved plans coverage under the SPDES permit program is typically not required provided that a SWPPP has been prepared which meets the substantive requirements. As discussed in Section 3.3.8, a SWPPP has been prepared and is included as Appendix M.

In accordance with 6 NYCRR 375-1 and DER-10, NYSDEC-issued permits are not required for any other activities associated with pre-remedial design 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.

The substantive technical requirements of these permitting programs must be met as determined by the DEC.

A Protection of Waters Permit would be required, for:

- The disturbance of the bed or banks of a protected stream, which includes water bodies in the course of a stream of 10 acres or less, with a classification of AA, A or B, or with a classification of C with a standard of (T) or (TS)
- The excavation or placing of fill in navigable waters of the state, below the mean high-water level, including adjacent and contiguous marshes and wetlands, with a water classification and standard of C or D.

For projects requiring a federal permit, a Water Quality Certification issued by the DEC may be required, in accordance with Section 401 of the Clean Water Act, to indicate the proposed activity will not violate water quality standards. This Water Qualification Certification may be required prior to disturbance of the Patchogue River and buffer zone. Section 307(c) of the Coastal Zone Management Act of 1972 requires applicants to obtain a certification of waiver that the activity complies with the state's coastal zone management program for activities affecting a state's coastal zone. The Site is within New York State's Coastal Zone boundary and would therefore require this certification.

Freshwater Wetlands Permit

Any physical disturbance, within the boundary or within the 100-foot adjacent buffer area, of a state protected freshwater wetland requires a Freshwater Wetland Permit. The Patchogue River is mapped as a NYSDEC-regulated wetland, and the entire Site is within the 100-foot buffer area. Since the transitional area of the wetlands on the Site will be disturbed during planned remedial activities, a letter, application form, and supporting documents were prepared and submitted to NYSDEC on March 5, 2018. The permit documents were prepared to demonstrate compliance with the requirements of Article 24 of the 6NYCRR Part 663, Part 664, and Part 665. The Freshwater Wetlands Permit was received from NYSDEC on May 2, 2018 and is presented in Appendix S.

5.2.3 Local Permits

Although permits are not be required to be obtained per 6 NYCRR 375-1.12c, the project will be discussed with the local officials to ensure a seamless implementation. Specifically, local approvals will be required from the Village of Patchogue for the development of trucking routes, planned construction noise outside the ordinance schedule or limits, any necessary street closure coordination for work conducted adjacent to West Main Street, the SWPPP, the implementation of the erosion and sediment controls, and the storm water management design.

The Remedial Contractor will be responsible to conduct remedial activities in accordance with the substantive requirements of the local regulations. Construction activities will have to be performed with applicable Patchogue codes and regulations.

Section 6

Project Implementation and Contractor Selection

6.1 Construction Implementation

The remedial construction activities will be performed in accordance with the Contract Documents and applicable permits and substantive permit requirements as described in this RDR (100% Submission). The Design Drawings (Appendix A) and the Technical Specifications (Appendix K) included provide for a performance-based construction. National Grid will retain one Remedial Contractor who will be responsible for the required remedial construction.

Final Design Drawings and Technical Specifications as well as the NYSDEC approved Final (100%) RDR will govern the implementation of the remedial activities.

6.2 Contractor Selection

National Grid selected a Remedial Contractor in accordance with its corporate policies and procedures. It is anticipated that the selection process will be performed via a Request for Proposal (RFP) containing this RDR, the Design Drawings, the Technical Specifications and National Grid's contracting information.

An RFP package with sufficient background, technical and contractual information was prepared and sent to a selected group of qualified Remedial Contractors. The RFP requested the submittal of a technical and cost proposal. Evaluation criteria was prepared for review of the proposals and a scoring matrix developed to objectively rank the submitted proposals. During the RFP process, questions from Contractors on the RFP were addressed through National Grid and Brown and Caldwell. National Grid requested clarifications from the Contractor proposals through questions and interviewed two bidders. The Remedial Contractor was selected based on the evaluation criteria, the responses to questions, and the interviews. A pre-construction meeting will be held with the National Grid, Brown and Caldwell, and the selected Remedial Contractor.

6.3 Contractor Design Submittal

The Remedial Contractor will be responsible for the preparation of numerous submittals for review by National Grid. The major submittals will include a Construction Management Plan, a Site-specific HASP and a Site-Specific Construction Quality Control Project Plan.

Within the CMP, the Remedial Contractor will be responsible for detailing the means and methods to complete the required remedial construction. The CMP will include a detailed description as well as the proposed sequencing for completing the major remedial activities. As-built drawings of the completed remediation and construction will also be required through the CMP. All engineering drawings prepared by the Remedial Contractor for temporary construction related use (i.e., embankment protection) will be required to be prepared and stamped by a Professional Engineer, retained by the Remedial Contactor, who is licensed in the State of New York. Similarly, survey documents will be signed and stamped by a Professional Surveyor, retained by the Remedial Contractor, who is licensed in the State of New York.

The HASP included as Appendix J to this RDR is for use by National Grid, Brown and Caldwell and the Construction Manager. The Contractor will be required to prepare a Site-specific HASP. The Remedial Contractor's Site-specific HASP will detail the activity-specific hazards associated with the implementation of the remedial activities (i.e., excavation and ISS). The Remedial Contractor's Site-specific HASP will be required to identify the personnel that will provide health and safety services and their credentials. Remedial Contractor personnel working on the Site will also be required to provide health and safety credentials including OSHA training certificates and medical records.

In accordance with Section 3.6.3.2, National Grid plans to utilize a standard community air monitoring plan during the construction activities, pursuant to NYSDEC DER-10, to monitor for dust and VOC emissions.

The Remedial Contractor's Site-specific CQCPP will be required to set forth the general framework and specific details of the methods and procedures that will be implemented to demonstrate that construction activities have been performed pursuant to the RDR and the Contract Documents. The Site-specific CQCPP will describe the quality organization of the Remedial Contractor and the allocations of responsibilities for performing the CQC activities.

Section 7

Construction Quality Assurance/Quality Control

A Construction Quality Assurance Project Plan (CQAPP) has been developed to address quality assurance (QA) issues and to ensure the integrity of analytical data obtained during all remedial activities to be performed at the Site. The CQAPP is included in Appendix B of this RDR. The CQAPP sets forth general methods and procedures that will be implemented to demonstrate that the remedial construction activities will be performed pursuant to the RDR.

As there will be numerous construction materials to be used during the remedial construction, the quality and suitability of these materials will need to be monitored on a continuous basis. For this purpose, the Remedial Contractor will prepare a Site-specific CQCPP. Once approved by National Grid, the CQCPP will become part of the CMP and be forwarded to the NYSDEC for review and approval.

Section 8

Health and Safety Plan

A HASP has been prepared by BC to address National Grid's, their duly appointed representative(s) and the Design Engineer's worker health and safety during the implementation of planned remedial construction activities described in this RDR. A copy of the HASP is included in Appendix J.

The Remedial Contractor will be required to provide a Contractor Site-Specific HASP (CSSHASP) to detail the Contractor's health and safety procedures to protect Site workers during implementation of the remedial construction. This CSSHASP will be prepared in accordance with all applicable requirements of the Occupational Safety and Health Administration (OSHA) and comply with 1910.120 and 1910.126. The CSSHASP must be signed and certified by a Certified Industrial Hygienist (CIH). The Remedial CSSHASP will be required to identify the personnel and their credentials, for the review by National Grid, that will provide health and safety services. All Remedial Contractor personnel working on the Site will also be required to provide health and safety credentials including OSHA training certificates and medical records. Once reviewed by National Grid, the CSSHASP will become part of the CMP and be forwarded to the NYSDEC for review and approval.

Section 9

References

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

Brown and Caldwell Associates, 2012. Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York," February.

Brown and Caldwell Associates, 2012. "Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1 52 182", February.

Brown and Caldwell Associates, 2012. Remedial Design Report (50-75% Submissions), Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York," December.

Brown and Caldwell Associates, 2012. "Construction Completion Report, Utility Corridor Work Plan Implementation, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York", December.

Brown and Caldwell Associates, 2018. "Remedial Design Report (90-95% Submission), Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York," February

Brown and Caldwell Associates, 2018. "Notice of Intrusive Activities (NOIA), Removal of On-Site Gas Manifold and Associated Piping, Patchogue Former Manufactured Gas Plant Site, Village of Patchogue, Suffolk County, New York Site No. 1-52-182," May 22.

Brown and Caldwell Associates, 2018. "Summary of Intrusive Activities, On-Site Gas Manifold and Associated Piping Removal, Patchogue Former Manufactured Gas Plant Site, Village of Patchogue, Suffolk County, New York Site No. 1-52-182," November 28.

Brown and Caldwell Associates, 2018. "Response to Comment Letter dated November 21, 2018, 95% Remedial Design Report, Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182", December 4

Brown and Caldwell Associates, 2018. "Response to Comment Letter dated December 3, 2018, 95% Remedial Design Report, Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182", December 6

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

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

NYSDEC, 2006. "6 NYCRR Part 375, Environmental Remediation Programs", December 14

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

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.

NYSDEC, 2017. "Explanation of Significant Differences, K – Patchogue MGP Site, Village of Patchogue, Suffolk County, Site No. 152182", October.

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

USDOT, 2009. Federal Highway Administration Manual on Uniform Traffic Control Devices, United States Department of Transportation, Federal Highway Administration, December 2009.

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

USEPA 1993a. Engineering Bulletin, Solidification/Stabilization of Organics and Inorganics. EPA/540/S-92/015. May 1993.

USEPA 1993b. Technical Resource Document, Solidification/Stabilization and its Application to Waste Material. EPA/530/R-93/012. June 1993.

Vanasse, Hangen, Brustlin, Inc., 2002. "Preliminary Site Assessment Report Order on Consent D1-001-99-05, NYSDEC Site No. 1-52-182 Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York", March.

Tables

TABLE 2-1
WATER LEVEL DATA - JULY 2012 AND AUGUST 2012
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Well ID	Top of Casing Elevation (Re-surveyed 8/28/12) (ft., NAVD)	7/18/2012 Depth to Water (ft., BTOC)	7/18/2012 Water Elevation (ft., NAVD)	7/18/2012 Remarks	8/28/2012 Depth to Water (ft., BTOC)	8/28/2012 Water Elevation (ft., NAVD)	8/28/2012 Remarks
MW-1	11.47	5.85	5.62		5.64	5.83	
MW-2S	Removed	NA	NA		NA	NA	
MW-2D	Removed	NA	NA		NA	NA	
MW-3	5.56	2.50	3.06		2.30	3.26	
MW-4S	7.97	5.08	2.89		4.98	2.99	
MW-4D	7.79	4.85	2.94		4.72	3.07	
MW-5	8.13	4.16	3.97		3.98	4.15	
MW-6	5.01	0.05	4.96		3.01	2.00	Depth to water measurement is anomalously low compared to previous measurements.
MW-7S	8.45	4.54	3.91		4.31	4.14	
MW-7D	8.31	4.36	3.95		4.16	4.15	
MW-8S	5.08	0.94	4.14		0.80	4.28	
MW-8D	4.98	0.80	4.18		6.30	-1.32	Depth to water measurement is anomalously low compared to previous measurements.
MW-9S	4.47	NM	NM	Located on adjacent property. Access to well obstructed by a storage container.	NM	NM	Located on adjacent property. Access to well obstructed by a storage container.
MW-9D	4.66	NM	NM	Located on adjacent property. Access to well obstructed by a storage container.	NM	NM	Located on adjacent property. Access to well obstructed by a storage container.
SG-1	5.23	4.03	1.20		4.06	1.17	
SG-2	5.16	3.83	1.33		3.84	1.32	
PZ-1A	8.05	3.72	4.33		3.71	4.34	
PZ-1B	8.91	4.6	4.31		4.38	4.53	
PZ-2A	8.77	4.5	4.27		4.25	4.52	
PZ-2B	8.29	3.98	4.31		3.76	4.53	
PZ-3A	8.78	5.07	3.71		4.75	4.03	
PZ-3B	8.90	5.22	3.68		5.03	3.87	
PZ-4B	4.79	1.77	3.02		1.57	3.22	

Notes:
NAVD - North American Vertical Datum
BGS - Below Ground Surface
BTOC - Below Top of Casing
NM - Not Measured

TABLE 2-2
VERTICAL HYDRAULIC GRADIENTS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

	Ground Surface Elevation (ft., NAVD)(a)	Top of Casing (TOC) Elevation (ft., NAVD)	Depth to Mid-Point of Screen (ft., BGS)(b)	Elevation Mid-Point of Screen (ft., NAVD)	Depth to Water 7/18/2012 (ft, below TOC)	Water Elevation 7/18/2012 (ft., NAVD)	Vertical Hydraulic Gradient (c) 7/18/2012	Depth to Water 8/28/2012 (ft, below TOC)	Water Elevation 8/28/2012 (ft., NAVD)	Vertical Hydraulic Gradient 8/28/2012
PZ-1A	6.3	8.05	5	1.3	3.72	4.33	0.001	3.71	4.34	-0.013
PZ-1B	5.9	8.91	16.6	-10.7	4.60	4.31		4.38	4.53	
PZ-2A	5.8	8.77	3.5	2.3	4.50	4.27	-0.003	4.25	4.52	-0.001
PZ-2B	5.3	8.29	12.5	-7.2	3.98	4.31		3.76	4.53	
PZ-3A	5.0	8.78	4.5	0.5	5.07	3.71	0.002	4.75	4.03	0.011
PZ-3B	5.0	8.90	15.5	-10.5	5.22	3.68		5.03	3.87	
PZ-4A	5.0	4.79	4	1	1.77	3.02	NA	1.57	3.22	NA
MW-9D	4.78	4.66	22.5	-17.72	NM (d)	NA (e)		NM	NA	

Notes:
(a) NAVD - North American Vertical Datum, 1988
(b) BGS - Belog ground surface
(c) Vertical hydraulic gradients (i_v) were calculated assuming that groundwater elevation in the deeper piezometer/well at a couplet is represenative of the mid-point depth of the well screen, and that the groundwater elevation in the shallower well at a couplet is represenative of th water table. Positive values indicate a downward i_v; negative values indicate an upward i_v.
(d) NM - Not measured. Access to well obstructed.
(e) NA - Not available

TABLE 2-3
IN-SITU HYDRAULIC CONDUCTIVITY TEST RESULTS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Location	Test Date		Horizontal Hydraulic Conductivity Estimate (K_h) (a) (cm/sec)
Fill			
PZ-1A	7/18/2012		2.3E-02
PZ-2A	7/18/2012		4.4E-03
PZ-3A	7/19/2012		8.5E-03
PZ-4A	7/19/2012		3.1E-03
		Geometric Mean	*7.1E-03*
		Maximum	*2.3E-02*
		Minimum	*3.1E-03*
Outwash Deposits			
PZ-1B	7/18/2012		5.2E-02
PZ-2B	7/18/2012		3.7E-02
PZ-3B	7/19/2012		2.6E-02
MW-1	7/18/2012		9.8E-03
MW-4D	7/19/2012		6.2E-02
MW-7D	7/19/2012		5.7E-02
MW-8D	7/19/2012		6.2E-02
		Geometric Mean	*3.8E-02*
		Maximum	*6.2E-02*
		Minimum	*9.8E-03*

Notes:
(a) Estimate from in situ hydraulic conductivity test (i.e., slug test) using Hvorslev (1951) analysis.

TABLE 2-5
TREATABILITY STUDY TESTING MATRIX
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Evaluation Stage	Aliquot ID	Material Tested	Reagent Addition Rate		Cure Times (days) when Tests were Performed					
			Portland Cement [% w.w.]	Bentonite [% w.w.]	UCS[1]	Volumetric Expansion	Hydraulic Conductivity[1]	Immersion	pH	Pocket Penetrometer
Preliminary Evaluation	N-01	Native Soils	7.5	0	28	28	28		28	1, 7
	N-02	Native Soils	12.5	0	28	28	28		28	1, 7
	N-03	Native Soils	7.5	1.5	28	28	28		28	1, 7
	N-04	Native Soils	12.5	1.5	28	28	28		28	1, 7
	F-01	Fill	5	0	28	28	28		28	1, 7
	F-02	Fill	10	0	28	28	28		28	1, 7
	F-03	Fill	5	1.5	28	28	28		28	1, 7
	F-04	Fill	10	1.5	28	28	28		28	1, 7
Optimization Evaluation	N-05	Native Soils[2]	0	0.5		7, 28			28	
	N-06	Native Soils[2]	0	1.5		7, 28			28	
	N-07	Native Soils	12.5	0.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-08[3]	Native Soils	7.5	0.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-09	Native Soils	5	0	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-10	Native Soils	5	0.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-11	Native Soils	5	1.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-12	Native Soils	3	0	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-13	Native Soils	3	0.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-14	Native Soils	3	1.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	N-15[3]	Native Soils	6.5	0	7, 28	7, 28	28	28	14, 28	2, 5, 7
	N-16	Native Soils	6.5	0.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	N-17	Native Soils	6.5	1.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	N-18	Native Soils	8.5	0	7, 28	7, 28	28	28	14, 28	2, 5, 7
	N-19	Native Soils	8.5	0.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	N-20	Native Soils	8.5	1.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-05	Fill[2]	0	0.5		7, 28			28	
	F-06	Fill[2]	0	1.5		7, 28			28	
	F-07	Fill	10	0.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	F-08	Fill	5	0.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	F-09	Fill	3	0	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	F-10	Fill	3	0.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	F-11	Fill	3	1.5	7, 14, 28	7, 14, 28	14, 28	14,28	14, 28	2, 5, 7
	F-12	Fill	6.5	0	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-13	Fill	6.5	0.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-14	Fill	6.5	1.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-15	Fill	7.5	0	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-16	Fill	7.5	0.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-17	Fill	7.5	1.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-18	Fill	8.5	0	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-19	Fill	8.5	0.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
	F-20[3]	Fill	8.5	1.5	7, 28	7, 28	28	28	14, 28	2, 5, 7
Repeatability Evaluation	N-08DUP	Native Soils	7.5	0.5	7, 28	7, 28	28	28	7, 28	2, 5, 7
	N-15DUP	Native Soils	6.5	0	7, 28	7, 28	28	28	7, 28	2, 5, 7
	F-20DUP	Fill	8.5	1.5	7, 28	7, 28	28	28	7, 28	2, 5, 7

Notes:
1. Includes moisture content, dry density and bulk density.
2. Bentonite-only aliquots (i.e., without cement) collapsed during the UCS testing; consequently, only volumetric expansion test was performed on those aliquots.
3. Repeatability analyses were performed on these samples.

TABLE 2-6
TREATABILITY STUDY TESTING RESULTS - UNTREATED SOIL
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Testing Parameter	Test Method	Unit	Sample	
			Native Soil	Fill
Moisture Content	ASTM D2216			
ASTM Moisture Content		%	15.21	17.09
Percent Solids		%	86.80	85.41
Bulk Unit Weight	ASTM D7263	pcf	116.8	115.0
Atterberg Limits	ASTM D4318			
Liquid Limit		LL	NV	NV
Plastic Limit		PL	NP	NP
Plasticity Index		PI	NP	NP
Loss on Ignition	ASTM D2974	%		
Moisture Content		%	30	17
Ash Content		%	78.2	91.5
Organic Matter		%	21.8	8.5
Particle Size Distribution	ASTM D422/D854			
Gravel		%	4.4	12.3
Sand		%	92.7	79.4
Silt		%	0.4	4.8
Clay		%	2.5	3.5
pH	EPA 9045	s.u.	7.47	9.51
Sample Description	USCS (D2487)		Black poorly graded sand	Very dark brown poorly graded sand with silt
Sample Classification	USCS (D2487)		SP	SP-SM

Notes:
% - Percent
NP - Not Plastic
NV - Non-Viscous
pcf - pounds per cubic foot
s.u. - Standard Unit
Sample descriptions based on the Unified Classification System.

TABLE 2-7
TREATABILITY STUDY TESTING RESULTS - TREATMENT ALIQUOTS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Kemron Sample Number	BC Sample ID	Untreated Material Type	Testing Stage	Reagent Addition % by Wet Soil wt.		Water Addition % By Reagent wt.	Cure Days	pH	Volumetric Expansion (%)	Unconfined Compressive Strength				Pocket Penetrometer (tons/ft^2)			Hydraulic Conductivity (K) (cm/sec)			
				Portland Cement	Bentonite					Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)	2 Day (1 Day for N-01 to N-04)	5 Day	7 Day	Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	K (cm/sec)
0427-001	N-01	Native	Preliminary	7.5	0.0	50	28	11.43	14.90	21.5	120.5	99.2	98.7	1.3		>4.5	21.9	124.0	101.8	5.9E-06
0427-002	N-02	Native	Preliminary	12.5	0.0	50	28	11.83	20.21	21.7	126.9	104.3	250.5	>4.5		>4.5	21.3	127.0	104.5	3.0E-07
0427-003	N-03	Native	Preliminary	7.5	1.5	140	28	11.24	45.00	30.9	108.3	82.7	26.0	1.3		>4.5	30.9	109.0	83.2	4.3E-07
0427-004	N-04	Native	Preliminary	12.5	1.5	110	28	11.77	50.73	30.4	111.6	85.6	91.4	>4.5		>4.5	28.7	112.0	87.2	2.6E-06
0427-009	N-05[1]	Native	Optimization	0.0	0.5	730	7		9.38											
							28	7.49	10.42											
0427-010	N-06[1]	Native	Optimization	0.0	1.5	533	7		23.96											
							28	7.60	20.83											
0427-011A	N-07	Native	Optimization	12.5	0.5	81.3	7		34.69	23.1	116.4	94.6	100.4	4.3	>4.5	>4.5				
							14	11.99	36.08	21.7	119.0	97.8	118.7				25.1	120.0	95.9	1.4E-06
							28	12.09	31.04	22.5	117.6	95.9	186.4				25.3	121.0	96.6	1.1E-06
0427-012A	N-08	Native	Optimization	7.5	0.5	116.4	7		29.79	23.4	115.6	93.6	19.9	2.3	4.5	4.5				
							14	11.63	30.42	21.6	118.0	97.0	49.2				25.8	115.7	92.0	5.1E-06
							28	12.11	25.73	23.8	118.0	95.3	52.1				26.3	119.6	94.7	6.9E-06
0427-033 DUP	N-08DUP	Native	Repeatability	7.5	0.5	118	7	12.54	30.31	21.6	117.9	97.0	44.8	>4.5	>4.5	>4.5				
							28	11.69	30.52	21.3	116.4	95.9	64.3				22.9	118.0	96.0	3.4E-06
0427-013A	N-09	Native	Optimization	5.0	0.0	100.0	7		19.48	18.2	120.4	101.9	30.4	4.3	4.5	4.5				
							14	11.88	19.90	17.0	121.4	103.7	43.6				20.9	123.9	102.5	2.4E-05
							28	12.02	15.83	20.8	120.9	100.1	30.7				20.0	124.4	103.7	1.8E-05
0427-014A	N-10	Native	Optimization	5.0	0.5	133.8	7		28.85	24.1	117.2	94.4	14.9	2.0	2.8	3.0				
							14	12.00	31.77	21.9	115.5	94.8	21.0				28.6	128.5	100.0	2.0E-05
							28	12.07	21.67	21.9	116.3	95.4	17.7				25.7	120.3	95.7	6.7E-06
0427-015A	N-11	Native	Optimization	5.0	1.5	231.9	7		42.60	34.8	109.6	81.3	10.3	0.8	1.0	1.3				
							14	12.02	42.40	33.5	112.7	84.5	15.5				44.4	114.5	79.2	5.1E-06
							28	11.95	30.94	34.6	111.0	82.5	11.5				32.9	112.9	85.0	2.0E-06
0427-016A	N-12	Native	Optimization	3.0	0.0	166.7	7		15.52	18.9	120.7	101.6	9.8	1.3	3.5	4.0				
							14	11.93	18.44	21.8	118.5	97.3	15.2				21.1	125.2	103.5	3.1E-05
							28	11.98	14.27	18.0	120.3	101.9	6.0				21.7	121.8	100.0	8.7E-05
0427-017A	N-13	Native	Optimization	3.0	0.5	181.6	7		28.44	23.6	113.6	91.9	6.6	0.8	1.5	2.0				
							14	11.92	30.31	22.9	113.6	92.5	12.0				25.9	117.4	93.2	2.0E-05
							28	12.08	22.40	23.3	112.3	91.0	8.9				24.5	117.1	94.1	1.6E-05
0427-018A	N-14	Native	Optimization	3.0	1.5	274.6	7		43.85	29.7	108.4	83.6	5.7	0.0	0.8	1.0				
							14	12.14	46.04	29.7	109.6	84.6	6.0				25.3	111.7	89.2	5.6E-06
							28	12.01	37.92	30.9	104.8	80.1	5.7				29.9	108.8	83.7	5.5E-06
0427-026	N-15	Native	Optimization	6.5	0.0	100	7	12.37	14.69	21.6	120.7	99.3	44.3	>4.5	>4.5	>4.5				
							28	11.31	15.21	17.8	121.2	102.9	76.6				20.6	125.3	103.9	2.0E-05

TABLE 2-7
TREATABILITY STUDY TESTING RESULTS - TREATMENT ALIQUOTS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Kemron Sample Number	BC Sample ID	Untreated Material Type	Testing Stage	Reagent Addition % by Wet Soil wt.		Water Addition % By Reagent wt.	Cure Days	pH	Volumetric Expansion (%)	Unconfined Compressive Strength				Pocket Penetrometer (tons/ft^2)			Hydraulic Conductivity (K) (cm/sec)			
				Portland Cement	Bentonite					Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)	2 Day (1 Day for N-01 to N-04)	5 Day	7 Day	Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	K (cm/sec)
0427-026 DUP	N-15DUP	Native	Repeatability	6.5	0.0	100	7	12.46	13.23	18.5	121.7	102.7	49.5	>4.5	>4.5	>4.5				
							28	11.37	14.48	19.5	123.4	103.3	78.3				17.8	127.0	107.9	1.1E-05
0427-027	N-16	Native	Optimization	6.5	0.5	93	7	12.93	27.81	23.0	115.9	94.3	28.0	>4.5	>4.5	>4.5				
							28	11.44	27.92	21.1	114.7	94.7	42.0				22.9	118.9	96.8	1.8E-05
0427-028	N-17	Native	Optimization	6.5	1.5	161	7	12.91	35.00	30.2	116.8	89.8	22.5	3.0	4.0	4.3				
							28	11.57	35.94	29.3	115.8	89.6	28.7				31.0	114.7	87.6	5.3E-06
0427-029	N-18	Native	Optimization	8.5	0.0	65	7	12.57	20.00	17.7	121.0	102.8	105.7	>4.5	>4.5	>4.5				
							28	11.31	20.52	16.7	121.0	103.6	162.8				17.6	125.2	106.4	2.8E-06
0427-030	N-19	Native	Optimization	8.5	0.5	95	7	12.68	27.50	20.8	117.9	97.6	62.6	>4.5	>4.5	>4.5				
							28	11.71	27.60	22.0	117.3	96.1	90.5				23.4	116.6	94.5	4.9E-06
0427-031	N-20	Native	Optimization	8.5	1.5	125	7	12.56	43.13	23.9	113.2	91.3	35.6	4.5	>4.5	>4.5				
							28	11.70	42.92	21.7	114.3	94.0	62.5				25.0	113.7	91.0	2.3E-06
0427-005	F-01	Fill	Preliminary	5.0	0.0	50	28	11.25	18.14	18.2	117.9	99.7	56.1	>4.5		>4.5	17.1	117.0	100.2	3.1E-07
0427-006	F-02	Fill	Preliminary	10.0	0.0	50	28	11.16	22.78	19.0	123.8	104.0	310.1	>4.5		>4.5	19.0	122.0	102.5	3.3E-07
0427-007	F-03	Fill	Preliminary	5.0	1.5	185	28	10.66	47.32	25.9	100.1	79.5	21.1	0.3		2.8	23.6	103.0	83.0	2.5E-07
0427-008	F-04	Fill	Preliminary	10.0	1.5	125	28	11.04	47.73	25.4	108.0	86.1	110.2	3.3		>4.5	25.4	107.0	85.4	1.9E-07
0427-019	F-05[1]	Fill	Optimization	0.0	0.5	730	7		6.19											
							28	9.54	8.25											
0427-020	F-06[1]	Fill	Optimization	0.0	1.5	533	7		15.46											
							28	9.93	14.43											
0427-021A	F-07	Fill	Optimization	10.0	0.5	93.9	7		34.54	21.8	118.0	96.8	103.0	>4.5	>4.5	>4.5				
							14	12.22	37.01	21.0	115.8	95.7	177.3				21.1	117.8	97.3	4.9E-07
							28	12.22	30.10	19.5	115.1	96.3	149.0				21.2	117.4	96.9	3.2E-07
0427-022A	F-08	Fill	Optimization	5.0	0.5	136.4	7		32.58	21.7	116.9	96.0	30.5	>4.5	>4.5	>4.5				
							14	12.12	34.23	21.7	113.3	93.1	33.6				22.4	115.1	94.0	7.0E-06
							28	12.00	24.95	19.7	114.4	95.6	23.1				20.2	117.0	97.3	1.1E-06
0427-023A	F-09	Fill	Optimization	3.0	0.0	147.6	7		16.39	20.9	117.3	97.0	21.5	4.0	4.5	4.5				
							14	11.95	18.97	17.5	120.4	102.4	24.7				22.4	117.1	95.7	1.4E-05
							28	11.84	14.43	17.7	121.8	103.6	28.2				20.7	119.9	99.3	4.3E-06
0427-024A	F-10	Fill	Optimization	3.0	0.5	185.7	7		24.12	22.2	110.8	90.6	11.9	2.5	3.5	4.5				
							14	11.93	24.64	19.2	115.6	97.0	11.7				22.3	114.1	93.3	3.9E-06
							28	12.08	21.24	18.8	111.3	93.7	9.6				21.9	113.0	92.7	2.0E-06

TABLE 2-7
TREATABILITY STUDY TESTING RESULTS - TREATMENT ALIQUOTS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Kemron Sample Number	BC Sample ID	Untreated Material Type	Testing Stage	Reagent Addition % by Wet Soil wt.		Water Addition % By Reagent wt.	Cure Days	pH	Volumetric Expansion (%)	Unconfined Compressive Strength				Pocket Penetrometer (tons/ft^2)			Hydraulic Conductivity (K) (cm/sec)			
				Portland Cement	Bentonite					Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	UCS (lb/in^2)	2 Day (1 Day for N-01 to N-04)	5 Day	7 Day	Moisture Content (%)	Bulk Density (lb/ft^3)	Dry Density (lb/ft^3)	K (cm/sec)
0427-025A	F-11	Fill	Optimization	3.0	1.5	277.8	7		39.28	26.5	114.4	88.1	9.9	1.0	2.8	3.0				
							14	12.00	43.81	25.5	109.6	87.3	10.4				29.6	108.7	83.8	4.2E-06
							28	11.91	36.80	23.5	109.5	88.7	10.0				26.2	113.0	89.5	2.9E-06
0427-034	F-12	Fill	Optimization	6.5	0.0	114	7	12.43	17.63	16.6	120.3	103.2	93.9	>4.5	>4.5	>4.5				
							28	11.50	17.11	16.2	119.9	103.2	148.9				15.6	124.0	107.2	8.6E-07
0427-035	F-13	Fill	Optimization	6.5	0.5	127	7	12.46	38.25	16.3	113.5	97.6	59.7	>4.5	>4.5	>4.5				
							28	11.61	38.45	15.7	116.6	96.5	96.3				18.0	111.3	94.4	3.8E-07
0427-036	F-14	Fill	Optimization	6.5	1.5	208	7	12.53	44.02	23.0	112.7	91.6	28.7	4.5	>4.5	>4.5				
							28	11.57	45.36	22.8	115.1	93.7	53.3				23.6	111.5	90.2	9.8E-07
0427-037	F-15	Fill	Optimization	7.5	0.0	106	7	12.89	19.28	14.6	125.4	109.4	177.3	>4.5	>4.5	>4.5				
							28	11.35	22.27	16.0	123.0	106.0	265.6				16.4	120.4	103.5	3.1E-07
0427-038	F-16	Fill	Optimization	7.5	0.5	96	7	12.32	31.44	17.2	114.9	98.1	73.5	>4.5	>4.5	>4.5				
							28	11.53	31.24	16.6	114.0	97.8	118.3				19.6	111.6	93.4	4.8E-07
0427-039	F-17	Fill	Optimization	7.5	1.5	155	7	12.46	42.89	26.4	113.0	89.4	35.4	>4.5	>4.5	>4.5				
							28	11.74	42.99	23.3	114.2	92.6	67.6				24.2	117.4	94.5	7.0E-07
0427-040	F-18	Fill	Optimization	8.5	0.0	96	7	12.95	28.14	16.0	116.9	100.7	181.4	>4.5	>4.5	>4.5				
							28	11.55	28.14	16.2	118.7	102.2	282.7				16.7	119.6	102.5	2.3E-07
0427-041	F-19	Fill	Optimization	8.5	0.5	95	7	12.50	30.93	19.1	118.9	99.8	102.2	>4.5	>4.5	>4.5				
							28	11.71	30.62	17.6	116.8	99.4	164.8				20.0	117.7	98.1	3.8E-07
0427-042	F-20	Fill	Optimization	8.5	1.5	119	7	12.54	42.06	22.4	115.1	94.1	73.8	>4.5	>4.5	>4.5				
							28	11.65	42.06	19.2	113.4	95.1	112.4				22.3	111.7	91.3	2.9E-07
0427-042 DUP	F-20DUP	Fill	Repeatability	8.5	1.5	119.0	7	12.43	36.49	25.3	117.6	93.9	41.5*	>4.5	>4.5	>4.5				
							28	11.61	36.29	25.1	117.5	94.0	68.4				29.7	110.5	85.2	9.4E-07

Notes:

1 - Bentonite-only aliquots (i.e., without cement) collapsed during the UCS testing; consequently, only volumetric expansion test was performed on those aliquots.

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-001	N-01	7.5%	0.0%	50.0%	Preliminary stage - 14-day cure immersion test was not performed.	~Water color gray (day 1 to 7) ~Top of water color light gray (day 1 to 7) ~Light to medium odor similar to creosote and heavy naphthalene (day 1 & 2) ~Moderate odor similar to creosote and heavy naphthalene (day 4 to 7) ~No oily sheen observed (day 1 to 7)
0427-002	N-02	12.5%	0.0%	0.5	Preliminary stage - 14-day cure immersion test was not performed.	~Water color turn gray (day 1 to 7) ~Top of water color light gray (1 to 7 day) ~Light to medium odor similar to creosote and heavy naphthalene (day 1 to 2) ~Moderate odor similar to creosote and heavy naphthalene day 4) ~Light odor similar to creosote and heavy naphthalene (day 5 & 6) ~Light to moderate odor similar to creosote and heavy naphthalene (day 7) ~No oily sheen observed (day 1 to 7)
0427-003	N-03	7.5%	1.5%	140.0%	Preliminary stage - 14-day cure immersion test was not performed.	~Water color turn gray (day 1 to 7) ~Water top color light gray (day 1 to 7) ~Light to medium odor similar to creosote and heavy naphthalene (day 1 to 2) ~Light odor similar to creosote and heavy naphthalene (4 day) ~Light to moderate odor similar to creosote and heavy naphthalene (day 5 to 7) ~No oily sheen observed (day 1 to 7)
0427-004	N-04	12.5%	1.5%	110.0%	Preliminary stage - 14-day cure immersion test was not performed.	~Water color turn gray (day 1 to 5) ~Water color turn light gray (day 6 & 7) ~Top of water color light gray(day 1 to 7) ~Light to medium odor similar to creosote and heavy naphthalene (day 1 to 4) ~Light to moderate odor similar to creosote and heavy naphthalene (day 5 & 6) ~Light odor similar to creosote and heavy naphthalene (day 7) ~No oily sheen observed (day 1 to 7)
0427-005	F-01	5.0%	0.0%	50.0%	Preliminary stage - 14-day cure immersion test was not performed.	~Water color turn gray(day 1 to 4) ~Water color turn light gray(day 5 to 7) ~Top of water color very pale brown (day 1) ~Top of water color very light brownish gray (day 2 & 4) ~Top of water color turn light gray(day 5 to 7) ~Light odor similar to creosote and heavy naphthalene (day 1 & 2) ~Light creosote naphthalene odor with a hint of toluene? lighter hydrocarbons? (day 4 to 7) ~No oily sheen observed (day 1 to 7)
0427-006	F-02	10.0%	0.0%	50.0%	Preliminary stage - 14-day cure immersion test was not performed.	~Water color turn gray (day 1 to 7) ~Top of water color light gray (day 1 to 7) ~Light odor similar to creosote and heavy naphthalene (day 1 to 4) ~Light to moderate odor similar to creosote and heavy naphthalene (day 5 to 7) ~No oily sheen observed (day 1 to 7)

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-007	F-03	5.0%	1.5%	185.0%	Preliminary stage - 14-day cure immersion test was not performed.	~Water color turn gray (day 1 & 2) ~Water color turn yellow (day 4 to 7) ~Top of water color light gray (day 1 to 7) ~Light to medium odor similar to creosote and heavy naphthalene (day 1 & 2) ~Light creosote naphthalene odor with a hint of toluene? lighter hydrocarbons? (day 4 & 5) ~Moderate creosote naphthalene odor with a hint of toluene? lighter hydrocarbons? (day 6 & 7) ~No oily sheen observed (day 1 to 7)
0427-008	F-04	10.0%	1.5%	125.0%	Preliminary stage - 14-day cure immersion test was not performed.	~Water color turn gray (day 1 to 7) ~Top of water color light gray (day 1 to 7) ~Medium odor similar to creosote and heavy naphthalene (day 1 & 2) ~Light creosote naphthalene odor with a hint of toluene? lighter hydrocarbons? (day 4 to 6) ~Moderate creosote naphthalene odor with a hint of toluene? lighter hydrocarbons? (day 7) ~No oily sheen observed (day 1 to 7)
0427-009	N-05	0.0%	0.5%	730%	Bentonite-only aliquots collapsed during testing, immersion test was not performed	
0427-010	N-06	0.0%	1.5%	533%	Bentonite-only aliquots collapsed during testing, immersion test was not performed	
0427-011A	N-07	12.5%	0.5%	81.3%	~Water color clear (day 1) ~Water color white (day 2 to 7) ~Top of water color light gray (day 1 to 7) ~White particles at bottom of beaker (day 1 to 7) ~Moderate concrete, light naphthalene odor (day 1) ~Strong concrete, mild naphthalene odor (day 2 to 4) ~Strong concrete, faint naphthalene odor (day 6 to 7)	~Water color very pale brown (day 1) ~Water color white (day 2 to 7)) ~Top of water color light gray (day 1 to 5) ~Top of water color white with light gray circle in the middle (day 6 to 7) ~Particles at bottom of beaker (day 1 to 7) ~Mild concrete odor (day 1) ~Mild concrete, faint naphthalene odor (day 2) ~Moderate concrete, faint naphthalene odor (day 3) ~Strong concrete, mild naphthalene odor (day 5 to 7) ~No oily sheen observed (day 1 to 7)
0427-012A	N-08	7.5%	0.5%	116.40%	~Water color very pale brown (day 1) ~Water color white (day 2 to 7) ~Top of water color light gray (day 1 to 7) ~Particles at bottom of beaker (day 1) ~White particles at bottom of beaker (day 2 to 7) ~Strong concrete, moderate naphthalene odor (day 1) ~Strong concrete, mild naphthalene odor (day 2 to 7)	~Water color clear (day 1 to 2) ~Water color very pale brown (day 3 to 7) ~Top of water color light gray (day 1 to5) ~Top of water color very pale brown with light gray circle in the middle (day 6 to 7) ~Particles at bottom of beaker (day 1 to 7) ~Sample is beginning to disintegrate (day 2) ~Sample is continuing to disintegrate (day 3 to 7) ~Mild concrete odor (day 1 to 2) ~Mild concrete, mild naphthalene odor (day 3) ~Moderate concrete, mild naphthalene odor (day 5) ~Strong concrete, moderate naphthalene (day 6 to 7) ~No oily sheen observed (day 1 to 7)
0427-033 DUP	N-08DUP	7.5%	0.5%	118.00%	14-day cure immersion test was not performed.	~Water color very pale brown (day 2) ~Water color white (day 3 to 7) ~Top of water color light gray (day 2 to 7) ~Faint concrete, faint naphthalene odor (day 2 to 3) ~Light concrete, faint naphthalene odor (day 4) ~Light concrete, light naphthalene odor (day 5 to 6) ~Light concrete strong naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7) ~No oily sheen observed (day 2 to 7)

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-013A	N-09	5.0%	0.0%	100.00%	~Water color clear (day 1)	~Water color clear (day 1 to 2)
					~Water color very pale brown (day 2 to 7)	~Water color very pale brown (day 3 to 7)
					~Top of water color light gray (day 1 to 7)	~Top of water color light gray (day 1 to 5)
					~Particles at bottom of beaker (day 1 to 7)	~Top of water color very pale brown with light gray
					~Light concrete, light naphthalene odor (day 1)	circle in middle (day 6 to 7)
					~Strong concrete, light naphthalene odor (day 2 to 7)	~Particles at bottom of beaker (day 1 to 7)
						~Light concrete, light naphthalene odor (day 1 to 3)
						~Moderate concrete, light naphthalene (day 5)
						~Strong concrete, moderate naphthalene (day 6 to 7)
						~No oily sheen observed (day 1 to 7)
0427-014A	N-10	5.0%	0.5%	133.80%	~Water color clear (day 1 to 3)	~Water color clear (day 1 to 2)
					~Water color very pale brown (day 4 to 7)	~Water color very pale brown (day 3 to 7)
					~Top of water color light gray (day 1 to 7)	~Top of water color light gray (day 1 to 5)
					~Particles at bottom of beaker (day 2 to 7)	~Top of water color very pale brown with light gray
					~Light concrete, light naphthalene odor (day 1)	circle in middle (day 6 to 7)
					~Mild concrete, mild naphthalene odor (day 2)	~Particles at bottom of beaker (day 1 to 7)
					~Moderate concrete, mild naphthalene	~Light concrete, light naphthalene odor (day 1)
					odor (day 3)	~Light concrete, moderate naphthalene odor (day 2 to 6)
					~Moderate concrete, moderate naphthalene	~Strong concrete, moderate naphthalene odor (day 7)
					odor (day 4 to 7)	~No oily sheen observed (day 1 to 7)
0427-015A	N-11	5.0%	1.5%	231.90%	~Water color clear (day 1)	~Water color clear (day 1 to 2)
					~Water color very pale brown (day 2 to 7)	~Water color very pale brown (day 3 to 7)
					~Top of water color light gray (day 1 to 7)	~Top of water color light gray (day 1 to 5)
					~Particles at bottom of beaker (day 1 to 7)	~Top of water color very pale brown with light gray
					~Strong concrete, moderate naphthalene	circle in middle (day 6 to 7)
					odor (day 1 to 3)	~Particles at bottom of beaker (day 1 to 7)
					~Strong concrete, light naphthalene	~Sample is beginning to disintegrate (day 3)
					odor (day 4 to 7)	~Sample is continuing to disintegrate (day 5 to 7)
						~Moderate concrete, light naphthalene odor (day 1 to 7)
						~No oily sheen observed (day 1 to 7)
0427-016A	N-12	3.0%	0.0%	166.70%	~Water color light brownish gray (day 1)	~Water color clear (day 1 to 2)
					~Water color very pale brown (day 2 to 7)	~Water color very pale brown (day 3 to 7)
					~Top of water color light gray (day 1 to 7)	~Top of water color light gray (day 1 to 5)
					~Particles at bottom of beaker (day 1 to 7)	~Top of water color very pale brown with light gray
					~Moderate concrete, moderate naphthalene	circle in middle (day 6 to 7)
					odor (day 1 to 3)	~Particles at bottom of beaker (day 1 to 7)
					~Moderate concrete, faint naphthalene	~Mild concrete, mild naphthalene odor (day 1)
					odor (day 4)	~Moderate concrete, mild naphthalene (day 2 to 6)
					~Strong concrete, faint naphthalene odor (day 6)	~Moderate concrete, strong naphthalene (day 7)
					~Strong concrete, light naphthalene odor (day 7)	~No oily sheen observed (day 1 to 7)
0427-017A	N-13	3.0%	0.5%	181.60%	~Water color clear (day 1)	~Water color very pale brown (day 1 to 7)
					~Water color very pale brown (day 2 to 7)	~Top of water color light gray with light gray
					~Top of water color light gray (day 1 to 7)	circle in middle (day 1, 3 to 7)
					~Particles at bottom of beaker (day 1 to 7)	~Top of water color light gray (day 2)
					~Light concrete, light naphthalene odor (day 1)	~Particles at bottom of beaker (day 1 to 7)
					~Mild concrete, light naphthalene odor (day 2 to 4)	~Mild concrete, mild naphthalene odor (day 1 to 3)
					~Moderate concrete, light naphthalene (day 6)	~Moderate concrete, moderate naphthalene (day 5 to 7)
					~Moderate concrete, moderate naphthalene (day 7)	

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-018A	N-14	3.0%	1.5%	274.60%	~Water color clear (day 1)	~Water color very pale brown (day 1 to 7)
					~Water color very pale brown (day 2 to 7)	~Top of water color light gray (day 1 to 2)
					~Top of water color light gray (day 1 to 7)	~Top of water color very pale brown with light gray
					~Particles at bottom of beaker (day 1 to 7)	circle in middle (day 3 to 7)
					~Strong concrete, moderate naphthalene	~Particles at bottom of beaker (day 1 to 7)
					odor (day 1 to 4)	~Mild concrete, mild naphthalene odor (day 1 to 3)
					~Strong concrete, light naphthalene (day 6 to 7)	~Moderate concrete, mild naphthalene (day 5)
						~Strong concrete, mild naphthalene (day 6 to 7)
						~No oily sheen observed (day 1 to 7)
0427-026	N-15	6.5%	0.0%	100.00%	14-day cure immersion test was not performed.	~Water color very pale brown (day 2 to 3)
						~Water color white (day 4 to 7)
						~Top of water color light gray (day 2 to 7)
						~Light concrete odor (day 2 to 3)
						~Moderate concrete odor (day 4)
						~Moderate concrete, faint naphthalene odor (day 5 to 6)
						~Moderate concrete, light naphthalene odor (day 7)
						~No oily sheen observed (day 2 to 7)
0427-026 DUP	N-15DUP	6.5%	0.0%	100.00%	14-day cure immersion test was not performed.	~Water color very pale brown (day 2 to 3)
						~Water color white (day 4 to 7)
						~Top of water color light gray (day 2 to 6)
						~Top of water color white (day 7)
						~Light concrete odor (day 2)
						~Moderate concrete odor (day 3 to 4)
						~Moderate concrete, light naphthalene odor (day 5 to 7)
						~No oily sheen observed (day 2 to 7)
0427-027	N-16	6.5%	0.5%	93.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 4)
						~Water color very pale brown (day 5 to 7)
						~Top of water color light gray (day 2 to 6)
						~Top of water color very pale brown (day 7)
						~Faint concrete odor (day 2 to 3)
						~Light concrete odor (day 4)
						~Moderate concrete odor (day 5 to 7)
						~Sample is beginning to disintegrate (day 6)
						~Particles at bottom of beaker (day 6 to 7)
						~No oily sheen observed (day 2 to 7)
0427-028	N-17	6.5%	1.5%	161.00%	14-day cure immersion test was not performed.	~Water color very pale brown (day 2 to 5)
						~Water color white (day 6 to 7)
						~Top of water color light gray (day 2 to 7)
						~Faint concrete, faint naphthalene odor (day 2 to 3)
						~Light concrete, faint naphthalene odor (day 4)
						~Light concrete, light naphthalene odor (day 5)
						~Light concrete, moderate naphthalene odor (day 6 to 7)
						~No oily sheen observed (day 2 to 7)
0427-029	N-18	8.5%	0.0%	65.00%	14-day cure immersion test was not performed.	~Water color very pale brown (day 2)
						~Water color white (day 3 to 7)
						~Top of water color light gray (day 2 to 6)
						~Top of water color white (day 7)
						~Faint concrete, light naphthalene odor (day 2 to 3)
						~Light concrete, light naphthalene odor (day 4)
						~Light concrete, moderate naphthalene odor (day 5 to 7)
						~No oily sheen observed (day 2 to 7)

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-030	N-19	8.5%	0.5%	95.00%	14-day cure immersion test was not performed.	~Water color white (day 2 to 7)
						~Top of water color light gray (day 2 to 6)
						~Top of water color white (day 7)
						~Light concrete odor (day 2 to 3)
						~Moderate concrete, faint naphthalene (day 4)
						~Moderate concrete, light naphthalene (day 5)
						~Moderate concrete, moderate naphthalene (day 6)
						~Moderate concrete, strong naphthalene (day 7)
						~No oily sheen observed (day 2 to 7)
0427-031	N-20	8.5%	1.5%	125.00%	14-day cure immersion test was not performed.	~Water color very pale brown (day 2)
						~Water color white (day 3 to 7)
						~Top of water color light gray (day 2 to 5)
						~Top of water color white (day 6 to 7)
						~Light concrete odor (day 2 to 3)
						~Moderate concrete, faint naphthalene odor (day 4)
						~Moderate concrete, light naphthalene odor (day 5)
						~Moderate concrete, moderate naphthalene
						odor (day 6)
						~Strong concrete, moderate naphthalene odor (day 7)
						~No oily sheen observed (day 2 to 7)
0427-019	F-05	0.0%	0.5%	730%	Bentonite-only aliquots collapsed during testing, immersion test was not performed	
0427-020	F-06	0.0%	1.5%	533%	Bentonite-only aliquots collapsed during testing, immersion test was not performed	
0427-021A	F-07	10.0%	0.5%	93.90%	~Water color clear (day 1 to 3)	~Water color clear (day 1 to 2)
					~Water color very pale brown (day 4)	~Water color white (day 3 to 7)
					~Water color white (day 6 to 7)	~Top of water color light gray (day 1 & 3)
					~Top of water color light gray (day 1 to 7)	~top of water color clear with light gray circle in
					~White particles at bottom of beaker (day 4 to 7)	middle (day 2)
					~Moderate concrete, moderate naphthalene	~Top of water color white with light gray circle
					odor (day 1 to 6)	in middle (day 5 to 7)
					~Moderate concrete, strong naphthalene (day 7)	~Moderate concrete odor (day 1 to 2)
						~Moderate concrete, mild menthol odor (day 3)
						~Moderate concrete, moderate naphthalene
						odor (day 5 to 7)
						~No oily sheen observed (day 1 to 7)
0427-022A	F-08	5.0%	0.5%	136.40%	~Water color clear (day 1 to 3)	~Water color clear (day 1 to 2)
					~Water color very pale brown (day 4 to	~Water color very pale brown (day 3 to 7)
					~Top of water color light gray (day 1 to 7)	~Top of water color clear with light gray circle in
					~Moderate concrete, moderate naphthalene	middle (day 1 to 2)
					odor (day 1 to 6)	~Top of water color light gray (day 3 to 5)
					~Strong concrete, strong naphthalene odor (day 7)	~Top of water color very pale brown with light gray
						circle in middle (day 6 to 7)
						~Moderate concrete odor (day 1 to 2)
						~Moderate concrete, faint menthol odor (day 3)
						~Moderate concrete, light menthol odor (day 5 to 7)
						~No oily sheen observed (day 1 to 7)

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-023A	F-09	3.0%	0.0%	147.60%	~Water color very pale brown (day 1 to 7)	~Water color clear (day 1 to 3)
					~Top of water color light gray (day 1 to 7)	~Water color very pale brown (day 5 to 7)
					~Moderate concrete, faint naphthalene odor (day 1 to 4)	~Top of water color clear with light gray circle in middle (day 1 to 2)
					~Moderate concrete, light naphthalene odor (day 7)	~Top of water color light gray (day 3 to 5)
					~Moderate concrete, strong naphthalene odor (day 7)	~Top of water color very pale brown with light gray circle in middle (day 6 to 7)
						~Particles at bottom of beaker (day 3 to 7)
						~Sample is beginning to disintegrate (day 2)
						~Sample is continuing to disintegrate (day 3 to 7)
						~Moderate concrete odor (day 1)
						~Moderate concrete, light naphthalene odor (day 2 to 6)
						~Moderate concrete, moderate naphthalene (day 7)
						~No oily sheen observed (day 1 to 7)
0427-024A	F-10	3.0%	0.5%	185.70%	~Water color very pale brown (day 1 to 7)	~Water color clear (day 1 to 2)
					~Top of water color light gray (day 1 to 7)	~Water color very pale brown (day 3)
					~Moderate concrete, faint naphthalene odor (day 1 to 4)	~Water color white (day 5 to 7)
					~Moderate concrete, light naphthalene odor (day 6)	~Top of water color light gray (day 1 to 5)
					~Moderate concrete, strong naphthalene odor (day 7)	~Top of water color white with light gray circle in middle (day 6 to 7)
						~Particles at bottom of beaker (day 3 to 7)
						~Sample is beginning to disintegrate on one side (day 1)
						~Sample is continuing to disintegrate (day 2 to 7)
						~Moderate concrete odor (day 1)
						~Moderate concrete, light naphthalene odor (day 2 to 5)
						~Strong concrete, light naphthalene (day 6)
						~Strong concrete, strong naphthalene odor (day 7)
						~No oily sheen observed (day 1 to 7)
0427-025A	F-11	3.0%	1.5%	277.80%	~Water color very pale brown (day 1 to 7)	~Water color clear (day 1 to 3)
					~Top of water color light gray (day 1 to 7)	~Water color very pale brown (day 5 to 7)
					~Strong concrete, moderate naphthalene odor (day 1 to 6)	~Top of water color light gray (day 1 to 3)
					~Strong concrete, strong naphthalene odor (day 7)	~Top of water color very pale brown (day 5)
						~Top of water color very pale brown with light gray circle in middle (day 6 to 7)
						~Particles at bottom of beaker (day 3 to 7)
						~Sample is beginning to disintegrate on one side (day 2)
						~Sample is continuing to disintegrate (day 3 to 7)
						~Small bubble formed on side (day 3)
						~Moderate concrete odor (day 1)
						~Moderate concrete, light naphthalene odor (day 2 to 5)
						~Moderate concrete, moderate naphthalene (day 6 to 7)
						~No oily sheen observed (day 1 to 7)
0427-034	F-12	6.5%	0.0%	114.00%	14-day cure immersion test was not performed.	~Water color very pale brown (day 2 to 7)
						~Top of water color light gray (day 2)
						~Top of water color very pale brown (day 3 to 7)
						~Faint concrete odor (day 2 to 3)
						~Faint concrete, light naphthalene odor (day 4 to 5)
						~Faint concrete, mild menthol odor (day 6)
						~Light concrete, moderate naphthalene odor (day 7)
						~Particles at bottom of beaker (day 6 to 7)
						~No oily sheen observed (day 2 to 7)

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-035	F-13	6.5%	0.5%	127.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 5) ~Top of water color clear (day 6 to 7) ~Faint concrete, faint naphthalene odor (day 2 to 3) ~Light concrete, faint naphthalene odor (day 4) ~Light concrete, light naphthalene odor (day 5) ~Light concrete, moderate naphthalene odor (day 6) ~Moderate concrete, moderate naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7)
0427-036	F-14	6.5%	1.5%	208.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 6) ~Top of water color clear with light gray circle in the middle (day 7) ~Light concrete, faint naphthalene odor (day 2 to 3) ~Light concrete, faint menthol (day 4 to 6) ~Light concrete, light menthol odor (day7) ~No oily sheen observed (day 2 to 7)
0427-037	F-15	7.5%	0.0%	106.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 5) ~Top of water color clear (day 6 to 7) ~Faint concrete, light naphthalene odor (day 2 to 3) ~Faint concrete, moderate naphthalene odor (day 4 to 7) ~No oily sheen observed (day 2 to 7)
0427-038	F-16	7.5%	0.5%	96.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 5) ~Top of water color clear (day 6 to 7) ~Faint concrete, light naphthalene odor (day 2 to 3) ~Light concrete, light naphthalene odor (day 4) ~Light concrete, moderate naphthalene odor (day 5 to 6) ~Light concrete, strong naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7)
0427-039	F-17	7.5%	1.5%	155.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 5) ~Top of water color clear (day 6 to 7) ~Faint concrete, faint naphthalene odor (day 2 to 3) ~Light concrete, faint naphthalene odor (day 4) ~Light concrete, light naphthalene odor (day 5 to 6) ~Light concrete, moderate naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7)
0427-040	F-18	8.5%	0.0%	96.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 6) ~Top of water color clear with light gray circle in the middle (day 7) ~Faint concrete, light naphthalene odor (day 2 to 3) ~Light concrete, light naphthalene odor (day 4 to 6) ~Light concrete, moderate naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7)
0427-041	F-19	8.5%	0.5%	95.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 7) ~Light concrete, faint naphthalene odor (day 2 to 3) ~Moderate concrete, faint naphthalene odor (day 4 to 6) ~Moderate concrete, light naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7)

TABLE 2-8
TREATABILITY STUDY TESTING RESULTS - IMMERSION TEST OBSERVATIONS
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

KEMRON Sample Number	BC Sample ID	Reagent Addition			7-Day Observations after 14-Day Cure	7-Day Observations after 28-Day Cure
		Portland Cement (% wet soil wt)	Bentonite (% wet soil wt)	Water (% reagent weight)		
0427-042	F-20	8.5%	1.5%	119.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 6) ~Top of water color clear with light gray circle in the middle (day 7) ~Light concrete, faint naphthalene odor (day 2 to 3) ~Moderate concrete, faint naphthalene odor (day 4 to 6) ~Moderate concrete, light naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7)
0427-042 DUP	F-20DUP	8.5%	1.5%	119.00%	14-day cure immersion test was not performed.	~Water color clear (day 2 to 7) ~Top of water color light gray (day 2 to 6) ~Top of water color clear with light gray circle in the middle (day 7) ~Faint concrete, faint naphthalene odor (day 2 to 3) ~Light concrete, faint naphthalene odor (day 4 to 6) ~Light concrete, light naphthalene odor (day 7) ~No oily sheen observed (day 2 to 7)

Notes:

- Indicates that deterioration of a 28-day cure sample was observed ("Particles at the bottom", "sample is beginning to disintegrate")

“Particles at the bottom” referred to small particles from the sides of the samples disintegrating.

“Sample is beginning to disintegrate” referred to obvious cracks in the sample.

Although, there were particles at the bottom and cracks in some samples, they all held the cylinder shape. None of the samples completely fell apart

TABLE 2-11
TREATABILITY STUDY TESTING RESULTS - REPEATABILITY
PATCHOGUE FORMER MANUFACTURED GAS PLANT SITE
VILLAGE OF PATCHOGUE, SUFFOLK COUNTY, NEW YORK

Kemron Sample Number	BC Sample ID	Untreated Material Type	Reagent Addition % by Wet Soil wt.		Volumetric Expansion (%)	UCS (lb/in^2)	K (cm/sec)
			Portland Cement	Bentonite			
0427-012A	N-08	Native	7.5	0.5	25.73	52.1	6.9E-06
0427-033 DUP	N-08DUP	Native	7.5	0.5	30.52	64.3	3.4E-06
				Difference [1]	**19%**	**23%**	**2.0**
0427-026	N-15	Native	6.5	0.0	15.21	76.6	2.0E-05
0427-026 DUP	N-15DUP	Native	6.5	0.0	14.48	78.3	1.1E-05
				Difference [1]	**-5%**	**2%**	**1.8**
0427-042	F-20	Fill	8.5	1.5	42.06	112.4	2.9E-07
0427-042 DUP	F-20DUP	Fill	8.5	1.5	36.29	68.4	9.4E-07
				Difference [1]	**-14%**	**-39%**	**0.3**

Notes:

1 - For the volumetric expansion and UCS, the difference is defined as the percentage of the original value:

Difference = 100% (Original - Duplicate) / Original

Hydraulic conductivity can vary over orders of magnitude; therefore, the difference is defined as a ratio of the original to the duplicate:

Difference = Original / Duplicate

The hydraulic conductivity difference between 0.1 and 10 indicates the same order of magnitude for the original and duplicate values.

TABLE 2-13
OFF-SITE INVESTIGATION SUMMARY
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Location ID	Date of Observation	Total Depth (ft., BGS)	Depth of Observation (ft., BGS)	Visual/Olfactory Observations
SB-201	5/8/2014	10	4.5-4.8	Black stringy, tacky, viscous NAPL, moderate naphthalene-like odor.
SB-202	5/8/2014	17	4.0-5.1	Slight naphthalene-like odor
			5.3-5.5	Black stringy, tacky, viscous NAPL partially coating sand grains, moderate naphthalene-like odor.
			5.8-6.1	Black stringy, tacky, viscous NAPL partially coating sand grains, moderate naphthalene-like odor;.
			9.0-9.3	Sporadic sheen visible on sand grains within soil core and on acetate liner.
SB-203	5/8/2014	13	3.8-4.0	Slight sheen visible on gravel surfaces, strong naphthalene-like odor.
			4.0-4.3	Slight naphthalene-like odor.
SB-204	5/8/2014	9		No visible observations or odor indicative of MGP-related or other materials.
SB-205	5/8/2014	8		No visible observations or odor indicative of MGP-related or other materials.
SB-206	5/8/2014	12	3.5-4.0	Black, stringy, tacky, viscous, NAPL partially coating wood and sand grains, moderate sheen, moderate naphthalene-like odor.
			4.0-4.9	Slight naphthalene-like odor.
SB-207	5/9/2014	10	4.4-5.0	Slight sheen visible on sand grains, slight naphthalene-like odor.
			5.0-5.2	Slight naphthalene-like odor.
SB-208	5/9/2014	11	5.6-5.8	Black stringy, tacky viscous NAPL partially coating sand grains and wood, strong naphthalene-like odor.
SB-209	5/9/2014	11	2.9	Specs of sheen on surface of water in borehole.
			3.0-3.3	Moderate sheen on sand grains, moderate naphthalene-like odor.
SB-210	5/9/2014	31	15-31	Soils recovered from 15 to 31 feet bgs had a faint to slight naphthalene-like odor likely due to potential transport of impacted groundwater during the drilling process from shallower intervals to the base of the borehole. No recovery from 27 to 29 or 29 to 31 feet BGS.

TABLE 2-13
OFF-SITE INVESTIGATION SUMMARY
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Location ID	Date of Observation	Total Depth (ft., BGS)	Depth of Observation (ft., BGS)	Visual/Olfactory Observations
SB-211	5/9/2014	11	2.6-4.7	Slight naphthalene-like odor.
			5.0-8.6	Slight naphthalene-like odor.
SB-212	3/17/2016	10	4.0-4.6	Little black staining (flat luster), faint-slight mothball-like odor.
			4.6-5.0	Black staining, moderate-strong mothball-like odor.
			5.0-5.4	Slight black staining, slight mothball-like odor.
			5.4-5.9	Soils moderately coated with black, moderately viscous NAPL (stringy, tacky), strong mothball-like odor, black staining, sheen.
			5.9-6.6	Faint mothball-like odor.
SB-213	3/17/2016	10	5.0-5.8	Black staining (flat luster), slight mothball-like odor.
			5.8-6.8	Little black staining (flat luster), moderate mothball-like odor.
SB-214	3/17/2016	10	4.0-4.2	Little black staining (flat luster), slight mothball-like odor;.
			4.2-4.5	Slight mothball-like odor.

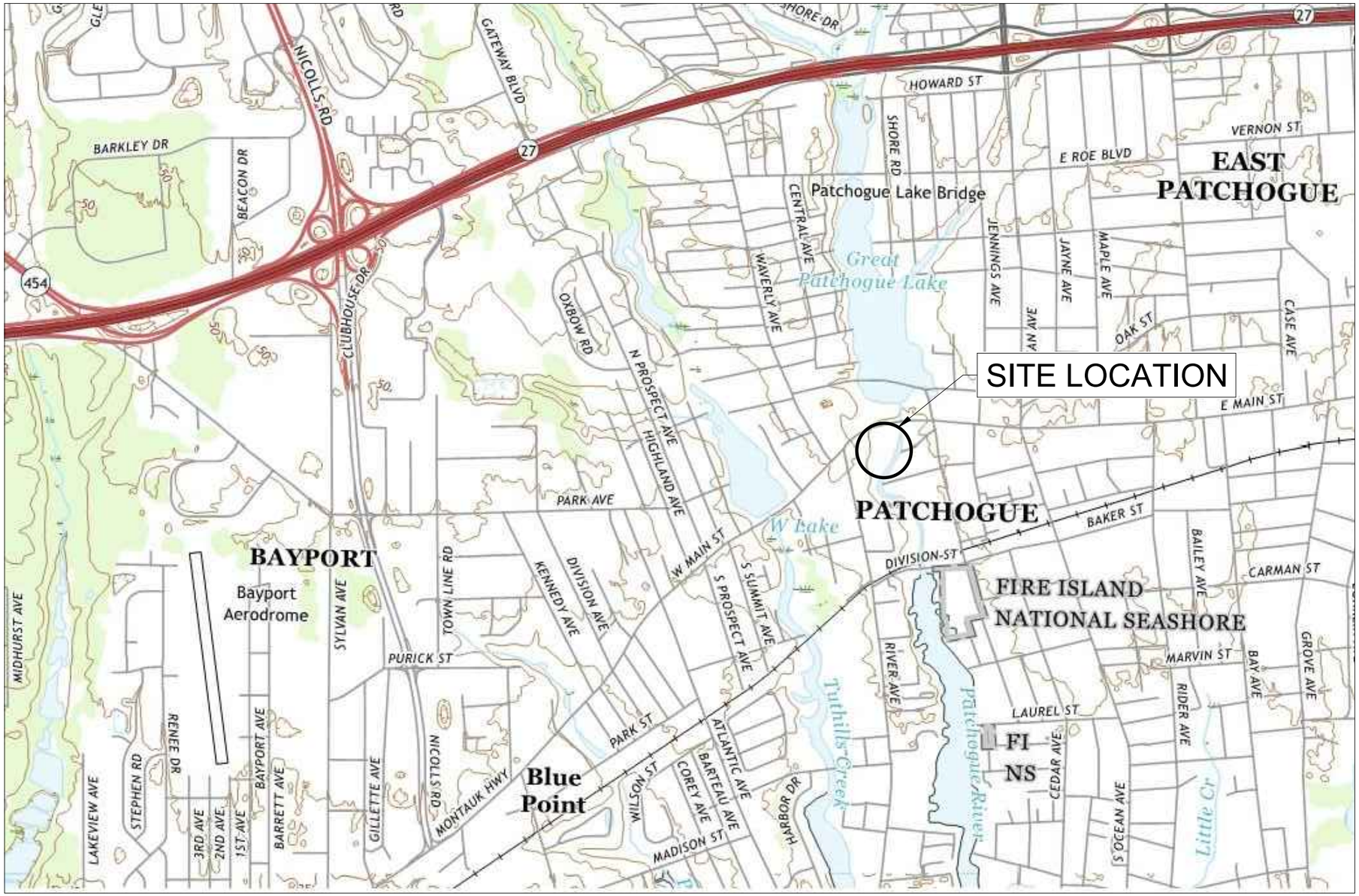
Notes:

BGS - Below Ground Surface

MGP - Manufactured Gas Plant

NAPL - Non-Aqueous Phase Liquid

Figures



SOURCE:
USGS 7.5 MINUTE TOPOGRAPHIC MAPS
PATCHOGUE □UADRANGLE
NEW YORK-SUFFOLK CO.
PATCHOGUE, NY 2016

0 750 1500
SCALE IN FEET

Brown AND Caldwell	SCALE: 1" = 1500' 149322 DATE: March 30, 2017	PATCHOGUE (212 and 234 WEST MAIN STREET) FORMER MGP SITE PATCHOGUE, NEW YORK	SITE LOCATION FIGURE 1-1

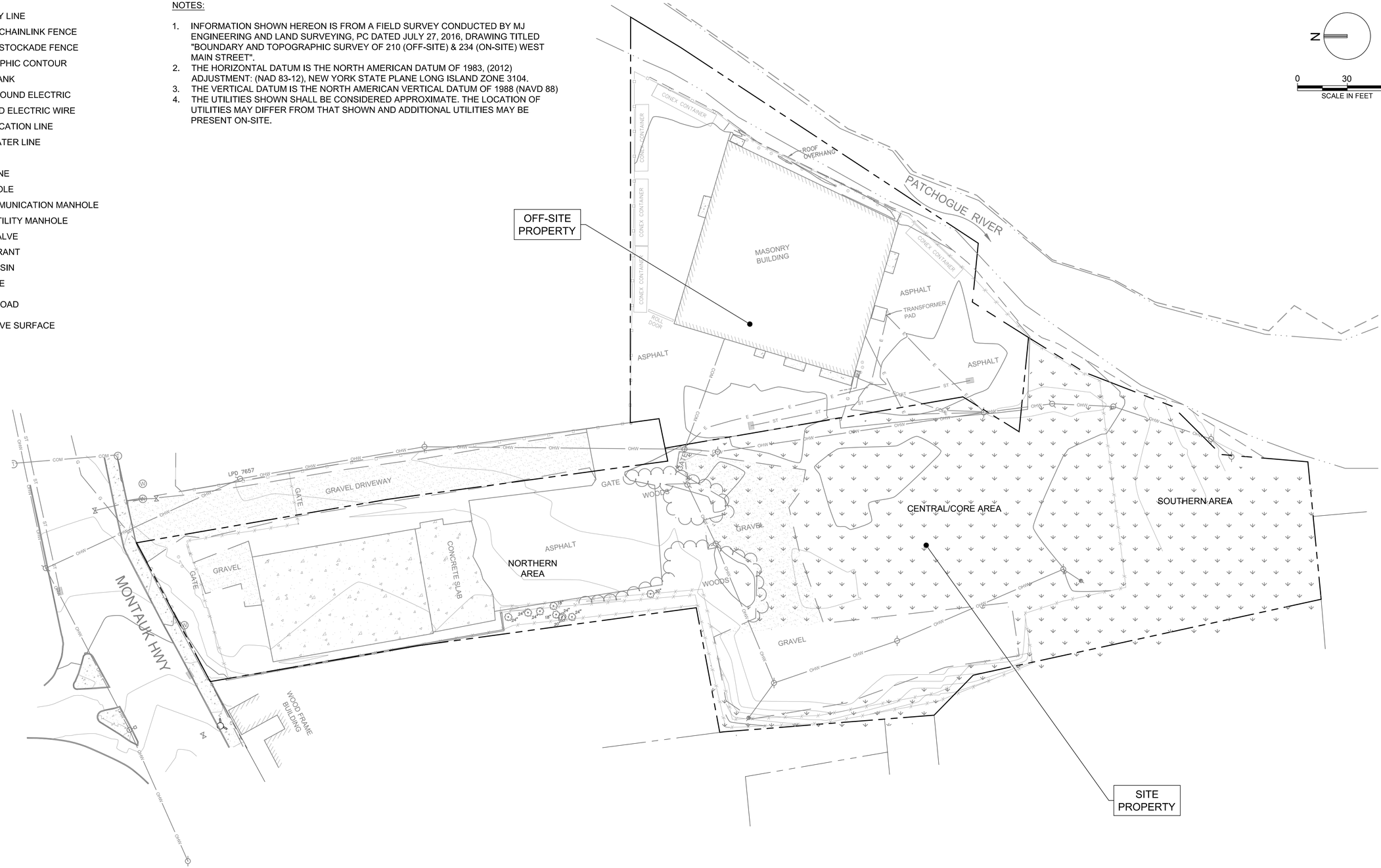
Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\60-95_RDR\2-Sheets\C-Ci□il File Name: FIGURE-1_ESD Plot Date: March 30, 2017 3:09 PM Cadd User: Eleanor Beck□ith

LEGEND:

- PROPERTY LINE
- EXISTING CHAINLINK FENCE
- EXISTING STOCKADE FENCE
- TOPOGRAPHIC CONTOUR
- TOP OF BANK
- UNDERGROUND ELECTRIC
- OVERHEAD ELECTRIC WIRE
- COMMUNICATION LINE
- STORMWATER LINE
- GAS LINE
- WATER LINE
- UTILITY POLE
- TELECOMMUNICATION MANHOLE
- WATER UTILITY MANHOLE
- WATER VALVE
- FIRE HYDRANT
- CATCH BASIN
- CONCRETE
- GRAVEL ROAD
- VEGETATIVE SURFACE

NOTES:

1. INFORMATION SHOWN HEREON IS FROM A FIELD SURVEY CONDUCTED BY MJ ENGINEERING AND LAND SURVEYING, PC DATED JULY 27, 2016, DRAWING TITLED "BOUNDARY AND TOPOGRAPHIC SURVEY OF 210 (OFF-SITE) & 234 (ON-SITE) WEST MAIN STREET".
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983, (2012) ADJUSTMENT: (NAD 83-12), NEW YORK STATE PLANE LONG ISLAND ZONE 3104.
3. THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
4. THE UTILITIES SHOWN SHALL BE CONSIDERED APPROXIMATE. THE LOCATION OF UTILITIES MAY DIFFER FROM THAT SHOWN AND ADDITIONAL UTILITIES MAY BE PRESENT ON-SITE.



Brown AND Caldwell	SCALE: 1" = 30' 147663 DATE: October 4, 2017	NATIONAL GRID PATCHOGUE FORMER MGP SITE 234 WESTMAIN STREET, VILLAGE OF PATCHOGUE, NY SITE PLAN	FIGURE 1-2

Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\2-SHEETS\C-CIVIL File Name: FIG_1-2 Plot Date: October 4, 2017 10:28 AM Cadd User: Robert Near

Figure 2-1
Aliquots of Native Soils
UCS as a Function of Cement and Bentonite Content

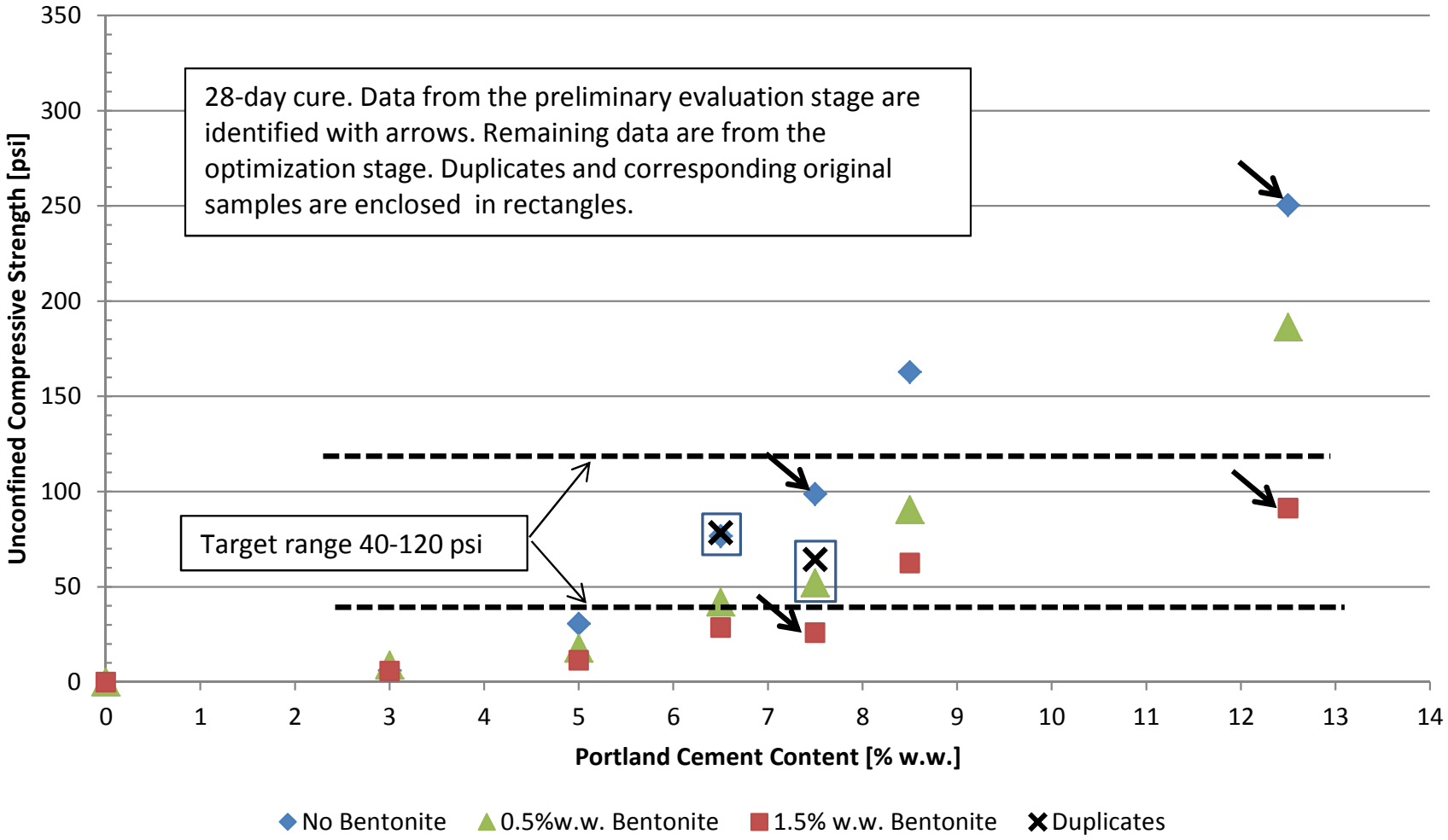


Figure 2-2
Aliquots of Fill
UCS as a Function of Cement and Bentonite Content

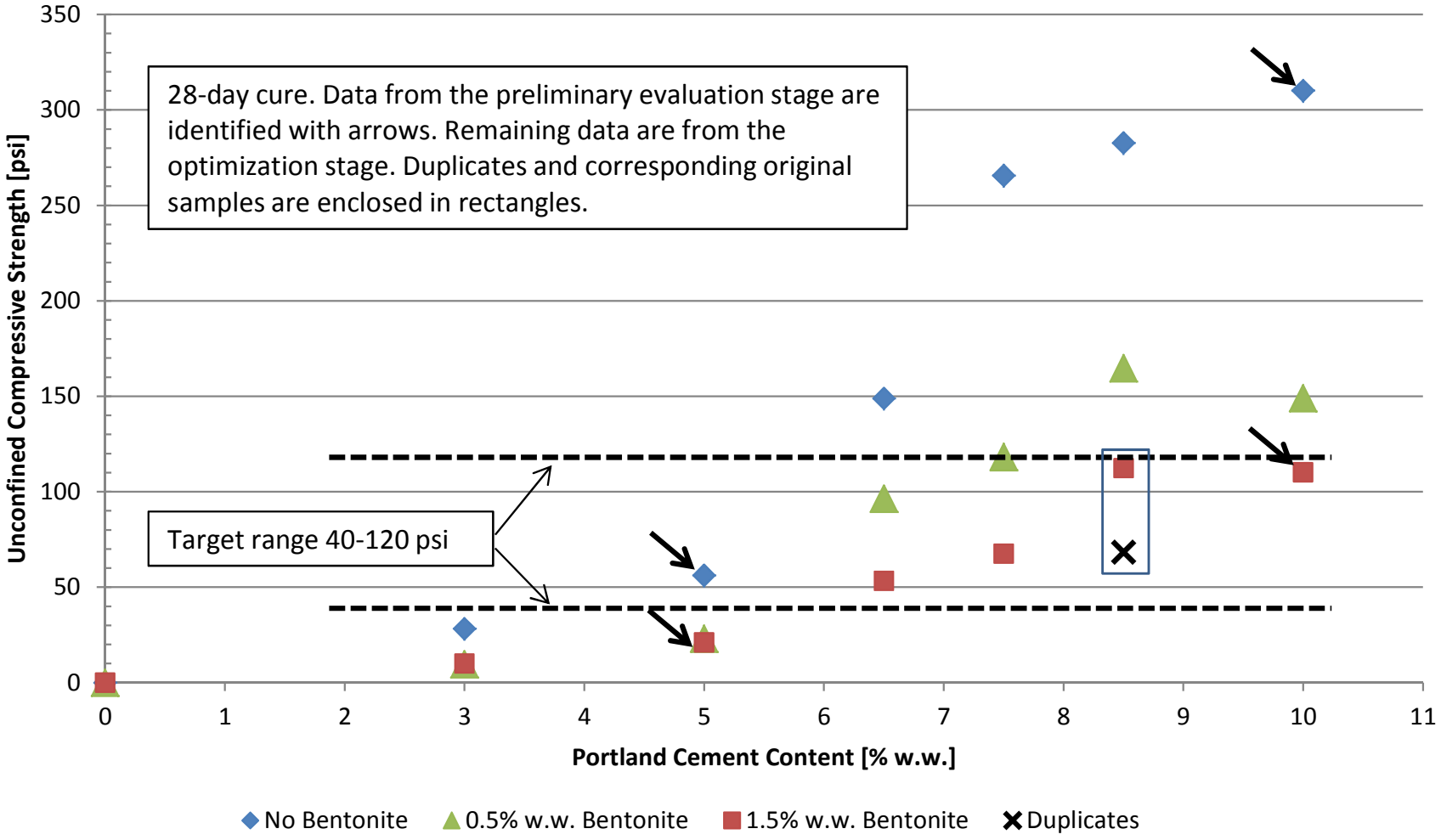


Figure 2-3
Aliquots of Native Soils
Hydraulic Conductivity as a Function of Cement and Bentonite Content

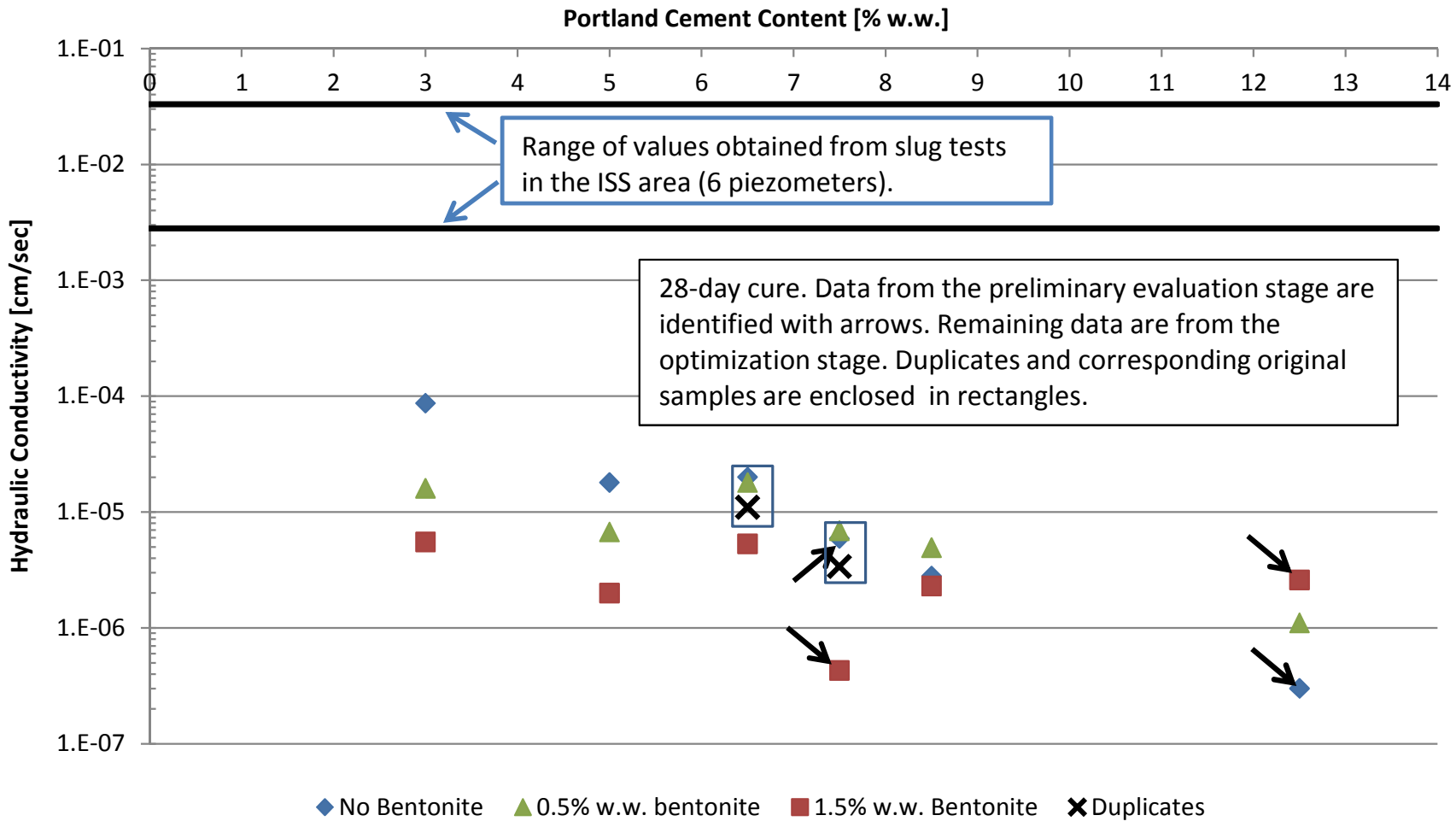


Figure 2-4
Aliquots of Fill
Hydraulic Conductivity as a Function of Cement and Bentonite Content

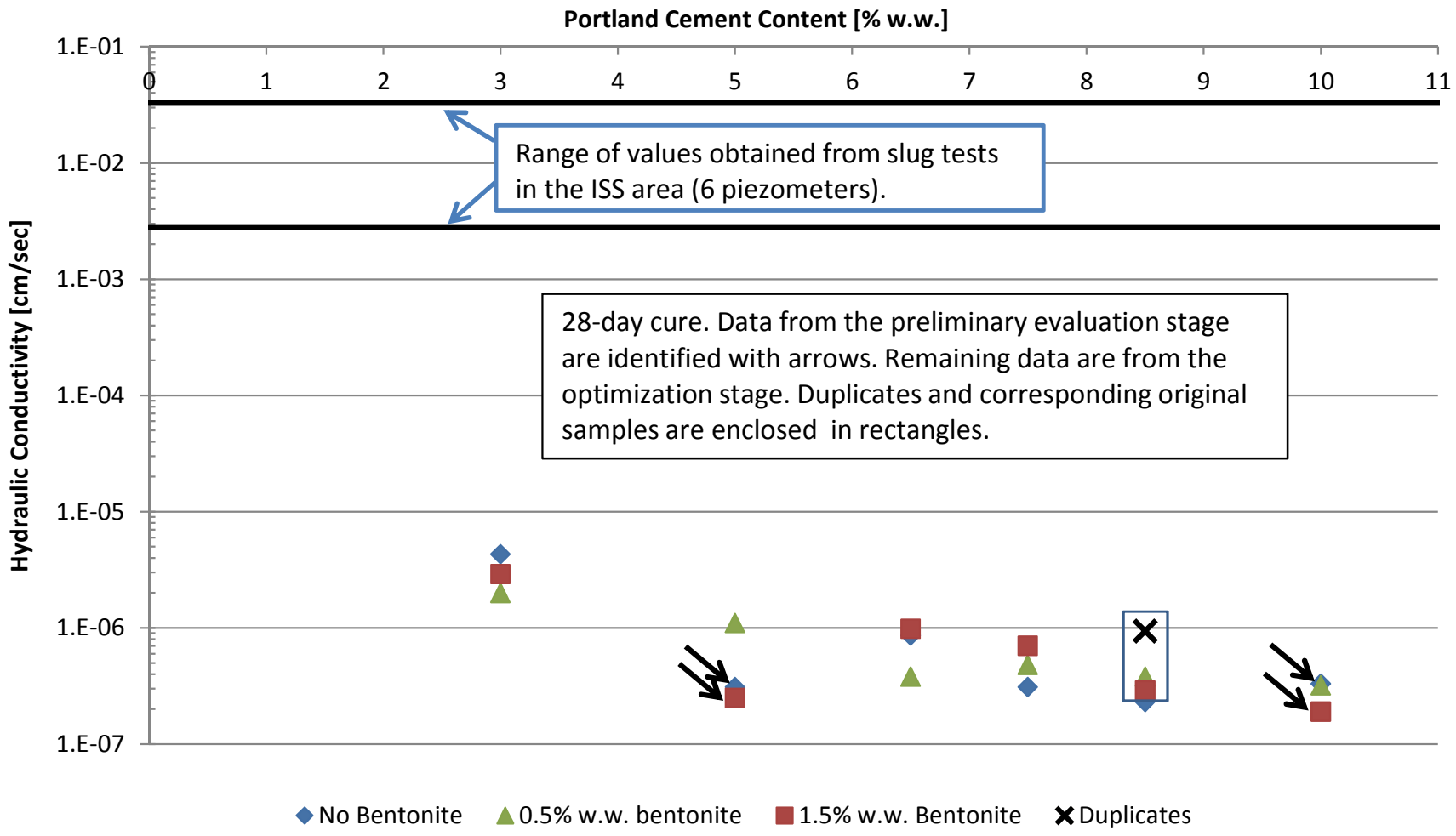


Figure 2-5
Aliquots of Native Soils
Volumetric Expansion as a Function of Cement and Bentonite Content

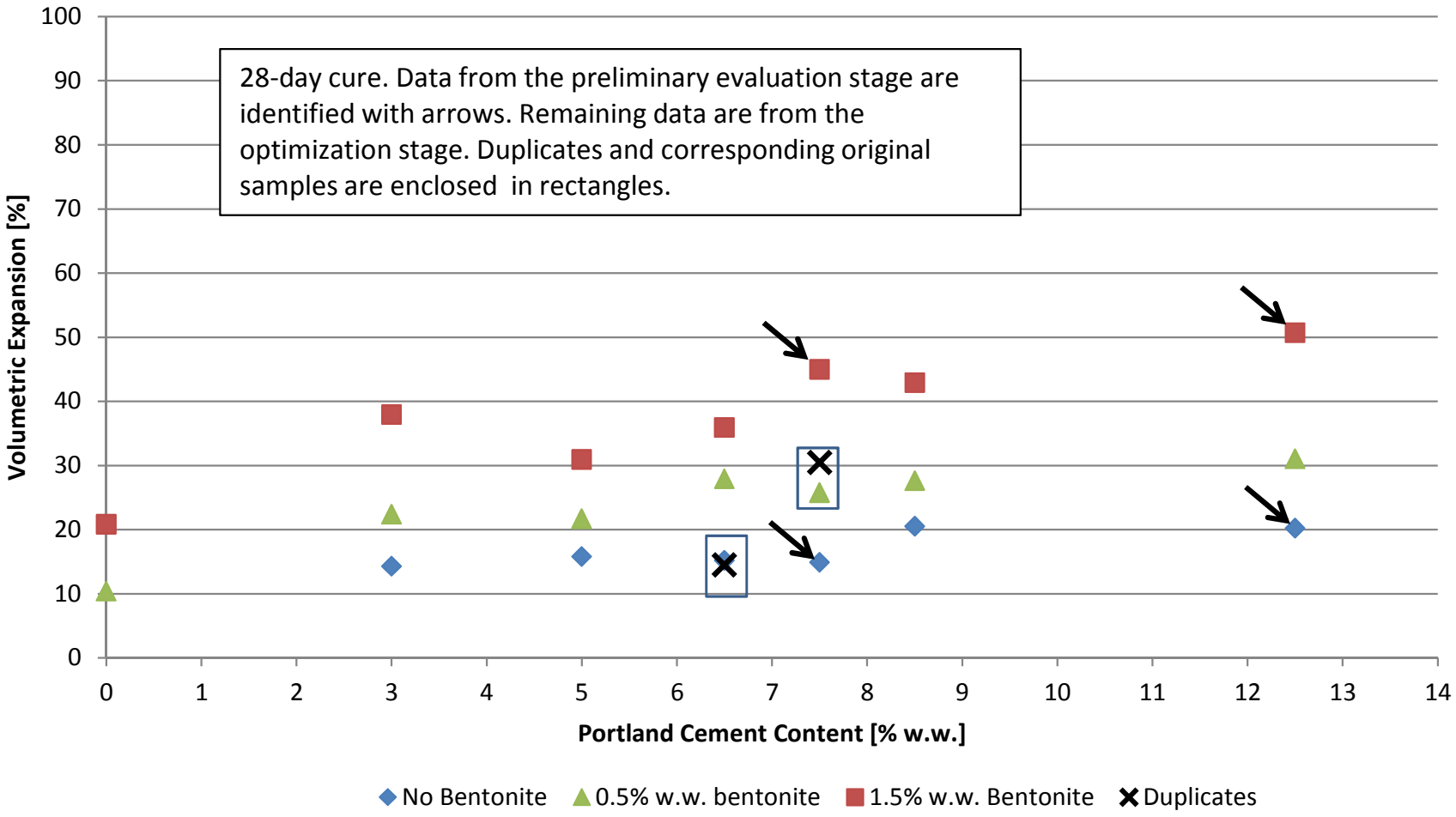


Figure 2-6
Aliquots of Fill
Volumetric Expansion as a Function of Cement and Bentonite Content

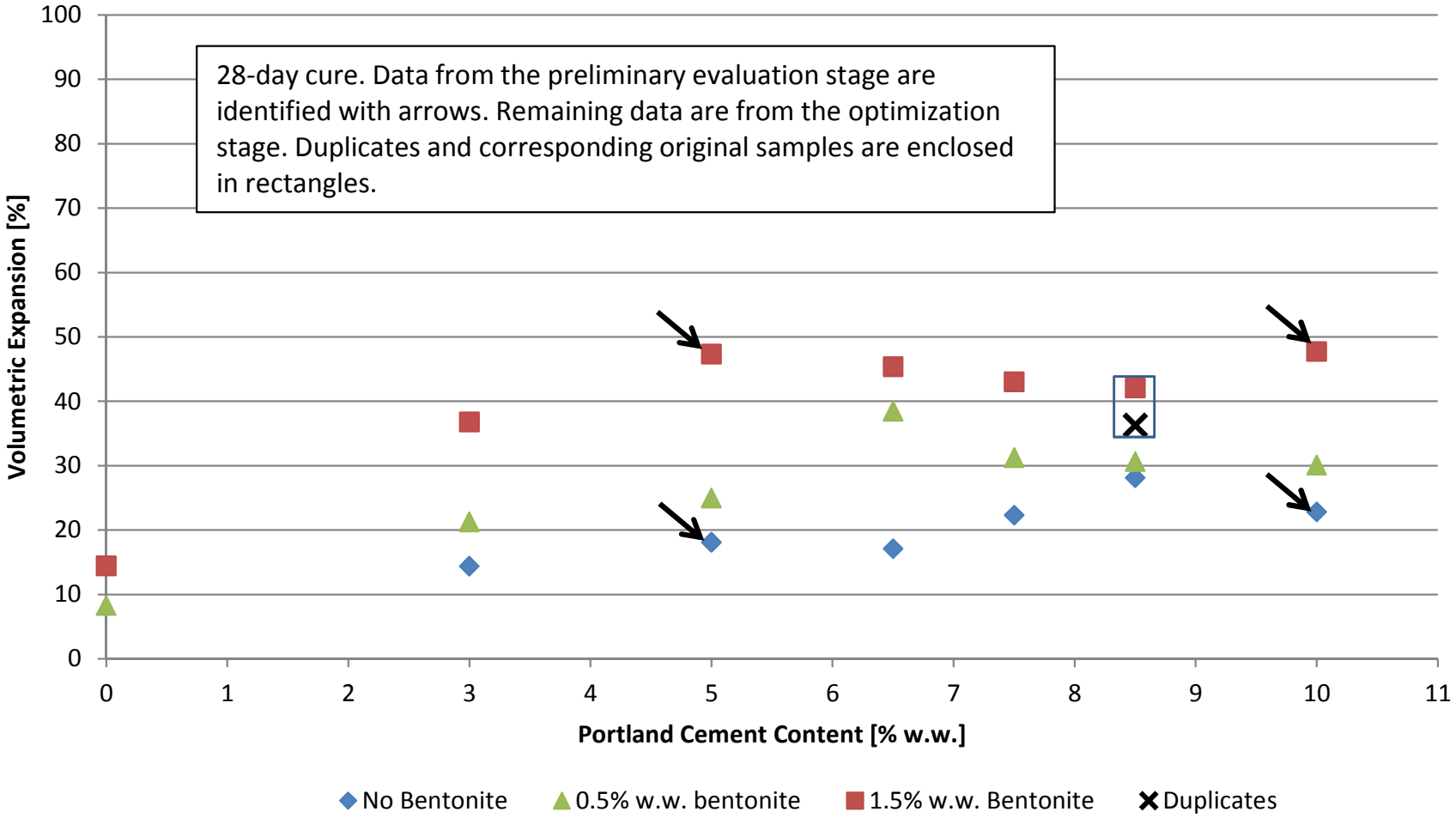


Figure 2-7
Summary of Results for Immersion and UCS Testing
28-day Cure

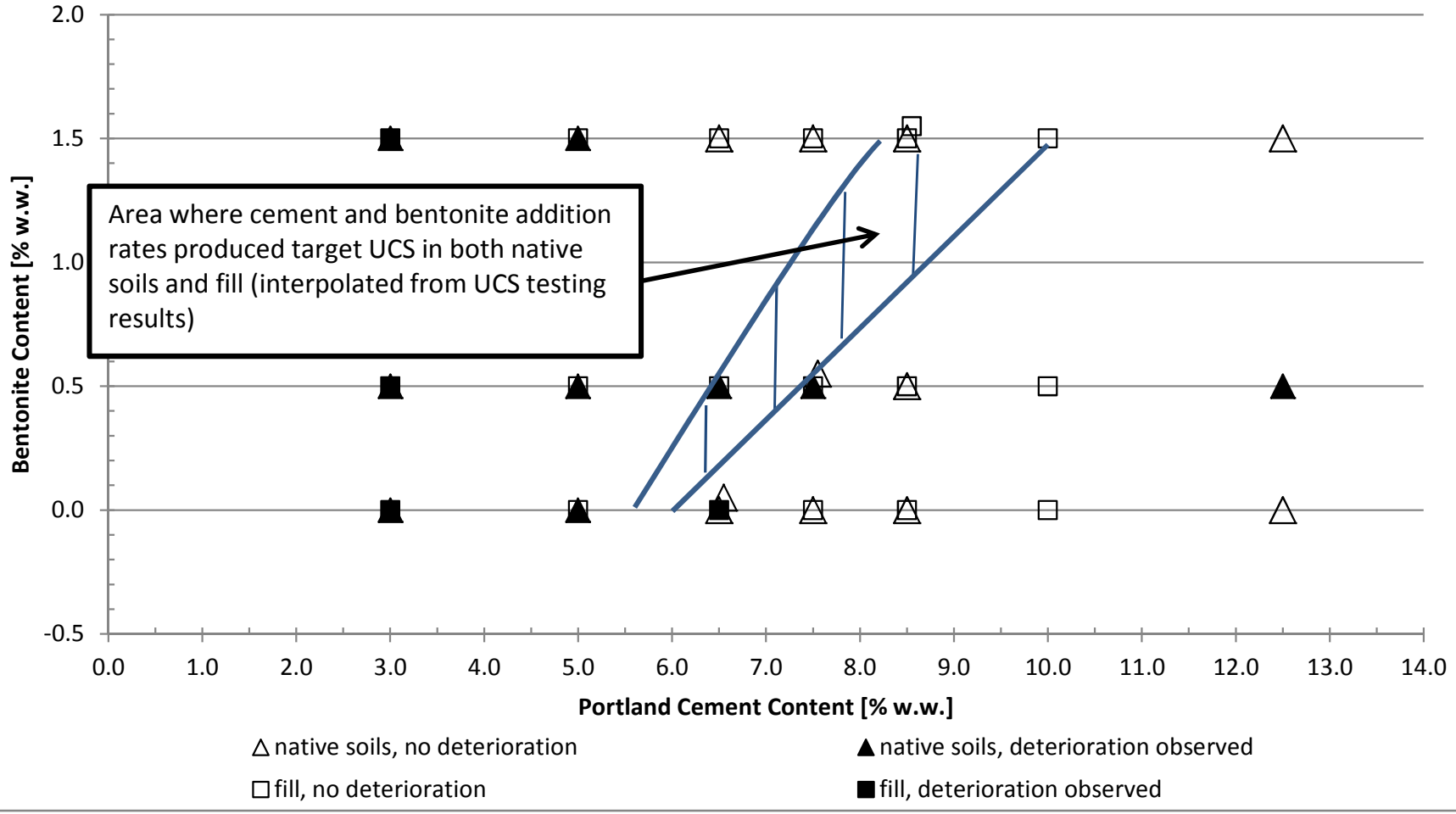


Figure 2-8
Unconfined Compressive Strength as a Function of Cure Time
Aliquots of 8.5% w.w. and 10.0% w.w. Portland Cement and 1.5% w.w. Bentonite

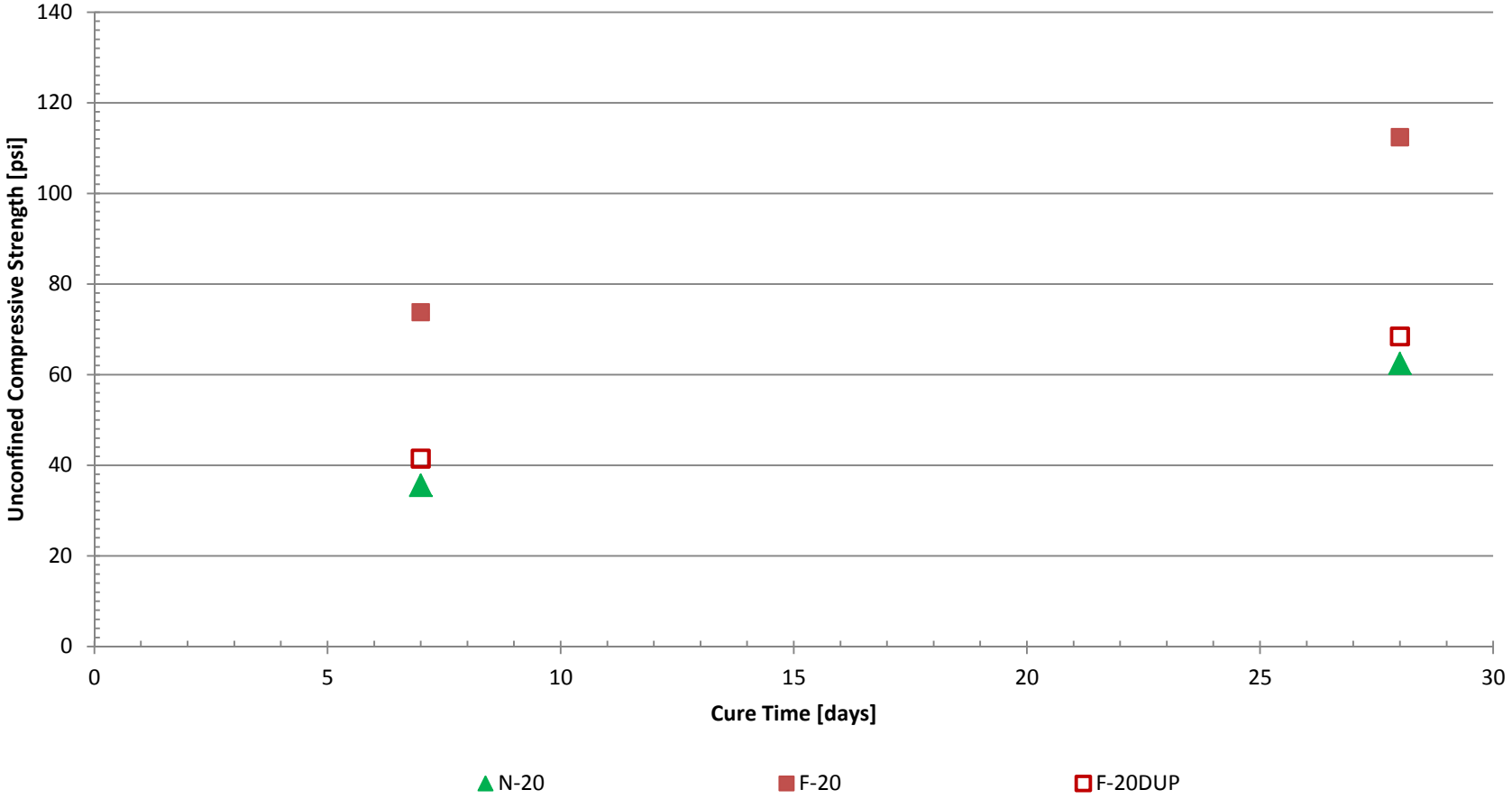
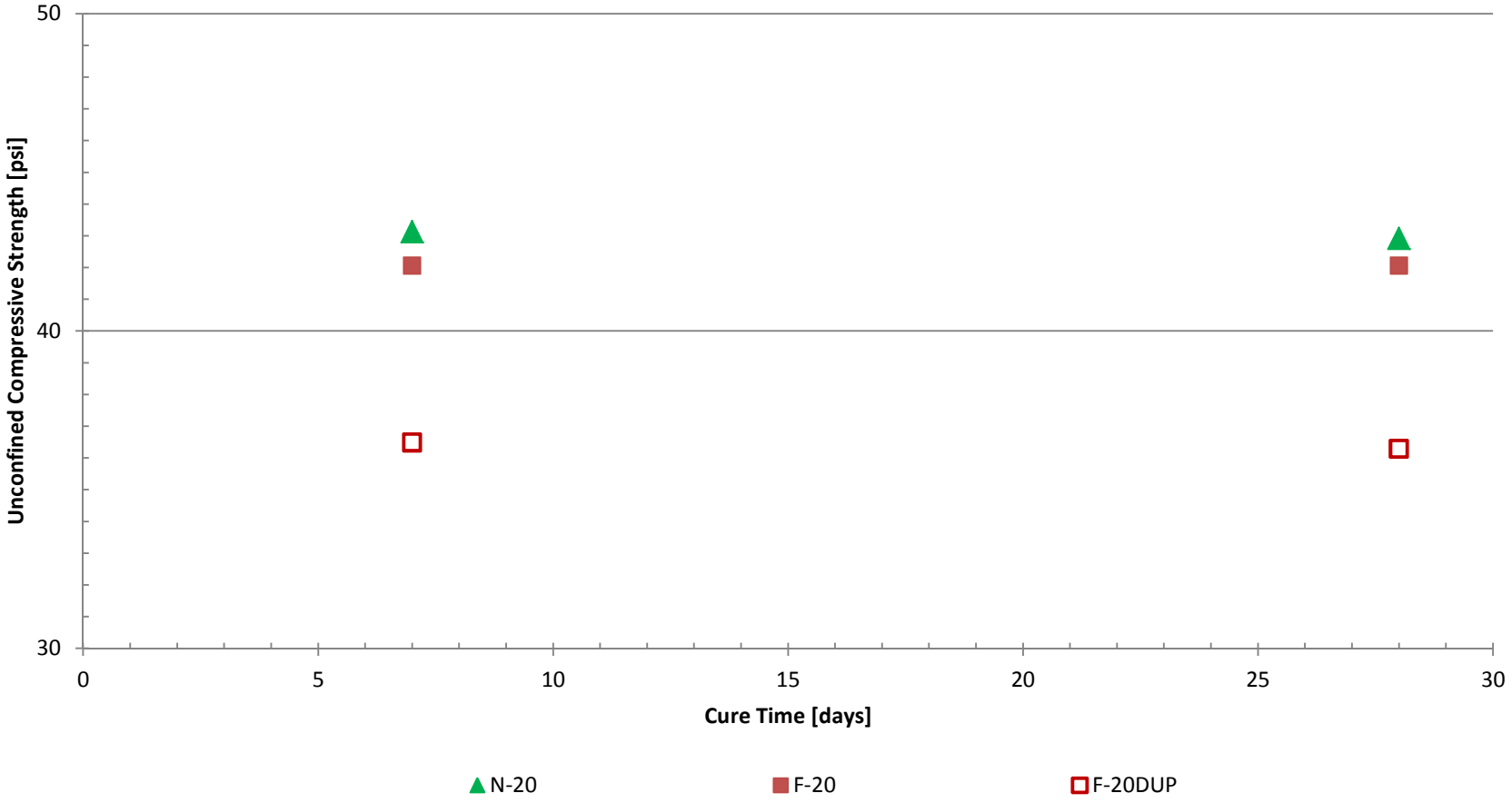


Figure 2-9
Volumetric Expansion as a Function of Cure Time
Aliquots of 8.5% w.w. and 10.0% w.w. Portland Cement and 1.5% w.w. Bentonite



Appendix A: Design Drawings

(Bound Separately)

REMEDIAL DESIGN DRAWINGS (100% SUBMISSION)
PATCHOGUE FORMER MGP SITE
234 WEST MAIN STREET
VILLAGE OF PATCHOGUE, NEW YORK

SOURCE: NEW YORK STATE GIS CLEARING HOUSE 2007 ORTHO IMAGERY

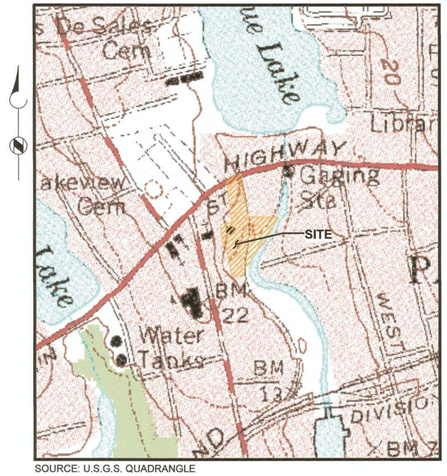
VICINITY MAP

0 200 400

SCALE IN FEET

LIST OF DRAWINGS

DRAWING NO.	TITLE
G-000	COVER
G-001	GENERAL NOTES AND LEGEND
C-101	EXISTING SITE CONDITIONS
C-102	HISTORICAL STRUCTURE LOCATIONS
C-103	HISTORICAL INVESTIGATION LOCATION PLAN
C-104	VISIBLE MGP-RELATED SOURCE MATERIAL AND GEOLOGICAL CROSS-SECTION LOCATIONS
C-105	GEOLOGICAL CROSS SECTIONS (A-A' AND B-B')
C-106	GEOLOGICAL CROSS SECTIONS (C-C' AND D-D')
C-107	WATER TABLE CONTOUR MAP - DECEMBER 27, 2016
C-108	WELL DECOMMISSIONING PLAN
C-110	SITE REMEDIATION PLAN
C-111	SITE PREPARATION PLAN
C-112	SITE RESTORATION PLAN
C-113	SITE RESTORATION GRADING PLAN
C-114	POST-REMEDIATION STORMWATER MANAGEMENT PLAN
C-115	STORMWATER MANAGEMENT CROSS SECTIONS AND PROFILE
C-301	REMEDIATION AREA CROSS SECTION
C-400	REMEDIAL ACTION PLAN - ENLARGEMENT A
C-401	REMEDIAL ACTION PLAN - ENLARGEMENT B
C-500	REMEDIATION DETAILS
C-501	SITE RESTORATION DETAILS
C-502	STORMWATER MANAGEMENT DETAILS
C-800	SOIL EROSION AND SEDIMENT CONTROL PLAN
C-801	SOIL EROSION AND SEDIMENT CONTROL DETAILS AND NOTES



SOURCE: U.S.G.S. QUADRANGLE

LOCATION MAP

0 500 1000

SCALE IN FEET

PREPARED FOR

NATIONAL GRID
175 EAST OLD COUNTRY ROAD
HICKSVILLE, NEW YORK 11801

PREPARED BY

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

May 2019

BC PROJECT NUMBER 153021

May 01, 2019 - 1:38pm
P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\100%-Design\2-SHEETS\G-GENERAL\G-000.dwg

NOTES

1. THE NOTE IN THE TITLE BLOCK OF THIS DRAWING WHICH READS "TWO INCHES AT FULL SCALE" APPEARS ON DRAWINGS FOR IDENTIFICATION OF SCALE DISTORTIONS ON HALF SIZE DRAWINGS AND DRAWING REPRODUCTIONS. IT SHALL MEAN THAT THE DRAWING IS FULL SIZE AND THE DRAWING SCALES ACCURATE WHEN THE LENGTH OF THIS LINE IS TWO INCHES. IF THE LENGTH IS OTHER THAN TWO INCHES, DRAWING SCALES MUST BE ADJUSTED ACCORDINGLY.
2. THE CONTRACTOR SHALL NOTIFY "DIG SAFELY NEW YORK" A MINIMUM OF 48 HOURS PRIOR TO STARTING ANY WORK.
3. ALL WORK SHALL BE CONSTRUCTED ACCORDING TO APPLICABLE STATE, COUNTY, AND LOCAL CODES.
4. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT AND SUPPORT EXISTING UTILITIES AND MAINTAIN CONTINUOUS SERVICE OF ALL UTILITIES.
5. EXISTING CONDITIONS IDENTIFIED HEREIN SHALL BE FIELD VERIFIED BY THE CONTRACTOR. THE CONTRACTOR SHALL IMMEDIATELY DISCUSS ANY CONFLICTS ARISING DURING CONSTRUCTION OF ANY IMPROVEMENTS SHOWN ON THESE DRAWINGS WITH THE NATIONAL GRID'S REPRESENTATIVE.
6. CONSTRUCTION ACTIVITIES SHALL BE LIMITED TO THE LIMIT OF WORK DEPICTED ON THESE DRAWINGS UNLESS OTHERWISE APPROVED BY NATIONAL GRID.
7. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH HAVE OCCURRED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES AFFECTING HIS WORK. ITEMS SHALL BE REPLACED WITH THE SAME TYPE OF MATERIAL THAT WAS REMOVED OR DAMAGED DURING CONSTRUCTION OR AS DIRECTED BY OWNER'S REPRESENTATIVE.
8. SURVEYING SHALL BE PERFORMED BY A NEW YORK STATE LICENSED LAND SURVEYOR
9. COORDINATES WILL BE REFERENCED TO THE STATE PLANE COORDINATE SYSTEM FOR NEW YORK USING THE NORTH AMERICAN DATUM OF 1983 (NAD 83), (2012) ADJUSTMENT: (NAD 83-12), NEW YORK STATE PLAN LONG ISLAND ZONE 3104 IN UNITS OF FEET.
10. ELEVATIONS WILL BE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88) IN UNITS OF FEET.
11. BASE MAP INFORMATION BASED ON PROPERTY SURVEY BY M.J. ENGINEERING AND LAND SURVEYING, P.C., DATED JULY 27, 2016, DRAWING TITLED "BOUNDARY AND TOPOGRAPHIC SURVEY OF 210 (OFF-SITE) & 234 (ON-SITE) WEST MAIN STREET."
12. APPROXIMATE LOCATION OF RAIL ROAD TRACKS AND SPURS ARE REFERENCED FROM THE RECORD OF DECISION (ROD) DATED MARCH 2011.

NOTES

THESE DRAWINGS PRESENT PLANS AND DETAILS FOR THE IMPLEMENTATION OF THE REMEDIAL ACTION FOR THE PATCHOGUE FORMER MANUFACTURED GAS PLANT (MGP) SITE LOCATED IN THE VILLAGE OF PATCHOGUE, TOWN OF BROOKHAVEN, SUFFOLK COUNTY, NEW YORK. REMEDIAL ACTIVITIES ARE BEING PERFORMED UNDER THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC OR DEC) IN ACCORDANCE WITH AN ORDER ON CONSENT (INDEX NO. A2-0552-0606) BETWEEN KEYSPAN CORPORATION (A PREDECESSOR COMPANY OF NATIONAL GRID) AND THE NYSDEC. THE REMEDY FOR THE SITE WAS SELECTED BY THE NYSDEC AND DOCUMENTED IN THE RECORD OF DECISION (ROD) DATED MARCH 2011. THE REMEDIAL DESIGN IS DOCUMENTED IN THE FINAL REMEDIAL DESIGN REPORT (RDR) PREPARED BY BROWN AND CALDWELL ASSOCIATES (BC).

THE REMEDIATION ACTIVITIES AND CONTRACTOR'S TECHNICAL REQUIREMENTS ARE DESCRIBED N MULTIPLE COMPONENTS OF THE CONTRACT DOCUMENTS. THESE COMPONENTS INCLUDE BUT ARE NOT LIMITED TO THE REMEDIAL ACTION CONSTRUCTION DRAWINGS, TECHNICAL SPECIFICATIONS, WORK ZONE AIR MONITORING PLAN, STORMWATER POLLUTION PREVENTION PLAN (SWPPP), MAINTENANCE AND PROTECTION OF TRAFFIC PLAN (MPTP), AND WASTE MANAGEMENT PLAN. THESE COMPONENTS SHOULD BE THOROUGHLY REVIEWED AND UNDERSTOOD BY THE CONTRACTOR. IN THE EVENT THAT THERE ARE DISCREPANCIES IN THE INFORMATION CONTAINED IN THE ABOVE-LISTED DOCUMENTS, THE CONTRACTOR SHALL IDENTIFY SUCH DISCREPANCIES IN WRITING TO NATIONAL GRID AND THE DESIGN ENGINEER FOR REVIEW.

EXISTING CONDITIONS LEGEND

- PROPERTY LINE
- CHAINLINK FENCE
- STOCKADE FENCE
- 5 — EXISTING TOPOGRAPHIC CONTOUR
- X 4.75 — EXISTING GRADE SPOT ELEVATION
- TOP OF BANK
- PATCHOGUE RIVER EDGE
- E — UNDERGROUND ELECTRIC
- OHW — OVERHEAD ELECTRIC WIRE
- COM — COMMUNICATION LINE
- ST — STORMWATER LINE
- G — GAS LINE
- W — WATER LINE
- UTILITY POLE
- PIEZOMETER LOCATION
- STAFF GAUGE
- 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 LOCATION
- PDI SOIL BORING LOCATION
- GEOTECHNICAL SOIL BORING LOCATION
- OFF-SITE INVESTIGATION BORING
- INDICATES LOCATION WHERE MGP-RELATED SOURCE MATERIAL WAS VISIBLY OBSERVED
- (20.5) — DEPTH BELOW GRADE SURFACE (FT.) WHERE DEEPEST OCCURRENCE OF VISIBLE MGP-RELATED SOURCE MATERIAL WAS OBSERVED
- TELECOMMUNICATION MANHOLE
- WATER UTILITY MANHOLE
- WATER VALVE
- FIRE HYDRANT
- CATCH BASIN
- UTILITY CORRIDOR (EXISTING 2-FT CRUSHED STONE COVER)
- EXISTING CONCRETE SURFACE
- EXISTING GRAVEL SURFACE / ROAD
- EXISTING VEGETATIVE SURFACE
- ASPHALT PAVEMENT

REMEDIAL ACTION LEGEND

- SHEETPILE
- SILT FENCE OR STRAW BALES
- MW-1 — MONITORING WELL TO BE DECOMMISSIONED
- PZ-1B — PIEZOMETER TO BE DECOMMISSIONED
- 5 — FINAL GRADE CONTOUR (FT., NAD 88)
- X 4.75 — FINAL GRADE GRADE SPOT ELEVATION (FT., NAD 88)
- LOW — LIMIT OF WORK
- ENLARGEMENT AREA (REFER TO DRAWINGS C-400 AND C-401)
- 4.0 — WATER TABLE CONTOUR (FT., NAVD) DASHED WHERE INFERRED
- GENERALIZED DIRECTION OF GROUNDWATER FLOW
- LIMIT OF REMEDIATION AREA
- (3.64) — GROUNDWATER ELEVATION (FT., NAVD) FOR SHALLOW MONITORING WELL, PIEZOMETER OR STAFF GAUGE
- SITE ACESS
- CENTRAL / CORE AREA
- UTILITY CORRIDOR / EXISTING 2-FT CRUSHED STONE COVER
- EXCAVATION AREA
- IN SITU SOLIDIFICATION AREA
- ISS TREATMENT NEAR EXISTING BUILDING
- DECONTAMINATION PAD
- ASPHALT PAVEMENT COVER OVER ISS
- ASPHALT PAVEMENT RESTORATION
- CRUSHED STONE COVER OVER ISS AND IN CENTRAL/CORE AREA
- CRUSHED STONE RESTORATION
- 21' — TARGET DEPTH FROM EXISTING GRADE OF EXCAVATION OR ISS TREATMENT
- FORMER MGP-RELATED STRUCTURE LOCATION
- EQUIPMENT AND MATERIALS STAGING AREA
- TEMPORARY WASTE CONTAINMENT AREA
- TEMPORARY ACCESS ROADWAY
- C / C-106 — C' / C-106 — CROSS-SECTION ALIGNMENT

DETAIL DESIGNATION

1 / C-100 — DETAIL DESIGNATION; DRAWING ON WHICH DETAIL IS LOCATED

BROWN AND CALDWELL
BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

WARNING: IT IS A VIOLATION OF THE NEW YORK STATE EDUCATION LAW ARTICLE 145, SECTION 7209(2) FOR ANY PERSON, UNLESS HE/SHE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY. IF THIS ITEM, BEARING THE SEAL OF AN ENGINEER, IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS/HER SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS/HER SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

STATE OF NEW YORK — MAREK OSTROWSKI — 073661 — LICENSED PROFESSIONAL ENGINEER
05/02/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
G-001.DWG
BC PROJECT NUMBER
153021
CLIENT PROJECT NUMBER

GENERAL

GENERAL NOTES AND LEGEND

DRAWING NUMBER
G-001
SHEET NUMBER
2 OF 24

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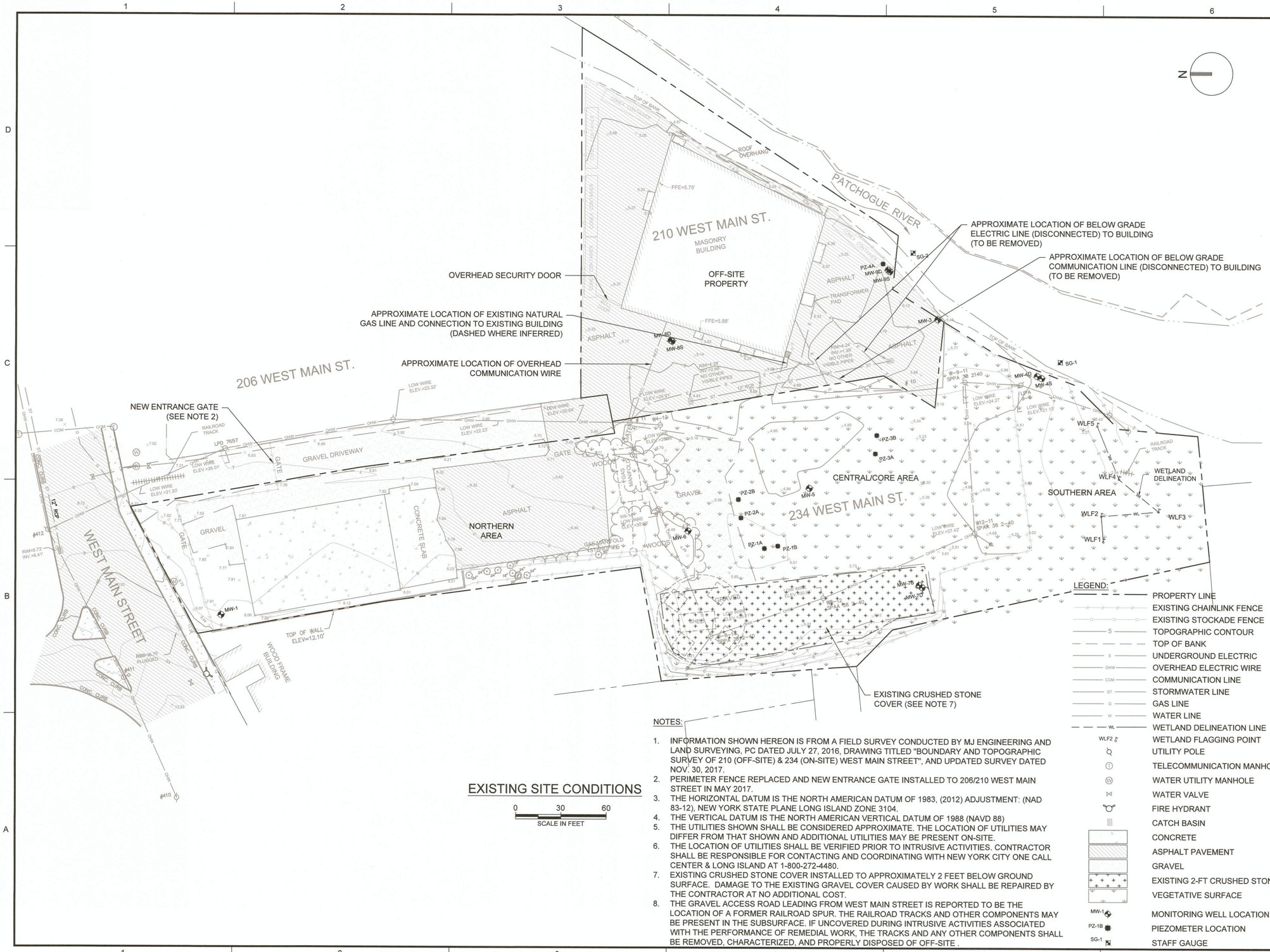

LEGEND:

- PROPERTY LINE
- EXISTING CHAINLINK FENCE
- EXISTING STOCKADE FENCE
- TOPOGRAPHIC CONTOUR
- TOP OF BANK
- UNDERGROUND ELECTRIC
- OVERHEAD ELECTRIC WIRE
- COMMUNICATION LINE
- STORMWATER LINE
- GAS LINE
- WATER LINE
- WETLAND DELINEATION LINE
- WETLAND FLAGGING POINT
- UTILITY POLE
- TELECOMMUNICATION MANHOLE
- WATER UTILITY MANHOLE
- WATER VALVE
- FIRE HYDRANT
- CATCH BASIN
- CONCRETE
- ASPHALT PAVEMENT
- GRAVEL
- EXISTING 2-FT CRUSHED STONE COVER
- VEGETATIVE SURFACE
- MONITORING WELL LOCATION
- PIEZOMETER LOCATION
- STAFF GAUGE

NOTES:

1. INFORMATION SHOWN HEREON IS FROM A FIELD SURVEY CONDUCTED BY MJ ENGINEERING AND LAND SURVEYING, PC DATED JULY 27, 2016, DRAWING TITLED "BOUNDARY AND TOPOGRAPHIC SURVEY OF 210 (OFF-SITE) & 234 (ON-SITE) WEST MAIN STREET", AND UPDATED SURVEY DATED NOV. 30, 2017.
2. PERIMETER FENCE REPLACED AND NEW ENTRANCE GATE INSTALLED TO 206/210 WEST MAIN STREET IN MAY 2017.
3. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983, (2012) ADJUSTMENT: (NAD 83-12), NEW YORK STATE PLANE LONG ISLAND ZONE 3104.
4. THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
5. THE UTILITIES SHOWN SHALL BE CONSIDERED APPROXIMATE. THE LOCATION OF UTILITIES MAY DIFFER FROM THAT SHOWN AND ADDITIONAL UTILITIES MAY BE PRESENT ON-SITE.
6. THE LOCATION OF UTILITIES SHALL BE VERIFIED PRIOR TO INTRUSIVE ACTIVITIES. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING AND COORDINATING WITH NEW YORK CITY ONE CALL CENTER & LONG ISLAND AT 1-800-272-4480.
7. EXISTING CRUSHED STONE COVER INSTALLED TO APPROXIMATELY 2 FEET BELOW GROUND SURFACE. DAMAGE TO THE EXISTING GRAVEL COVER CAUSED BY WORK SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST.
8. THE GRAVEL ACCESS ROAD LEADING FROM WEST MAIN STREET IS REPORTED TO BE THE LOCATION OF A FORMER RAILROAD SPUR. THE RAILROAD TRACKS AND OTHER COMPONENTS MAY BE PRESENT IN THE SUBSURFACE. IF UNCOVERED DURING INTRUSIVE ACTIVITIES ASSOCIATED WITH THE PERFORMANCE OF REMEDIAL WORK, THE TRACKS AND ANY OTHER COMPONENTS SHALL BE REMOVED, CHARACTERIZED, AND PROPERLY DISPOSED OF OFF-SITE .

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A

UPPER SADDLE RIVER, NJ

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STATE OF NEW YORK
MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
05/02/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN STREET
VILLAGE OF PATCHOGUE, NY

REMEDIAL DESIGN DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	03/29/19	WETLANDS PERMIT
2	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: C. OLIVEIRA
DRAWN: A. SANTIAGO / R. NEAR
CHECKED:
CHECKED: K. BOGATCH
APPROVED: M. OSTROWSKI

FILENAME
C-101.DWG

BC PROJECT NUMBER
153021

CLIENT PROJECT NUMBER

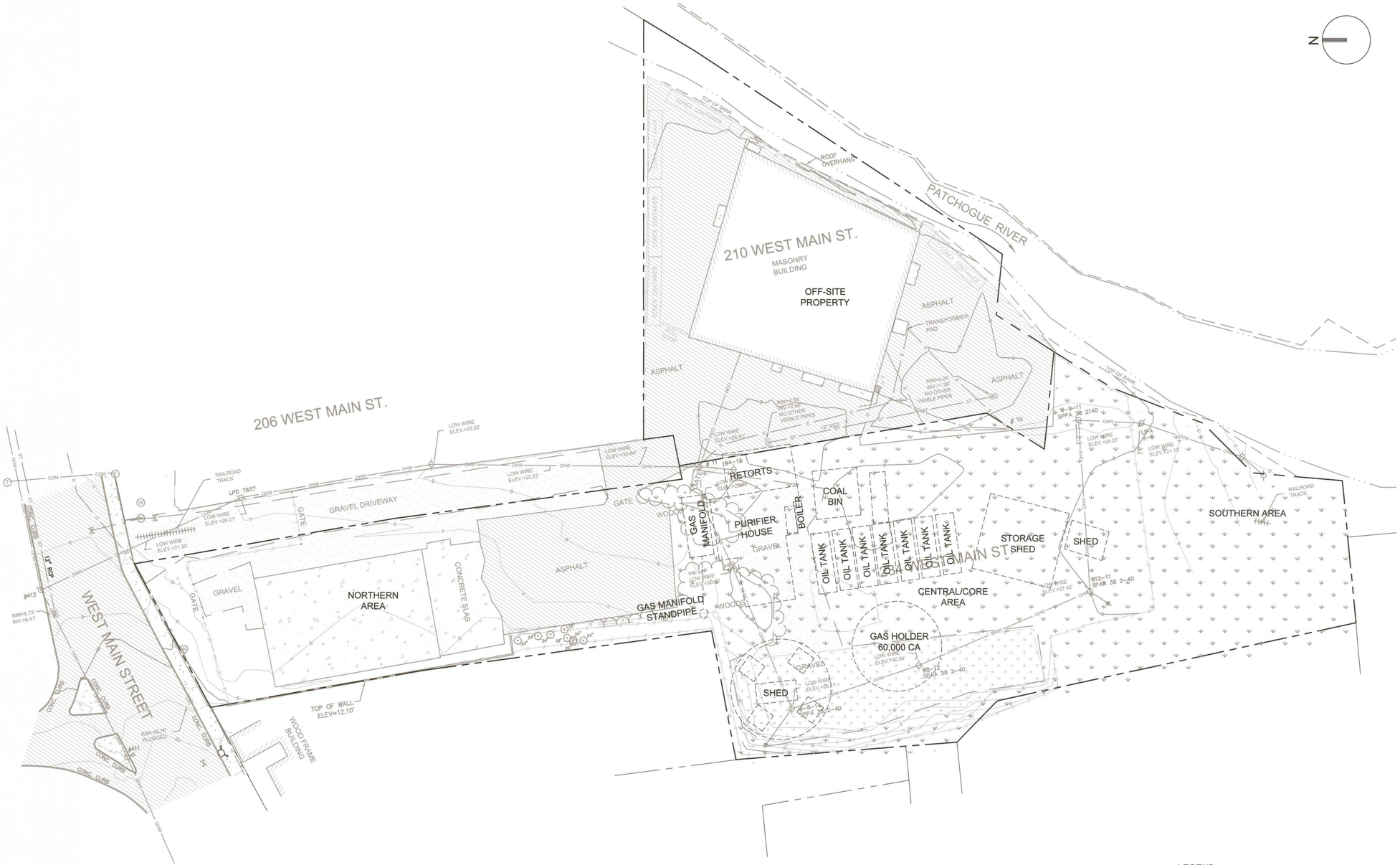
CIVIL

EXISTING SITE CONDITIONS

DRAWING NUMBER
C-101

SHEET NUMBER
3 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-101.DWG PLOT DATE: 5/1/2019 1:25 PM CAD USER: ROBERT NEAR



HISTORICAL STRUCTURE LOCATIONS

0 30 60
SCALE IN FEET

LEGEND:

FORMER MGP-RELATED STRUCTURE LOCATION

NOTE:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-102.DWG PLOT DATE: 5/1/2019 1:25 PM CAD USER: ROBERT NEAR

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2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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STATE OF NEW YORK
MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
5/1/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: C. OLIVEIRA
DRAWN: A. SANTIAGO / R. NEAR
CHECKED:
CHECKED: K. BOGATCH
APPROVED: M. OSTROWSKI

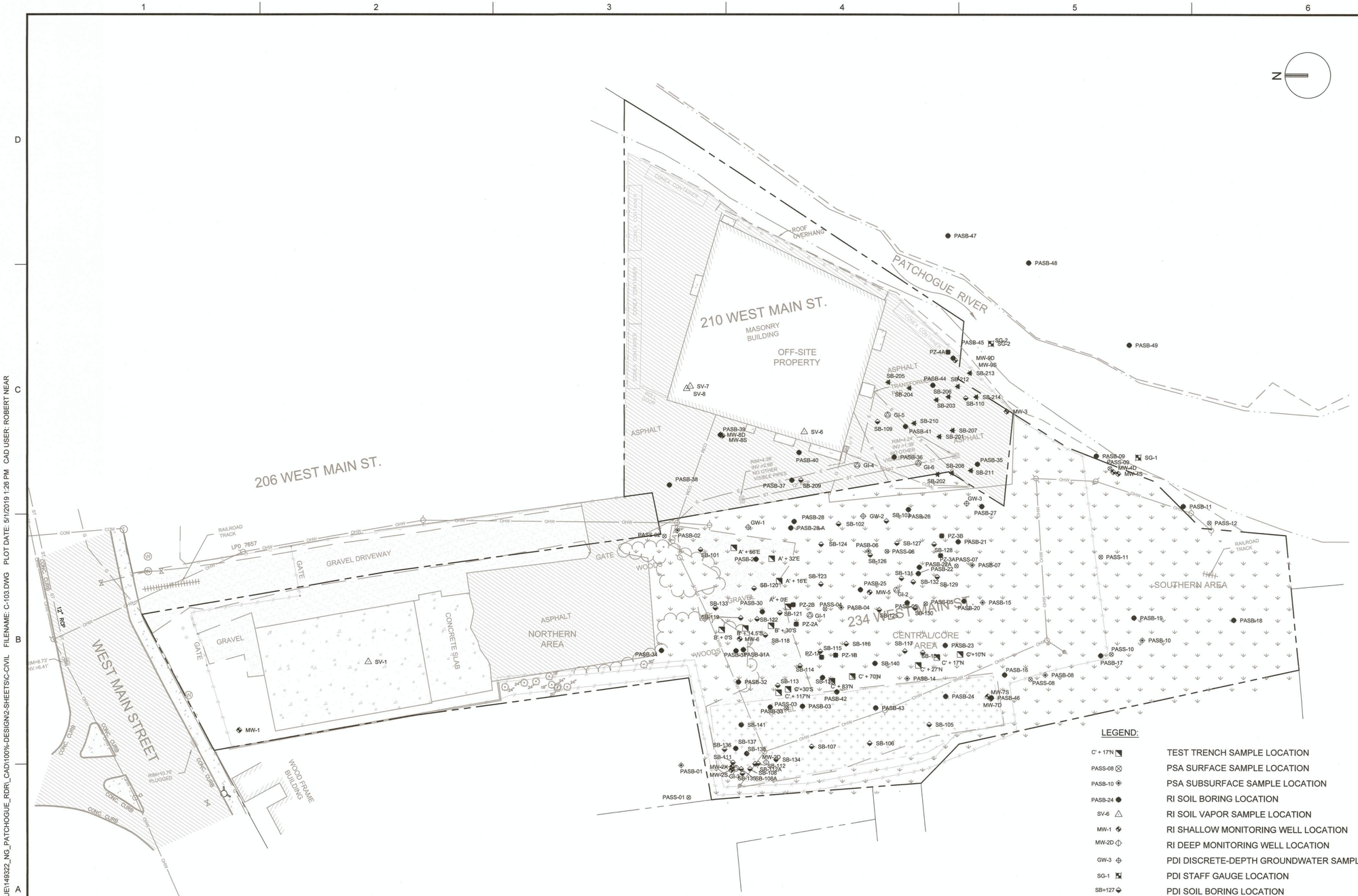
FILENAME
C-102.DWG
BC PROJECT NUMBER
153021
CLIENT PROJECT NUMBER

CIVIL

HISTORICAL
STRUCTURE
LOCATIONS

DRAWING NUMBER
C-102

SHEET NUMBER
4 OF 24



HISTORICAL INVESTIGATION LOCATION PLAN

0 30 60
SCALE IN FEET

LEGEND:

C' + 17'N	TEST TRENCH SAMPLE LOCATION
PASS-08	PSA SURFACE SAMPLE LOCATION
PASB-10	PSA SUBSURFACE SAMPLE LOCATION
PASB-24	RI SOIL BORING LOCATION
SV-6	RI SOIL VAPOR SAMPLE LOCATION
MW-1	RI SHALLOW MONITORING WELL LOCATION
MW-2D	RI DEEP MONITORING WELL LOCATION
GW-3	PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION
SG-1	PDI STAFF GAUGE LOCATION
SB=127	PDI SOIL BORING LOCATION
PZ-1B	PIEZOMETER LOCATION
GI-6	GEOTECHNICAL SOIL BORING LOCATION
SB-208	OFF-SITE INVESTIGATION BORING

NOTE:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.

Path: P:\NATIONAL_GRID\PATCHOGUE\148322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-103.DWG PLOT DATE: 5/1/2019 1:26 PM CAD USER: ROBERT NEAR

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UPPER SADDLE RIVER, NJ

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STATE OF NEW YORK
MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
05/01/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

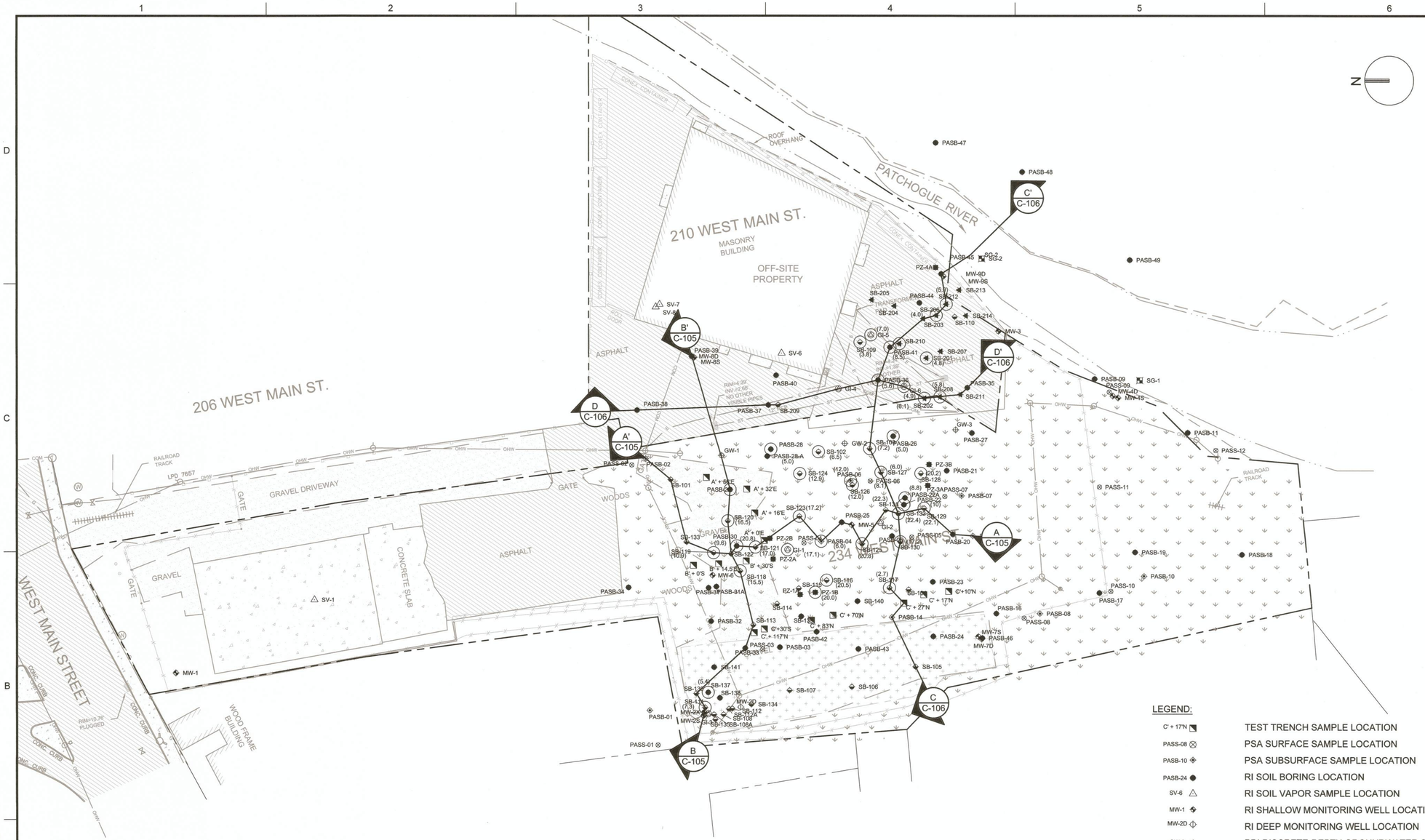
DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-103.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	---

CIVIL

HISTORICAL
INVESTIGATION
LOCATION PLAN

DRAWING NUMBER
C-103

SHEET NUMBER
5 OF 24



VISIBLE MGP-RELATED SOURCE MATERIAL AND GEOLOGICAL CROSS-SECTION LOCATIONS

0 30 60
SCALE IN FEET

LEGEND:

- TEST TRENCH SAMPLE LOCATION (C' + 17'N)
- PSA SURFACE SAMPLE LOCATION (PASS-08)
- PSA SUBSURFACE SAMPLE LOCATION (PASB-10)
- RI SOIL BORING LOCATION (PASB-24)
- RI SOIL VAPOR SAMPLE LOCATION (SV-6)
- RI SHALLOW MONITORING WELL LOCATION (MW-1)
- RI DEEP MONITORING WELL LOCATION (MW-2D)
- PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION (GW-3)
- PDI STAFF GAUGE LOCATION (SG-1)
- PDI SOIL BORING LOCATION (SB=127)
- PIEZOMETER LOCATION (PZ-1B)
- GEOTECHNICAL SOIL BORING LOCATION (GI-6)
- OFF-SITE INVESTIGATION BORING (SB-208)
- INDICATES LOCATION WHERE VISIBLE MGP-RELATED SOURCE MATERIAL WAS OBSERVED
- CROSS-SECTION ALIGNMENT / DRAWING NUMBER (C C-106 / C' C-106)
- (20.5) DEPTH BELOW GRADE SURFACE (FT.) WHERE DEEPEST OCCURRENCE OF VISIBLE MGP-RELATED SOURCE MATERIAL WAS OBSERVED

NOTE:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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STATE OF NEW YORK
MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
03/02/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-104.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	----

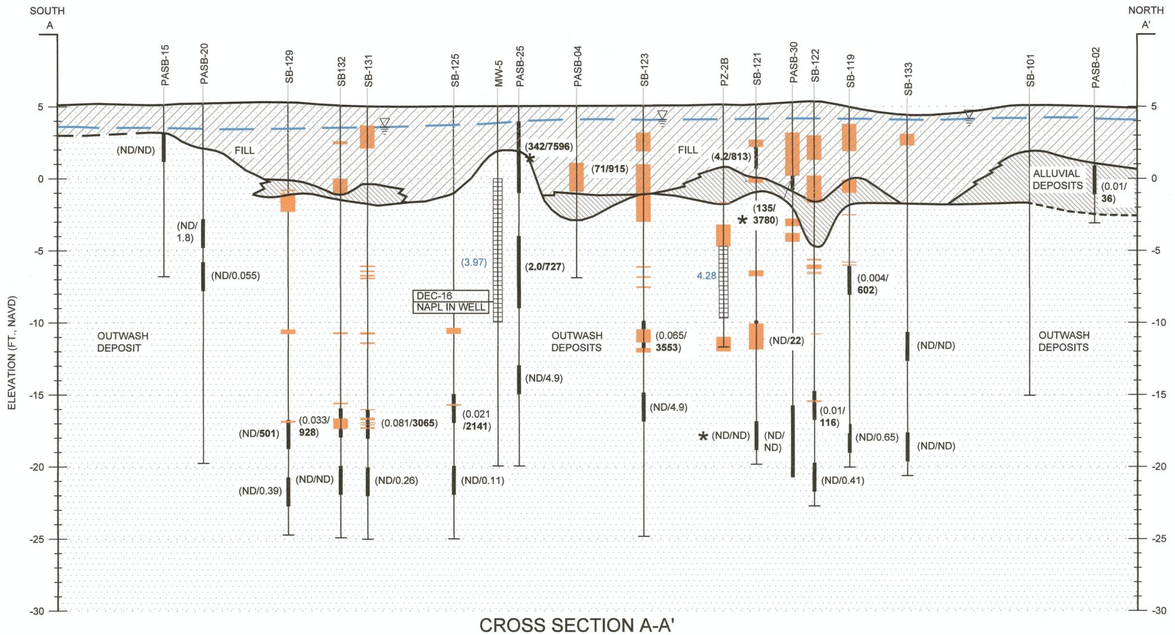
CIVIL

VISIBLE MGP-RELATED SOURCE MATERIAL AND GEOLOGICAL CROSS-SECTION LOCATIONS

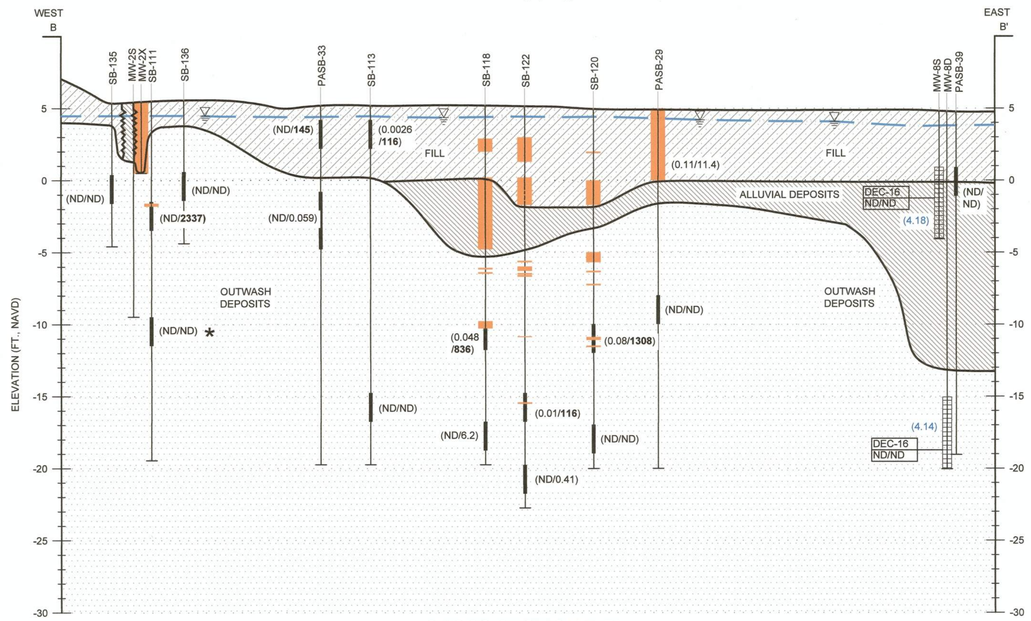
DRAWING NUMBER
C-104

SHEET NUMBER
6 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-104.DWG PLOT DATE: 5/1/2019 1:27 PM CAD USER: ROBERT NEAR



CROSS SECTION A-A'
SCALE H: 1" = 40'
V: 1" = 10'

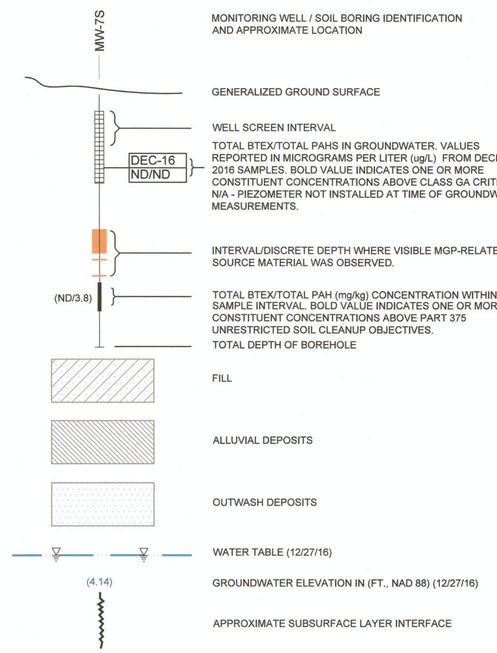


CROSS SECTION B-B'
SCALE H: 1" = 40'
V: 1" = 10'

ABBREVIATIONS:

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

LEGEND:



NOTES:
1. FOR LOCATION OF CROSS-SECTIONS REFER TO DRAWING C-104.

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UPPER SADDLE RIVER, NJ

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MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR / R. NEAR
CHECKED:	P. PETRINO
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-105.DWG

BC PROJECT NUMBER
153021

CLIENT PROJECT NUMBER

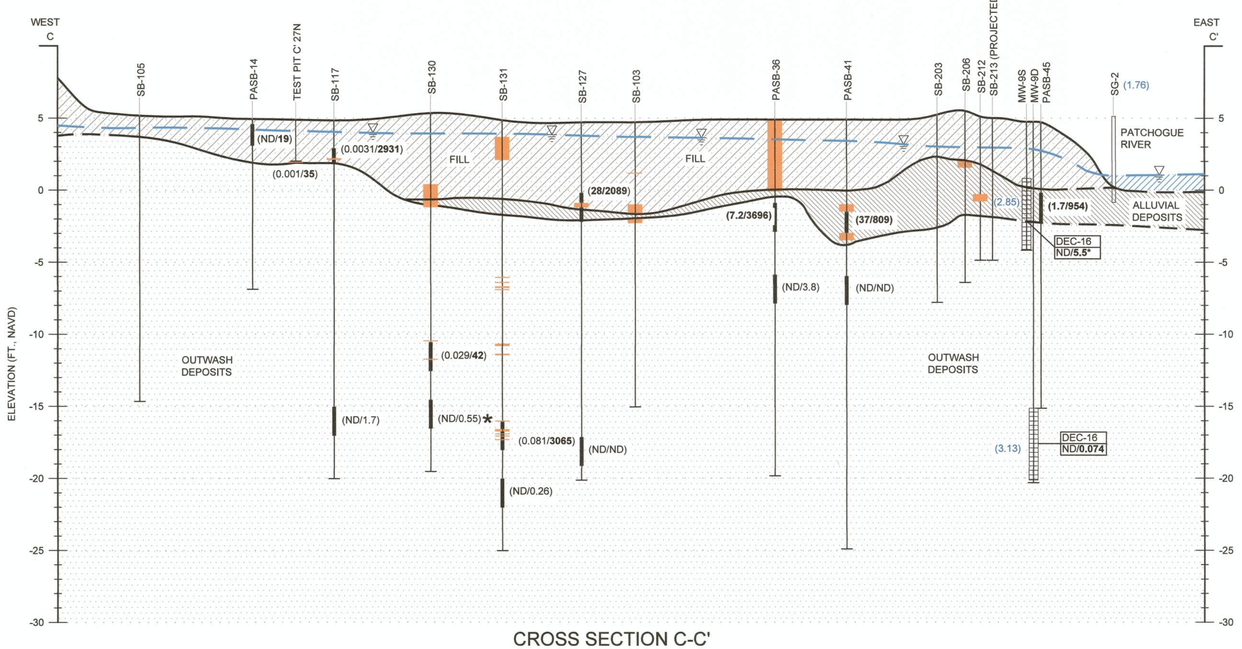
CIVIL

GEOLOGICAL CROSS-SECTIONS (A-A' AND B-B')

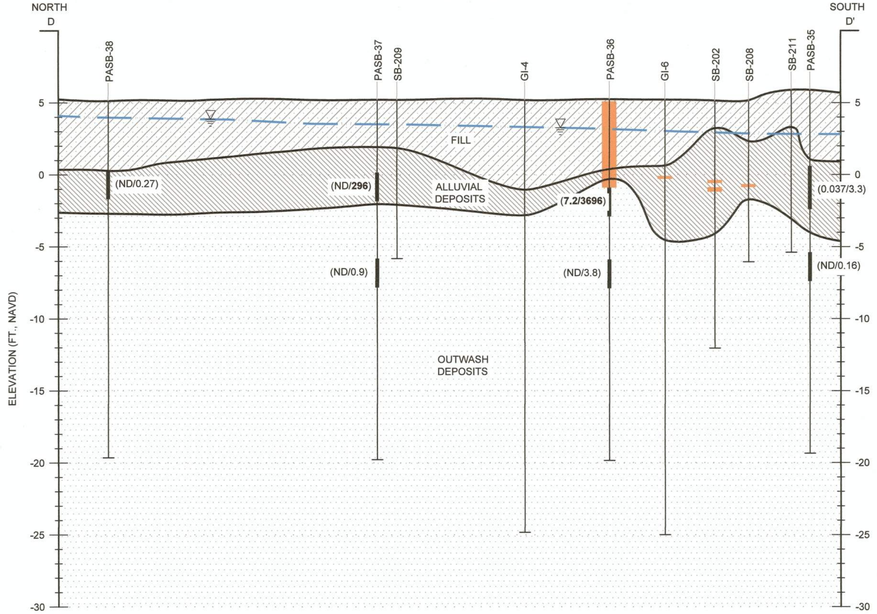
DRAWING NUMBER
C-105

SHEET NUMBER
7 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-105.DWG PLOT DATE: 5/1/2019 1:27 PM CAD USER: ROBERT NEAR



CROSS SECTION C-C'
SCALE H: 1" = 40'
V: 1" = 10'

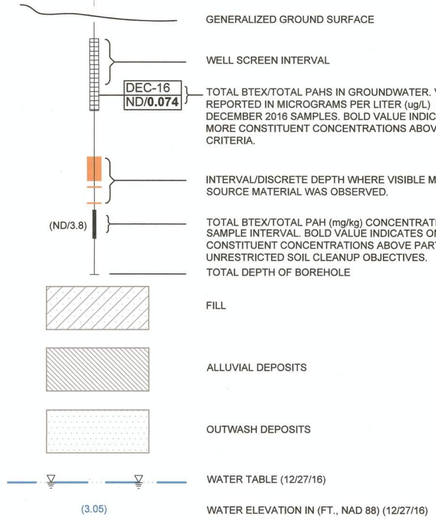


CROSS SECTION D-D'
SCALE H: 1" = 40'
V: 1" = 10'

ABBREVIATIONS:

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

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) FROM DECEMBER 2016 SAMPLES. BOLD VALUE INDICATES ONE OR MORE CONSTITUENT CONCENTRATIONS ABOVE CLASS GA CRITERIA.

INTERVAL/DISCRETE DEPTH WHERE VISIBLE MGP-RELATED SOURCE MATERIAL WAS OBSERVED.

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 (12/27/16)

WATER ELEVATION IN (FT., NAD 88) (12/27/16)

NOTES:
1. FOR LOCATION OF CROSS-SECTIONS REFER TO DRAWING C-104.

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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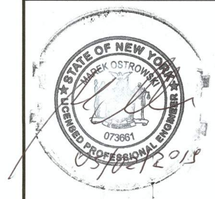

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
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CHECKED:	P. PETRINO
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-106.DWG

BC PROJECT NUMBER
153021

CLIENT PROJECT NUMBER

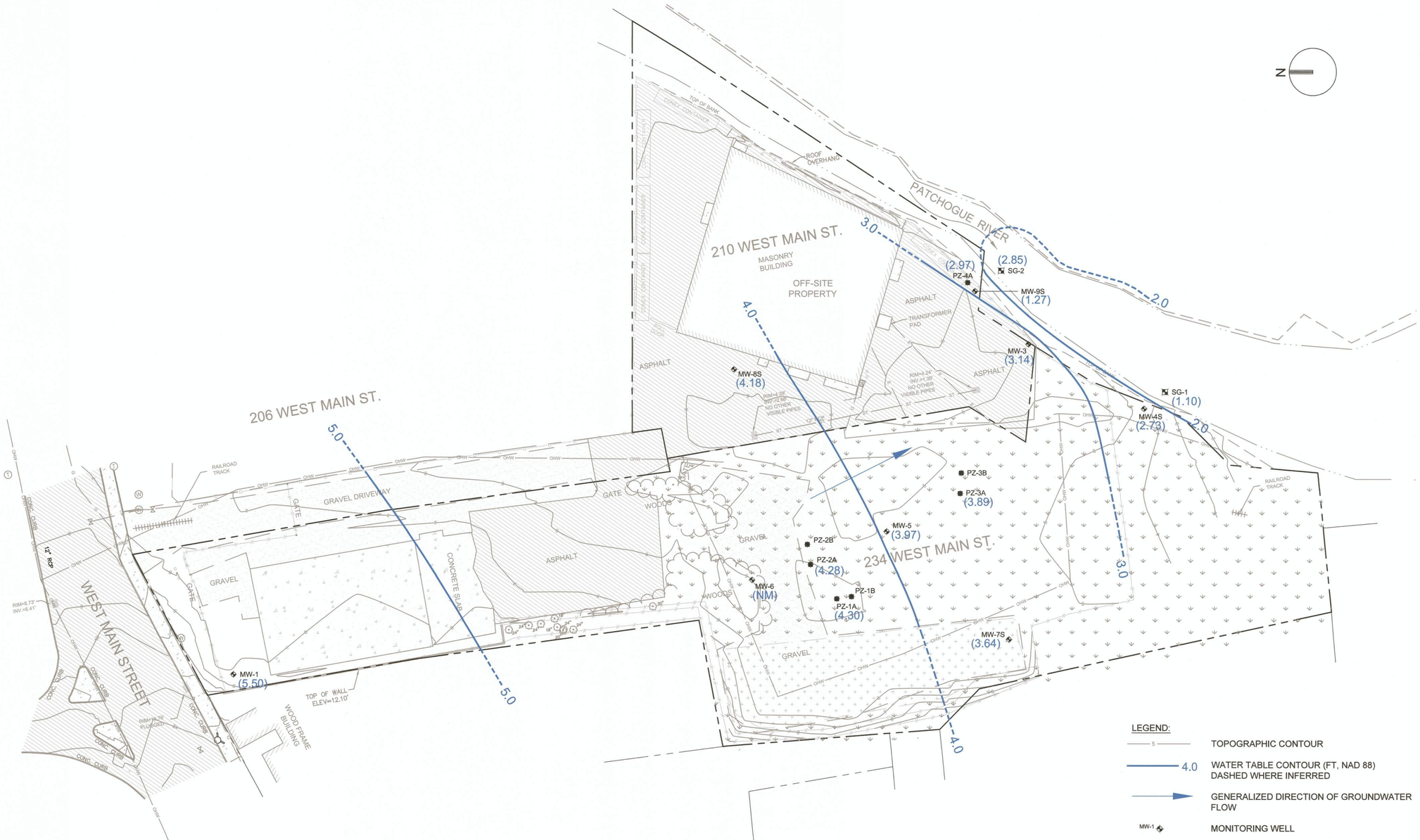
CIVIL

GEOLOGICAL CROSS-SECTIONS (C-C' AND D-D')

DRAWING NUMBER
C-106

SHEET NUMBER
8 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-106.DWG PLOT DATE: 5/1/2019 1:27 PM CAD USER: ROBERT NEAR



WATER TABLE CONTOUR MAP - DECEMBER 27, 2016

LEGEND:

- TOPOGRAPHIC CONTOUR
- 4.0 — WATER TABLE CONTOUR (FT, NAD 88) DASHED WHERE INFERRED
- GENERALIZED DIRECTION OF GROUNDWATER FLOW
- MW-1 — MONITORING WELL
- PZ-1B — PIEZOMETER
- SG-1 — STAFF GAUGE
- (3.64) — GROUNDWATER ELEVATION (FT., NAD 88) FOR SHALLOW MONITORING WELL, PIEZOMETER OR STAFF GAUGE

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. GROUNDWATER ELEVATIONS BASED ON MEASUREMENTS TAKEN ON DECEMBER 27, 2016.

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-107.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	----

CIVIL

WATER TABLE CONTOUR MAP - DECEMBER 27, 2016

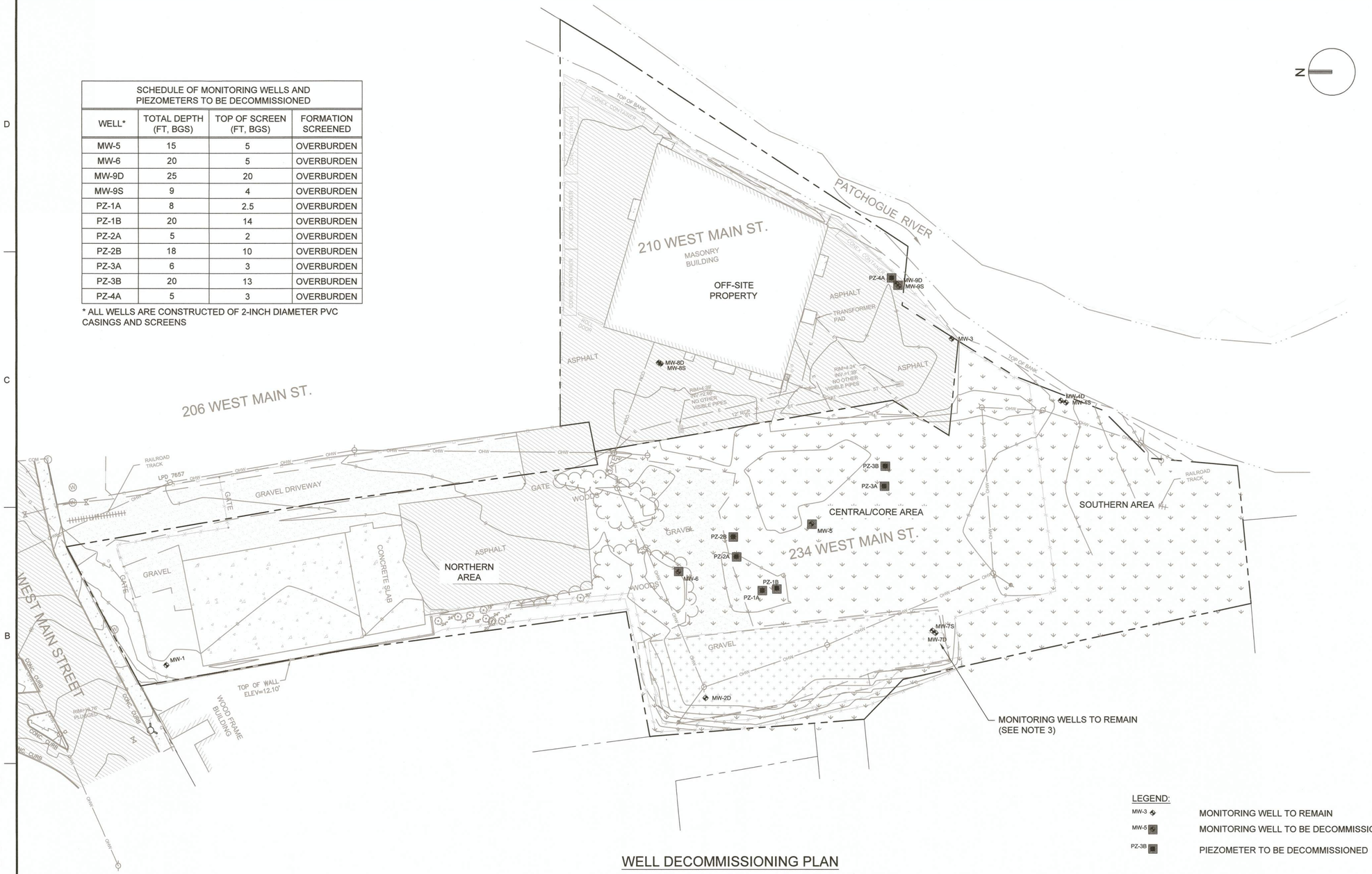
DRAWING NUMBER
C-107

SHEET NUMBER
9 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-107.DWG PLOT DATE: 5/1/2019 1:28 PM CAD USER: ROBERT NEAR

SCHEDULE OF MONITORING WELLS AND PIEZOMETERS TO BE DECOMMISSIONED			
WELL*	TOTAL DEPTH (FT, BGS)	TOP OF SCREEN (FT, BGS)	FORMATION SCREENED
MW-5	15	5	OVERBURDEN
MW-6	20	5	OVERBURDEN
MW-9D	25	20	OVERBURDEN
MW-9S	9	4	OVERBURDEN
PZ-1A	8	2.5	OVERBURDEN
PZ-1B	20	14	OVERBURDEN
PZ-2A	5	2	OVERBURDEN
PZ-2B	18	10	OVERBURDEN
PZ-3A	6	3	OVERBURDEN
PZ-3B	20	13	OVERBURDEN
PZ-4A	5	3	OVERBURDEN

* ALL WELLS ARE CONSTRUCTED OF 2-INCH DIAMETER PVC CASINGS AND SCREENS



WELL DECOMMISSIONING PLAN

0 30 60
SCALE IN FEET

LEGEND:

- MW-3 — MONITORING WELL TO REMAIN
- MW-5 — MONITORING WELL TO BE DECOMMISSIONED
- PZ-3B — PIEZOMETER TO BE DECOMMISSIONED

NOTES:

1. BASE MAP INFORMATION SHOWN HEREON IS FROM A FIELD SURVEY CONDUCTED BY MJ ENGINEERING AND LAND SURVEYING, PC ON JULY 27, 2016.
2. MONITORING WELLS/PIEZOMETERS SHALL BE DECOMMISSIONED IN ACCORDANCE WITH SPECIFICATION SECTION 02 61 00.
3. CONTRACTOR SHALL LOCATE AND PROTECT EXISTING MONITORING WELLS TO REMAIN (9 WELLS).

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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STATE OF NEW YORK · MAREK OSTROWSKI · 073661 · LICENSED PROFESSIONAL ENGINEER
5/02/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS		
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0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-108.DWG
BC PROJECT NUMBER
153021
CLIENT PROJECT NUMBER

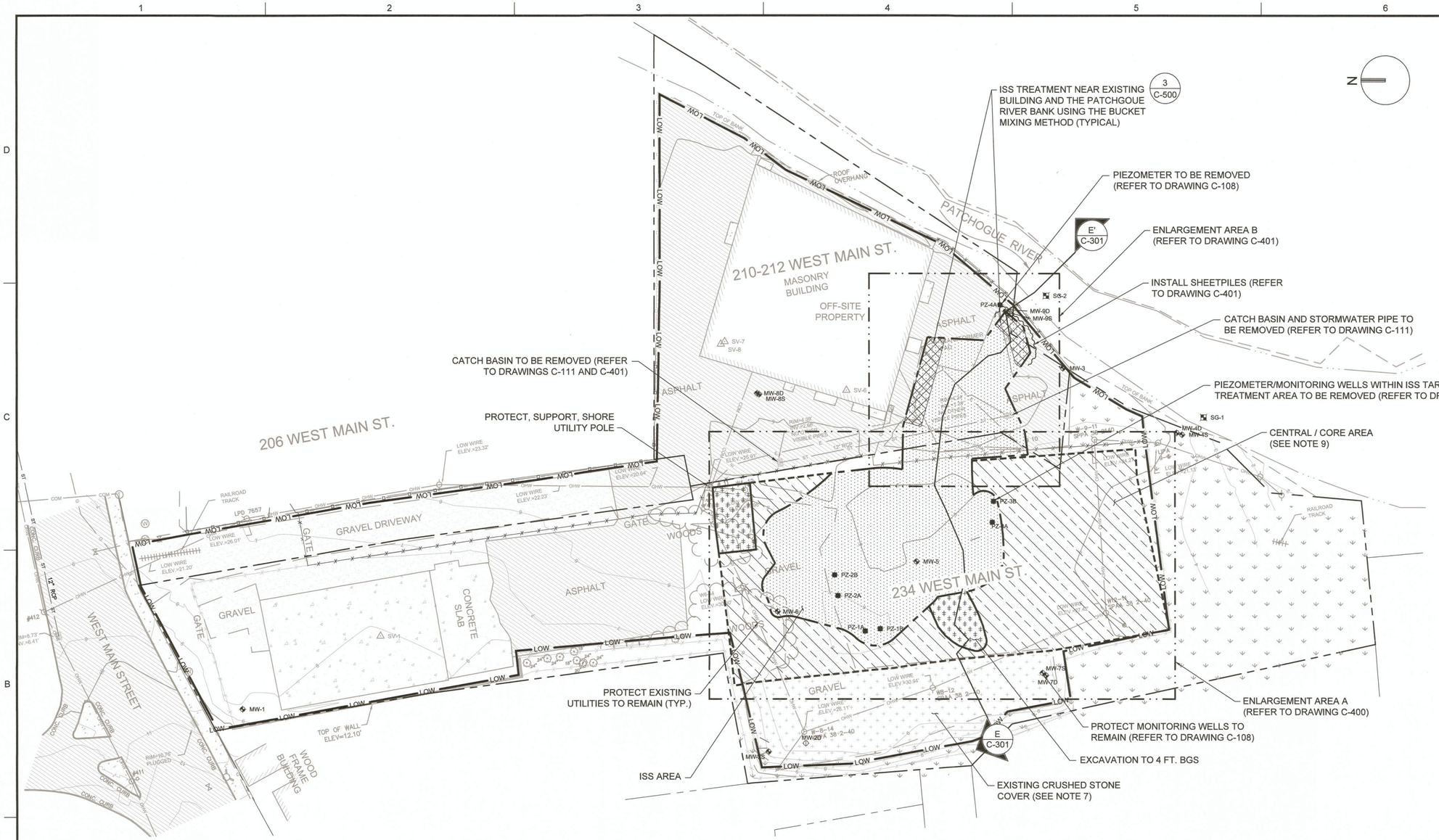
CIVIL

WELL DECOMMISSIONING PLAN

DRAWING NUMBER
C-108

SHEET NUMBER
10 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-108.DWG PLOT DATE: 5/1/2019 1:28 PM CAD USER: ROBERT NEAR



SITE REMEDIATION PLAN

0 30 60
SCALE IN FEET

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. ISS TREATMENT AND EXCAVATION OF ISS AREA NEAR THE EXISTING BUILDING SHALL PROCEED AS DIRECTED ON DRAWING C-500, DETAIL 3.
3. ESTABLISH AND MAINTAIN AN EXCLUSION, DECONTAMINATION AND SUPPORT ZONE AROUND THE ISS AREA. PERSONNEL AND EQUIPMENT SHALL BE DECONTAMINATED IN A DECONTAMINATION ZONE BETWEEN THE EXCLUSION ZONE AND SUPPORT ZONE.
4. ISS DELINEATION DENOTES MINIMUM AREA TO BE TREATED. CONTRACTOR MAY EXPAND TREATMENT AREA TO ACCOMMODATE ISS TREATMENT TECHNIQUE REQUIREMENTS.
5. ISS TREATMENT SHALL PROCEED GENERALLY FROM NORTH-NORTHWEST TO SOUTH-SOUTHEAST, FOLLOWING THE GROUNDWATER GRADIENT.REFER TO DRAWING C-107 FOR GROUNDWATER CONTOURS.
6. THE ISS TARGET TREATMENT AREA SHALL BE EXCAVATED TO A DEPTH OF APPROXIMATELY 4 FT BELOW FINAL GRADE FOLLOWING IMPLEMENTATION OF ISS.
7. CONTRACTOR SHALL NOT DISTURB THE EXISTING CRUSHED STONE COVER.
8. ISS TREATMENT AND BACKFILLING OF THE ISS AREA SHALL BE COMPLETED PRIOR TO INSTALLATION OF CRUSHED STONE COVER WITHIN THE CENTRAL/CORE AREA.
9. FOLLOWING ISS IMPLEMENTATION, EXCAVATE CENTRAL/CORE AREA (BEYOND THE LIMITS OF ISS) TO A TARGET DEPTH OF 2 FT. BELOW FINAL GRADE. INSTALL CRUSHED STONE COVER OVER ENTIRE CENTRAL/CORE AREA INCLUDING THE ISS AREA AS SHOWN ON DRAWING C-112.
10. DUE TO SHALLOW GROUNDWATER, A WORK PLATFORM AND CONTAINMENT BERMS MAY BE NECESSARY FOR ISS. DESIGN, CONSTRUCTION, MANAGEMENT, AND REMOVAL OF WORK PLATFORMS AND CONTAINMENT BERMS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
11. TREATMENT DEPTHS VARY THROUGHOUT ISS TARGET AREA AND ARE INCLUDED IN DRAWINGS C-400 AND C-401.
12. FOR SOIL BORING LOCATIONS ON CROSS-SECTION E-E' REFER TO DRAWINGS C-400 AND C-401.
13. THE LOCATION OF FORMER RAILROAD SPURS MAY DIFFER FROM THAT SHOWN. AS ENCOUNTERED, MGP STRUCTURES AND LIRR SPURS WILL BE REMOVED, CHARACTERIZED, AND PROPERLY DISPOSED OF OFF-SITE. SEE DRAWING C-102 FOR APPROXIMATE LOCATIONS OF FORMER MGP STRUCTURES.

LEGEND:

- LOW — LIMIT OF WORK
- TOP OF BANK
- PATCHOGUE RIVER EDGE
- ENLARGEMENT AREA (REFER TO DRAWINGS C-400 AND C-401)
- CENTRAL / CORE AREA
- TARGETED EXCAVATION AREA (TO 4 FT. BGS)
- ISS AREA
- UTILITY CORRIDOR / EXISTING 2-FT CRUSHED STONE COVER
- ISS TREATMENT NEAR SENSITIVE STRUCTURES

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BROWN AND CALDWELL ASSOCIATES
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STATE OF NEW YORK · MAREK OSTROWSKI · 073661 · LICENSED PROFESSIONAL ENGINEER
05/01/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS		
REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	03/29/19	WETLANDS PERMIT
2	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-110.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	----

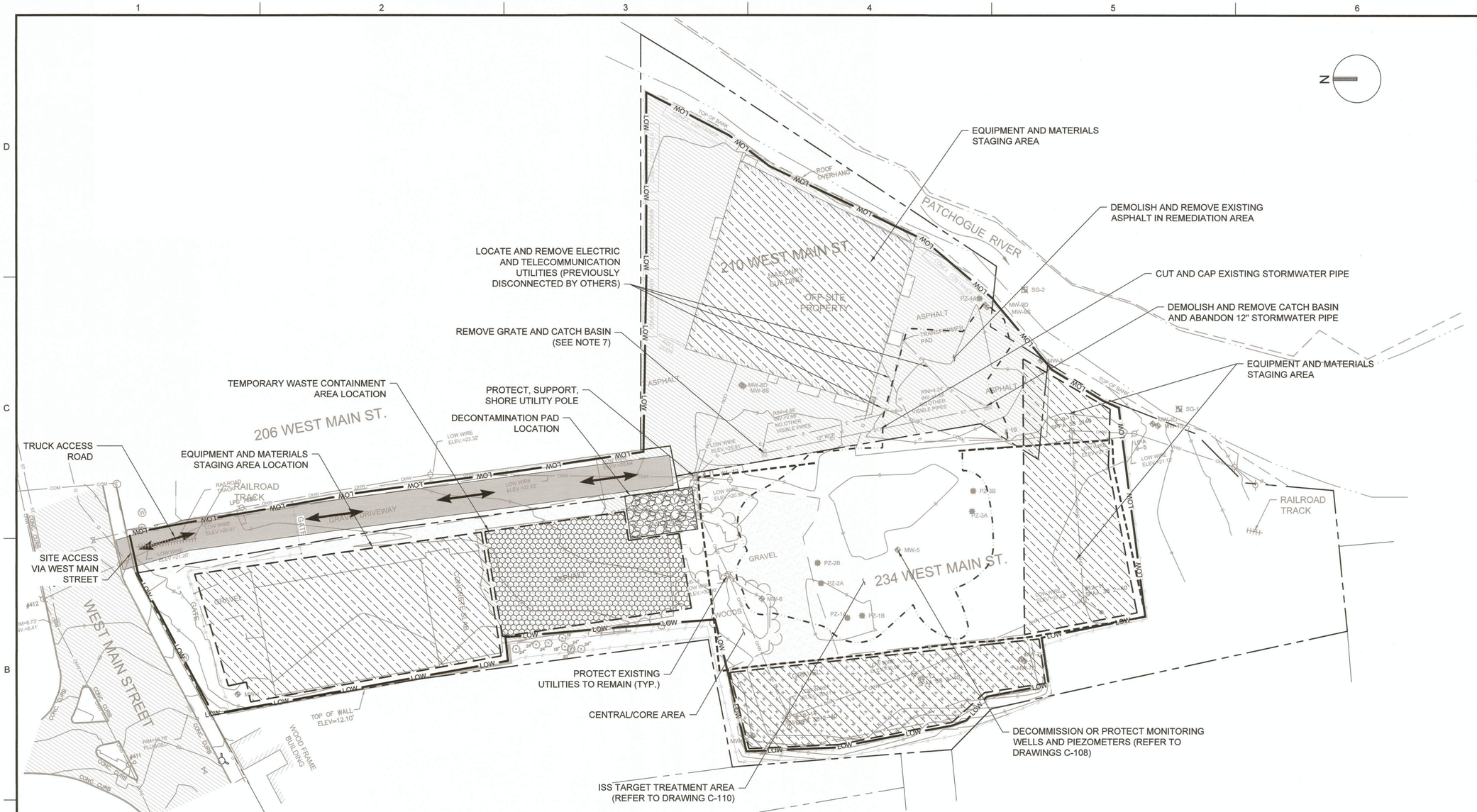
CIVIL

SITE REMEDIATION PLAN

DRAWING NUMBER
C-110

SHEET NUMBER
11 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN2-SHEETS\C-CIVIL FILENAME: C-110.DWG PLOT DATE: 5/1/2019 1:29 PM CAD USER: ROBERT NEAR



SITE PREPARATION PLAN

0 30 60

SCALE IN FEET

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. REFER TO TECHNICAL SPECIFICATIONS AND DRAWING C-110 FOR CONSTRUCTION SEQUENCE.
3. STAGING AREAS AND DECONTAMINATION PAD LOCATIONS ARE SHOWN FOR REFERENCE ONLY. FINAL LOCATION OF THESE AREAS WILL BE DETERMINED BY THE CONTRACTOR AND INCLUDED IN THE 100% DESIGN DOCUMENTS.
4. LOCATION AND AERIAL EXTENT OF WASTE CONTAINMENT AREA, EQUIPMENT AND MATERIAL STAGING AREA, AND DECONTAMINATION PAD ARE SHOWN AS AVAILABLE AREAS FOR THESE ACTIVITIES. CONTRACTOR SHALL PROPOSE ACTUAL AREAS, LIMITS AND LOCATIONS. ANY DAMAGE TO THE EXISTING STRUCTURES/SURFACE IN THESE AREAS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST.
5. CONTRACTOR MAY USE FIRST FLOOR OF EXISTING BUILDING FOR EQUIPMENT AND MATERIALS STAGING AREA. USE OF SECOND FLOOR IS NOT PERMITTED.
6. CONTRACTOR SHALL LOCATE AND PROTECT EXISTING MONITORING WELLS TO REMAIN.
7. CONTRACTOR SHALL REMOVE GRATE AND CATCH BASIN. CONTRACTOR SHALL DISPOSE OF CATCH BASIN, GRATE AND MATERIAL CONTAINED IN THE CATCH BASIN AT AN APPROVED OFF-SITE FACILITY. BACKFILL WITH CRUSHED STONE TO EXISTING GRADE.
8. AS ENCOUNTERED, MGP STRUCTURES AND LIRR SPURS WILL BE REMOVED, CHARACTERIZED, AND PROPERLY DISPOSED OF OFF-SITE. SEE DRAWING C-102 FOR APPROXIMATE LOCATION OF FORMER MGP STRUCTURES.

LEGEND:

- LOW — LIMIT OF WORK
- LIMIT OF REMEDIATION AREA
- TRAFFIC ROUTE
- EQUIPMENT AND MATERIALS STAGING AREA
- DECONTAMINATION PAD
- TEMPORARY WASTE CONTAINMENT AREA
- TEMPORARY ACCESS ROADWAY
- EXISTING CRUSHED STONE COVER

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
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MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
05/01/2019

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N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS		
REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-111.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	---

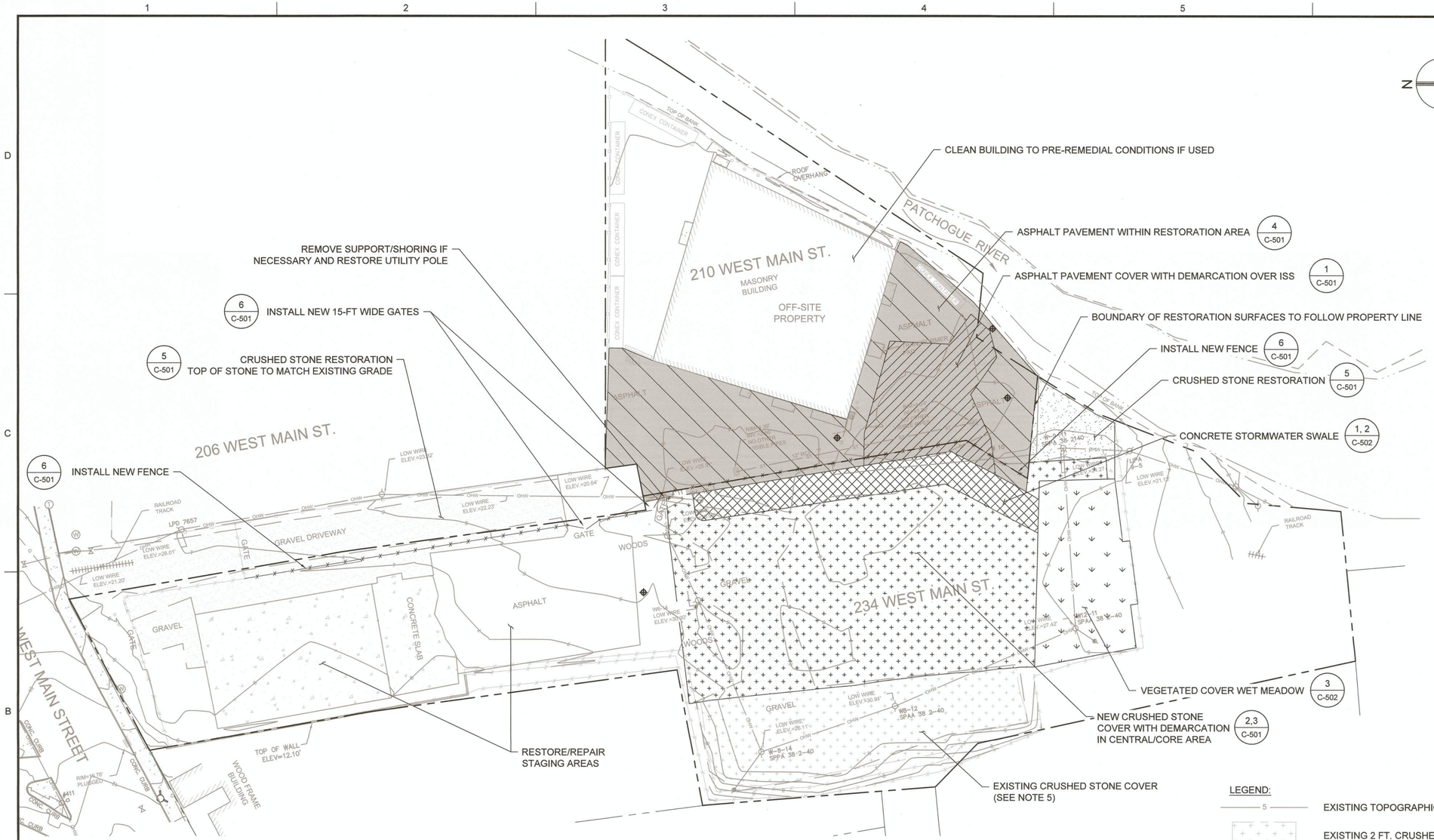
CIVIL

SITE PREPARATION PLAN

DRAWING NUMBER
C-111

SHEET NUMBER
12 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\148322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-111.DWG PLOT DATE: 5/1/2019 1:30 PM CAD USER: ROBERT NEAR



SITE RESTORATION PLAN

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. INSTALL NEW FENCING AND GATES ALONG THE OFF-SITE PROPERTY BOUNDARY AND TIE INTO EXISTING FENCE.
3. SEQUENCE SITE RESTORATION WORK IN ACCORDANCE WITH SPECIFICATION SECTION 01 10 00.
4. REMOVE ALL CONTRACTOR SUPPORT FACILITIES, UTILITIES, EQUIPMENT, MATERIALS, CONTRACTOR GENERATED WASTE, AND RESTORE EXISTING BUILDING TO PRE-REMEDIAL ACTION CONDITIONS.
5. EXISTING GRAVEL COVER TO BE PROTECTED DURING REMEDIAL CONSTRUCTION ACTIVITIES. DAMAGE TO THE GRAVEL COVER SHALL BE REPAIRED, IN KIND, BY THE CONTRACTOR AT NO ADDITIONAL COST.
6. INSTALL CRUSHED STONE COVER AND ASPHALT PAVEMENT COVER IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
7. RESTORE AREAS USED FOR EQUIPMENT AND MATERIALS STAGING, TEMPORARY WASTE CONTAINMENT, DECONTAMINATION PADS AND TEMPORARY ACCESS ROADS TO PRE-EXISTING CONDITIONS.

LEGEND:

- EXISTING TOPOGRAPHIC CONTOUR (FT., NAD 88)
- EXISTING 2 FT. CRUSHED STONE COVER
- NEW MONITORING WELL TO BE INSTALLED
- NEW 6-FT CHAIN-LINK FENCE
- ASPHALT PAVEMENT COVER OVER ISS
- ASPHALT PAVEMENT WITHIN RESTORATION AREA
- CRUSHED STONE COVER IN CENTRAL/CORE AREA
- CRUSHED STONE RESTORATION
- CONCRETE STORMWATER SWALE
- VEGETATED COVER IN WET MEADOW

Path: P:\NATIONAL_GRID\PATCHOGUE\146322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-112.DWG PLOT DATE: 5/1/2019 1:31 PM CAD USER: ROBERT NEAR

Brown AND Caldwell

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2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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073661
LICENSED PROFESSIONAL ENGINEER
05/02/2019

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NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS		
REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-112.DWG

BC PROJECT NUMBER
153021

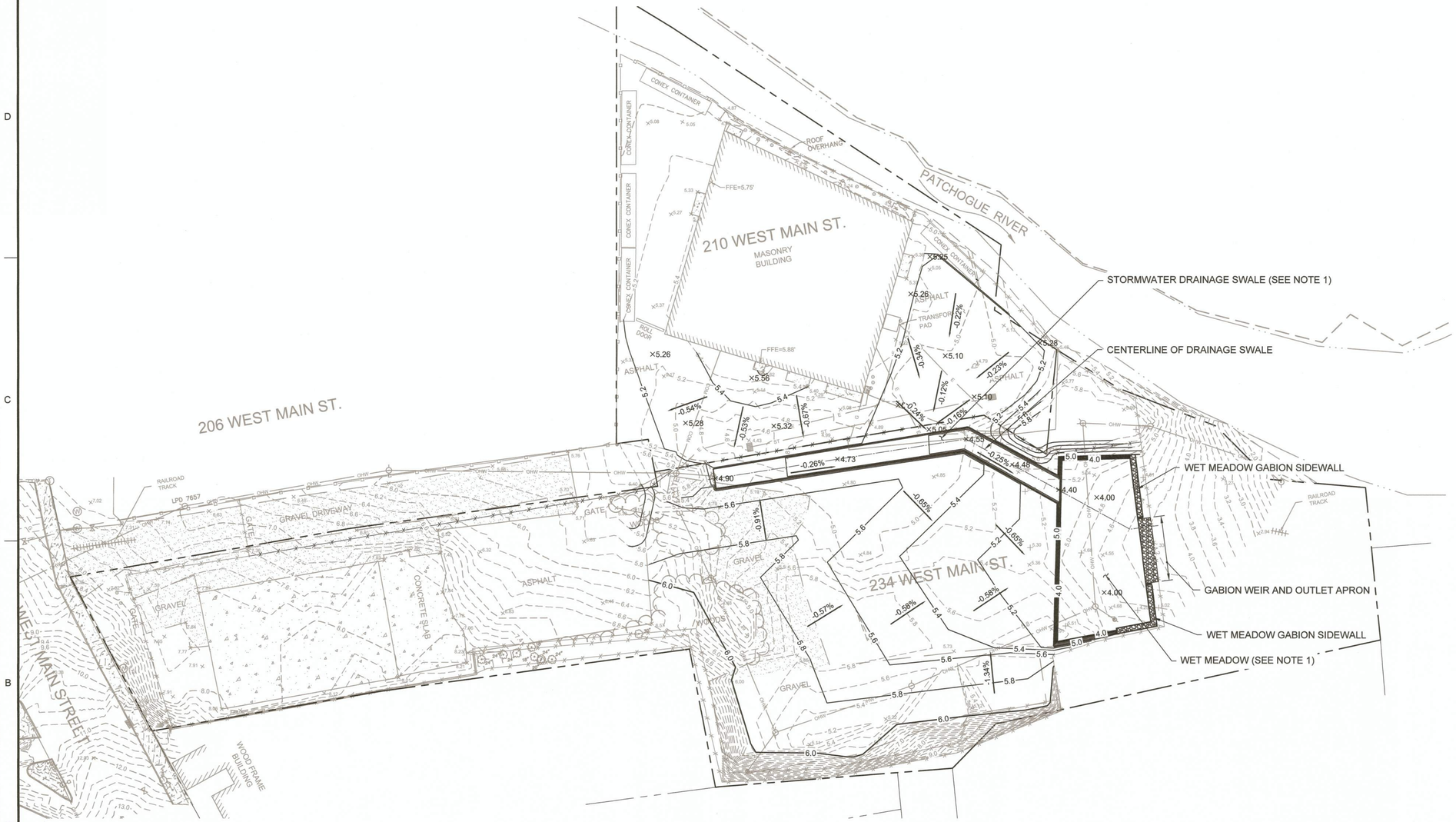
CLIENT PROJECT NUMBER

CIVIL

SITE RESTORATION PLAN

DRAWING NUMBER
C-112

SHEET NUMBER
13 OF 24



SITE RESTORATION GRADING PLAN

0 30 60
SCALE IN FEET

LEGEND:

- PROPERTY LINE
- 6.0 EXISTING TOPOGRAPHIC CONTOUR (FT., NAD 88)
- 5.0 FINAL GRADE CONTOUR (FT., NAD 88)
- ×4.80 EXISTING GRADE SPOT GRADE (FT., NAD 88)
- ×5.27 FINAL GRADE SPOT GRADE (FT., NAD 88)
- -0.65% FINAL GRADE SLOPE
- CHAIN-LINK FENCE

NOTES:
1. SEE DRAWING C-114 FOR ADDITIONAL INFORMATION ON THE DRAINAGE SWALE AND WET MEADOW.

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-113.DWG PLOT DATE: 5/1/2019 1:31 PM CAD USER: ROBERT NEAR

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
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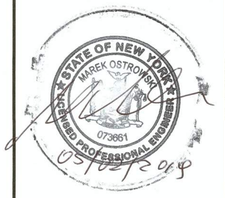

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DRAWINGS (100%)

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LINE IS 2 INCHES AT FULL SIZE

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CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

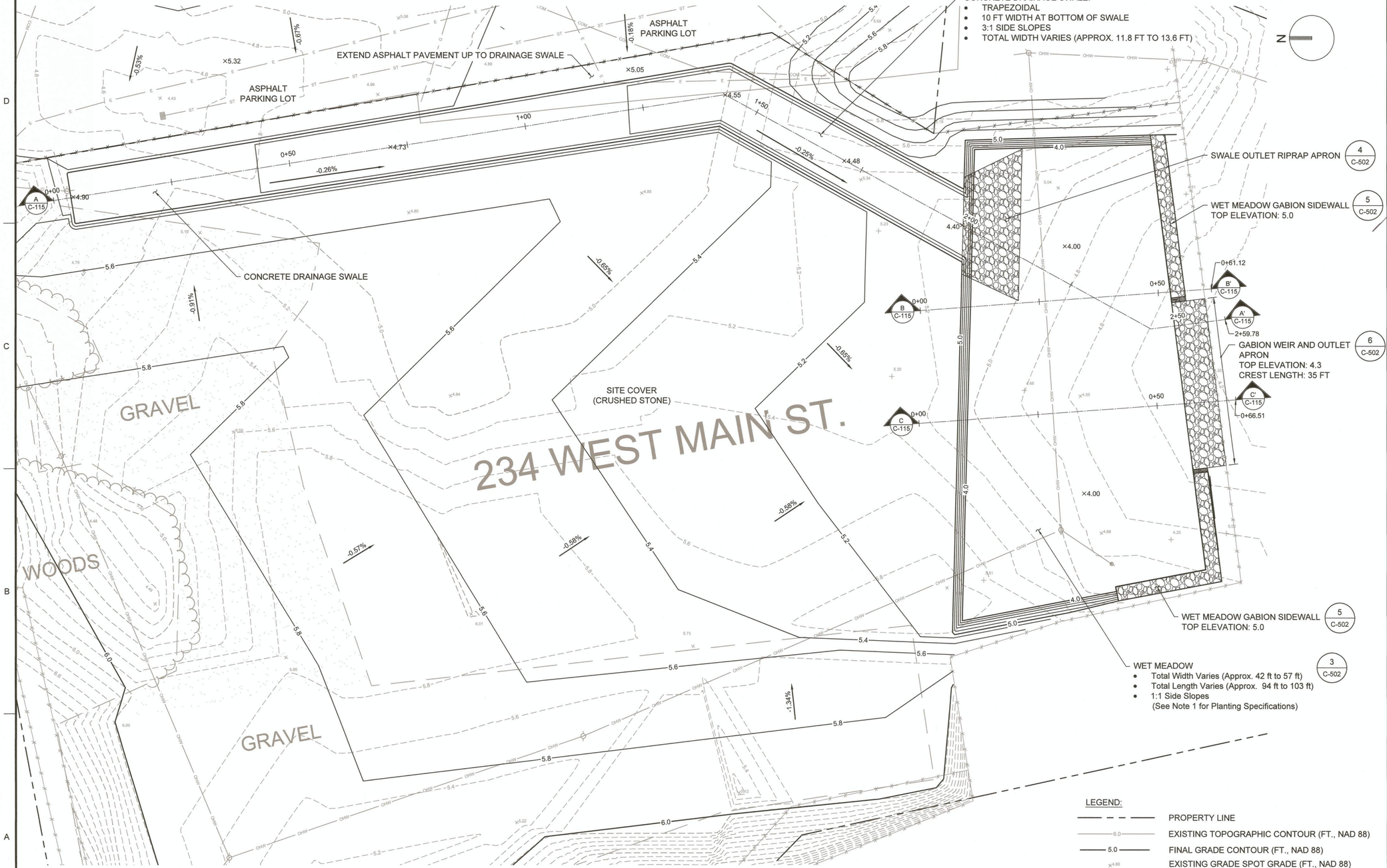
FILENAME
C-113.DWG
BC PROJECT NUMBER
153021
CLIENT PROJECT NUMBER

CIVIL

SITE RESTORATION
GRADING PLAN

DRAWING NUMBER
C-113

SHEET NUMBER
14 OF 24



NOTES:
1. WET MEADOW SHALL BE PLANTED WITH SEED MIXTURE AND RATES (LBS PER 1,000 SF) AS FOLLOWS:
   A. DEER TONGUE: 0.35 OR SWITCHGRASS: 0.45
   B. REDTOP: 0.1
   C. BIRDSFOOT TREFOIL: 0.23

POST-REMEDIATION STORMWATER MANAGEMENT PLAN

0 10 20
SCALE IN FEET

LEGEND:
- PROPERTY LINE
- EXISTING TOPOGRAPHIC CONTOUR (FT., NAD 88)
- FINAL GRADE CONTOUR (FT., NAD 88)
- EXISTING GRADE SPOT GRADE (FT., NAD 88)
- FINAL GRADE SPOT GRADE (FT., NAD 88)
- FINAL GRADE SLOPE
- CHAIN-LINK FENCE

Brown AND Caldwell
BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
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05/02/2019

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234 WEST MAIN STREET
VILLAGE OF PATCHOGUE, NY

REMEDIAL DESIGN DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

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CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-114.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	----

CIVIL

POST-REMEDIATION STORMWATER MANAGEMENT PLAN

DRAWING NUMBER
C-114
SHEET NUMBER
15 OF 24

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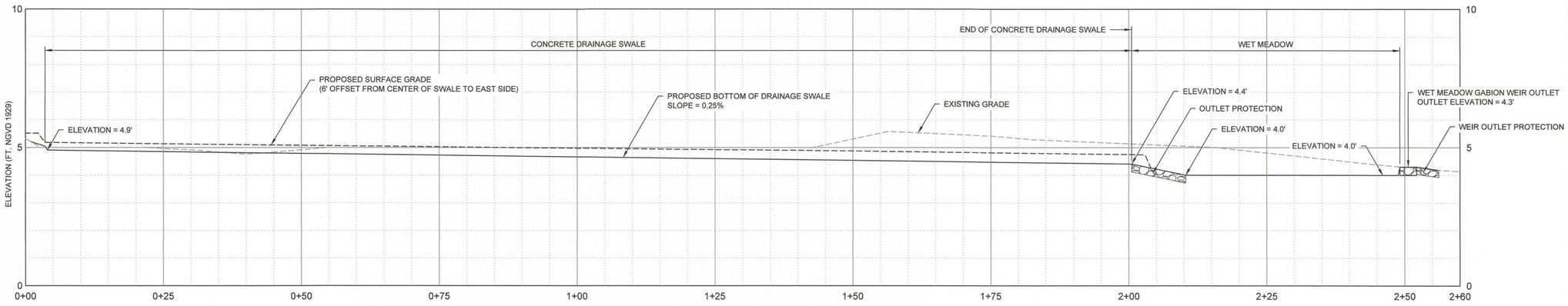
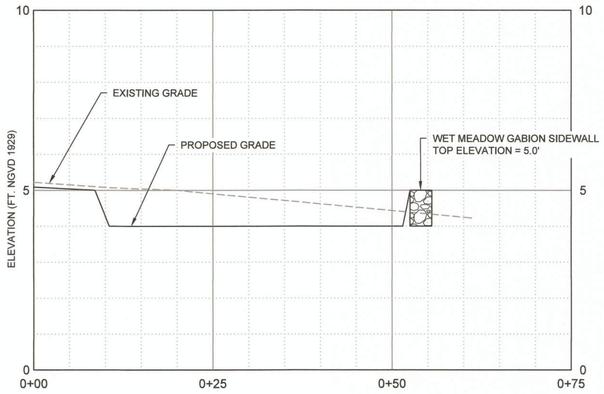


STORMWATER MANAGEMENT PROFILE A-A'

0 10' 20' HORIZONTAL

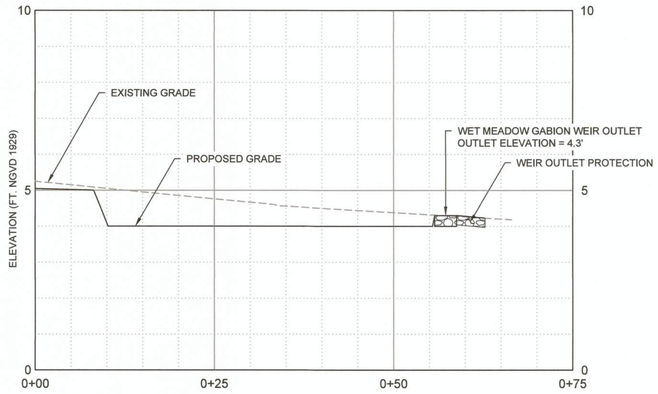
0 2' 4' VERTICAL



STORMWATER MANAGEMENT SECTION B-B'

0 10' 20' HORIZONTAL

0 2' 4' VERTICAL



STORMWATER MANAGEMENT SECTION C-C'

0 10' 20' HORIZONTAL

0 2' 4' VERTICAL

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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STATE OF NEW YORK
MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
05/02/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-115.DWG

BC PROJECT NUMBER
153021

CLIENT PROJECT NUMBER

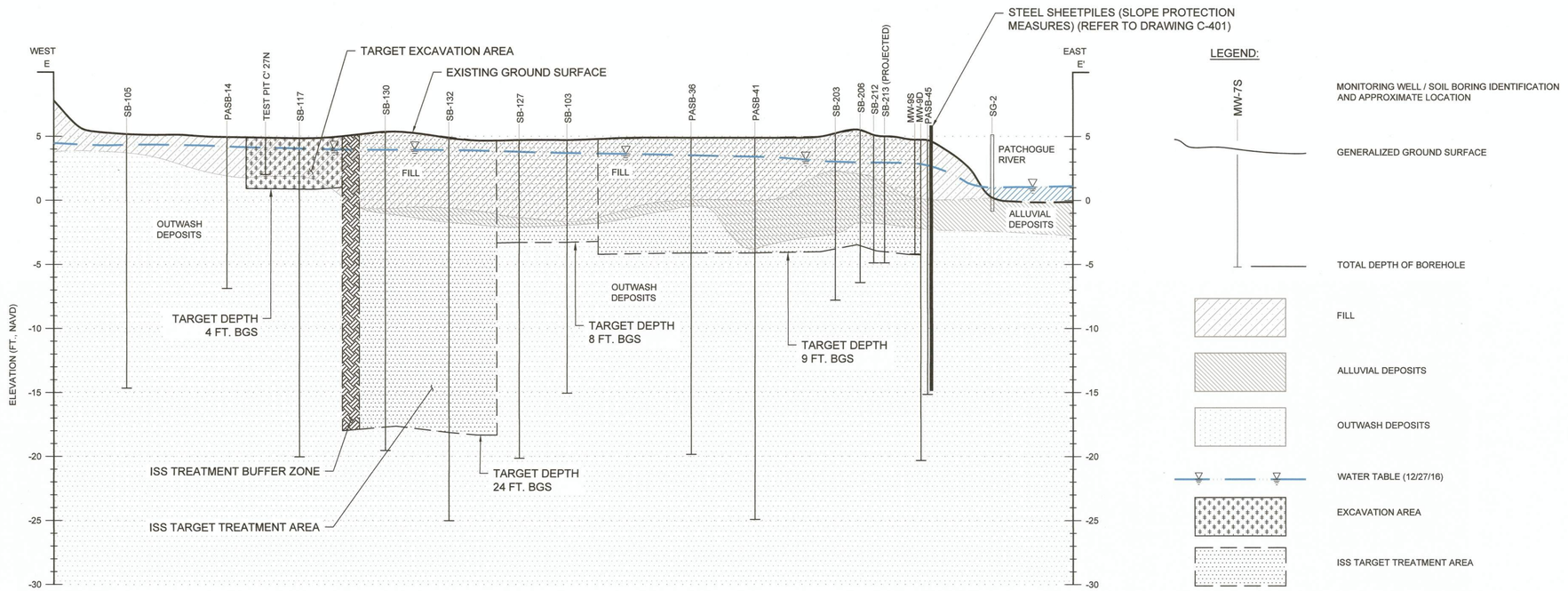
CIVIL

STORMWATER
MANAGEMENT
CROSS-SECTIONS
AND PROFILE

DRAWING NUMBER
C-115

SHEET NUMBER
16 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-115.DWG PLOT DATE: 5/1/2019 1:32 PM CAD USER: ROBERT NEAR



CROSS-SECTION E-E'
SCALE H: 1" = 40'
V: 1" = 10'

LEGEND:

- MW-7S — MONITORING WELL / SOIL BORING IDENTIFICATION AND APPROXIMATE LOCATION
- GENERALIZED GROUND SURFACE
- TOTAL DEPTH OF BOREHOLE
- FILL
- ALLUVIAL DEPOSITS
- OUTWASH DEPOSITS
- WATER TABLE (12/27/16)
- EXCAVATION AREA
- ISS TARGET TREATMENT AREA
- ISS TREATMENT BUFFER ZONE
- SLOPE PROTECTION MEASURES

NOTES:

1. REFER TO DRAWING C-110 FOR CROSS SECTION LOCATION.
2. REFER TO DRAWINGS C-400 AND C-401 FOR BORING LOCATIONS.

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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STATE OF NEW YORK
MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
05/01/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS		
REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: C. OLIVEIRA
DRAWN: A. SANTIAGO / R. NEAR
CHECKED:
CHECKED: K. BOGATCH
APPROVED: M. OSTROWSKI

FILENAME
C-301.DWG
BC PROJECT NUMBER
153021
CLIENT PROJECT NUMBER

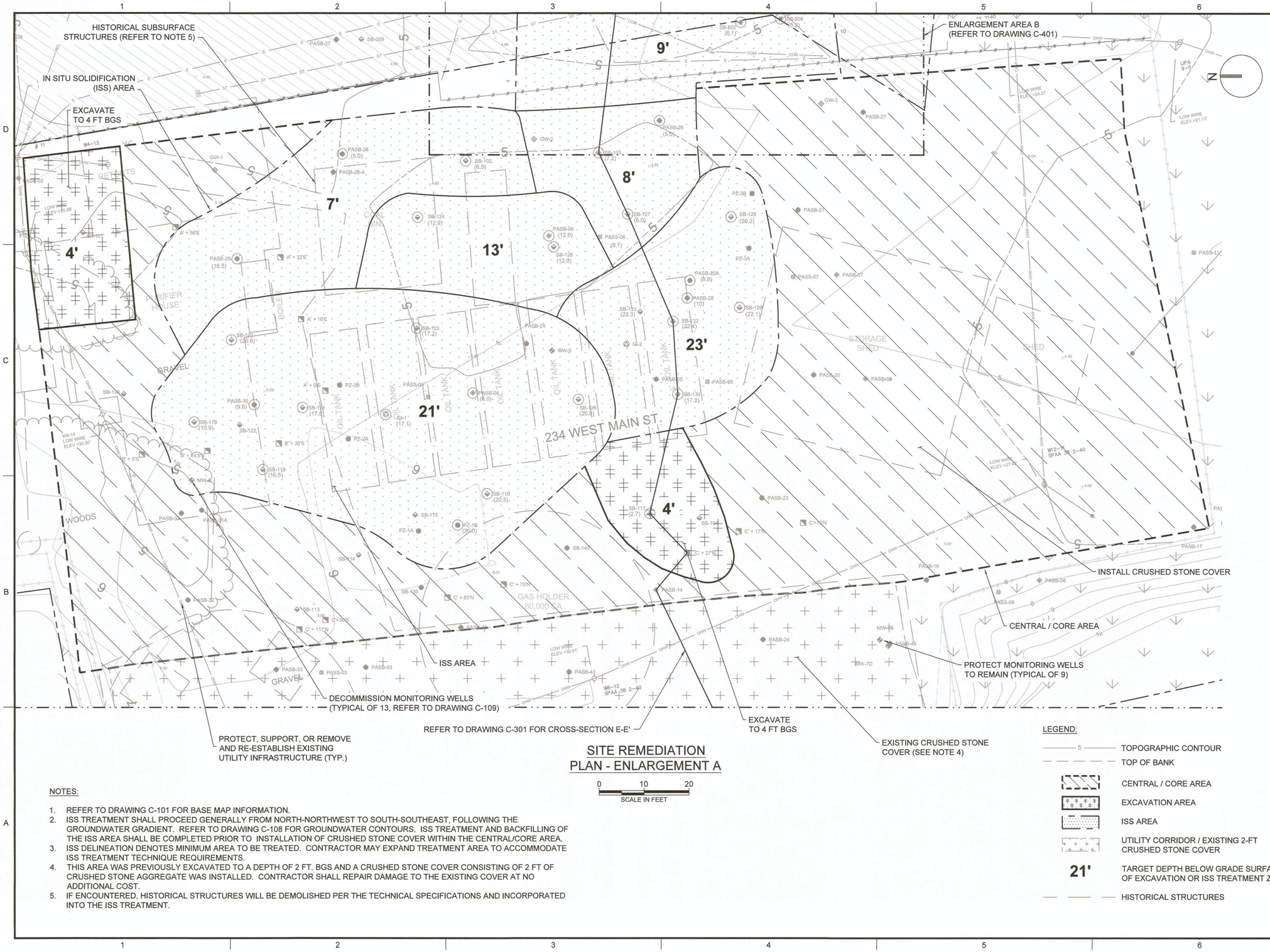
CIVIL

REMEDIATION AREA
CROSS SECTION

DRAWING NUMBER
C-301

SHEET NUMBER
17 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-301.DWG PLOT DATE: 5/1/2019 1:33 PM CAD USER: ROBERT NEAR



SITE REMEDIATION PLAN - ENLARGEMENT A

0 10 20
SCALE IN FEET

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. ISS TREATMENT SHALL PROCEED GENERALLY FROM NORTH-NORTHWEST TO SOUTH-SOUTHEAST, FOLLOWING THE GROUNDWATER GRADIENT. REFER TO DRAWING C-108 FOR GROUNDWATER CONTOURS. ISS TREATMENT AND BACKFILLING OF THE ISS AREA SHALL BE COMPLETED PRIOR TO INSTALLATION OF CRUSHED STONE COVER WITHIN THE CENTRAL/CORE AREA.
3. ISS DELINEATION DENOTES MINIMUM AREA TO BE TREATED. CONTRACTOR MAY EXPAND TREATMENT AREA TO ACCOMMODATE ISS TREATMENT TECHNIQUE REQUIREMENTS.
4. THIS AREA WAS PREVIOUSLY EXCAVATED TO A DEPTH OF 2 FT. BGS AND A CRUSHED STONE COVER CONSISTING OF 2 FT OF CRUSHED STONE AGGREGATE WAS INSTALLED. CONTRACTOR SHALL REPAIR DAMAGE TO THE EXISTING COVER AT NO ADDITIONAL COST.
5. IF ENCOUNTERED, HISTORICAL STRUCTURES WILL BE DEMOLISHED PER THE TECHNICAL SPECIFICATIONS AND INCORPORATED INTO THE ISS TREATMENT.

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A

UPPER SADDLE RIVER, NJ

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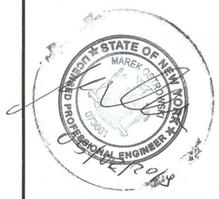


MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	10/15/18	FRP ADDENDUM 3
2	03/29/19	WETLANDS PERMIT
3	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: C. OLIVEIRA
DRAWN: A. SANTIAGO / R. NEAR
CHECKED:
CHECKED: K. BOGATCH
APPROVED: M. OSTROWSKI

FILENAME
C-400.DWG
BC PROJECT NUMBER
153021
CLIENT PROJECT NUMBER

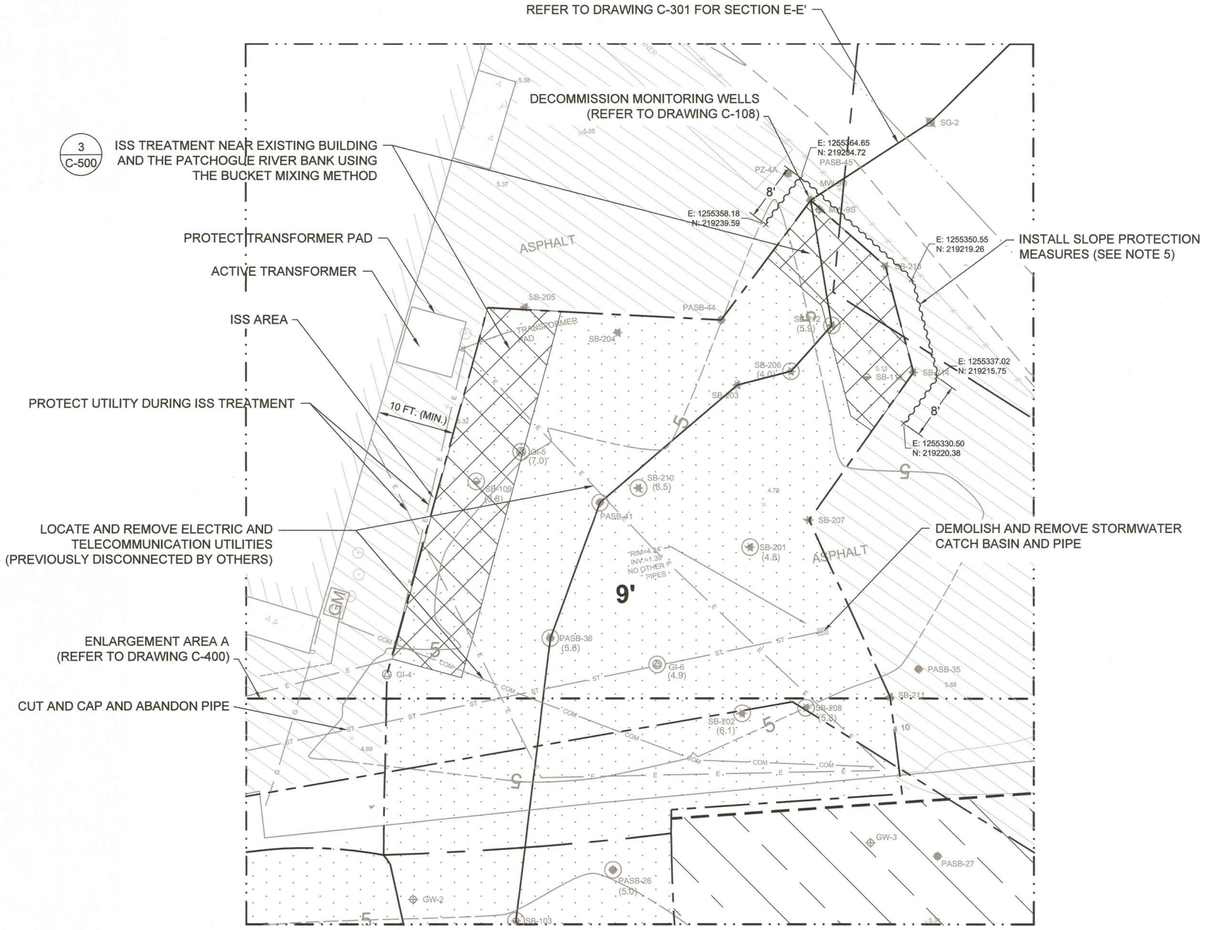
CIVIL

SITE REMEDIATION PLAN - ENLARGEMENT A

DRAWING NUMBER
C-400

SHEET NUMBER
18 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-400.DWG PLOT DATE: 5/1/2019 1:34 PM CAD USER: ROBERT NEAR



SITE REMEDIATION PLAN - ENLARGEMENT B

0 10 20

SCALE IN FEET

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. WORK SHALL BE SEQUENCED SUCH THAT ISS TREATMENT PROGRESSES FROM GROUNDWATER UPGRADIENT TO DOWNGRADIENT (I.E., ISS TREATMENT PROGRESSES FROM NORTH TO SOUTH FOLLOWING GROUNDWATER GRADIENT).
3. ISS DELINEATION DENOTES MINIMUM AREA TO BE TREATED. CONTRACTOR MAY EXPAND TREATMENT AREA TO ACCOMMODATE ISS TREATMENT TECHNIQUE REQUIREMENTS.
4. THIS AREA WAS PREVIOUSLY EXCAVATED TO A DEPTH OF 2 FT. BGS AND A CRUSHED STONE COVER CONSISTING OF 2 FT OF CRUSHED STONE AGGREGATE WAS INSTALLED. CONTRACTOR SHALL NOT DISTURB THE EXISTING COVER.
5. CONTRACTOR SHALL INSTALL A SHEETPILE SLOPE PROTECTION SYSTEM PRIOR TO ISS RELATED ACTIVITIES IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS. SHEETPILES SHALL HAVE A MINIMUM EMBEDMENT DEPTH OF 12 FT. BGS. SHEETPILES SHALL HAVE A MINIMUM STICK-UP OF 3 FT. ABOVE GROUND SURFACE. SHEETPILE SYSTEM TO BE INSTALLED AND REMOVED BY HYDRAULIC PRESSING. VIBRATORY OR IMPACT DRIVING WILL NOT BE ALLOWED.

LEGEND:

- EXISTING TOPOGRAPHIC CONTOUR
- TOP OF BANK
- CENTRAL / CORE AREA
- EXCAVATION AREA
- ISS TARGET TREATMENT AREA
- ISS TARGET TREATMENT AREA (BUCKET MIXING)
- 9' TARGET DEPTH FROM BELOW GRADE SURFACE OF ISS TREATMENT ZONE
- SLOPE PROTECTION MEASURES

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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LICENSED PROFESSIONAL ENGINEER
05/01/2019

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-401.DWG

BC PROJECT NUMBER
153021

CLIENT PROJECT NUMBER

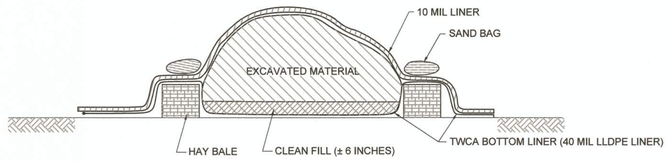
CIVIL

SITE REMEDIATION PLAN - ENLARGEMENT B

DRAWING NUMBER
C-401

SHEET NUMBER
19 OF 24

Path: P:\NATIONAL_GRID\PATCHOGUE\148322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN\2-SHEETS\C-CIVIL FILENAME: C-401.DWG PLOT DATE: 5/1/2019 1:35 PM CAD USER: ROBERT NEAR

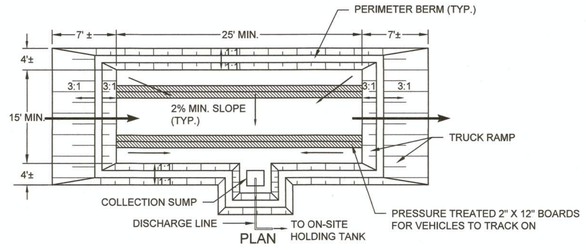


NOTES:

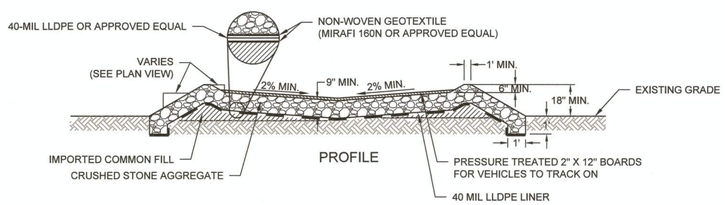
1. HAY BALES WILL BE PLACED IN A MANNER THAT PREVENTS SEDIMENT AND SOIL IN CONTACT WITH WASTE MATERIAL FROM SPILLING OUT THE TWCA.
2. WASTE MATERIAL WILL BE COVERED SECURELY (FROM RAIN AND WIND DISTURBANCES) WITH A LINER AT THE END OF EACH WORK DAY.
3. WASTE MATERIAL WILL BE PLACED IN A MANNER WHICH, WHEN COVERED WITH LINER, WILL PREVENT POOLING OF RAINWATER.
4. THE LOCATION OF THE HAY BALES WILL BE ADJUSTED BASED ON THE VOLUME OF WASTE MATERIAL TO PREVENT SAGGING OF THE LINER.
5. SAND BAGS WILL BE PLACED ON TOP OF THE LINER (COVER) TO KEEP THE LINER TAUGHT, AND IN A MANNER WHICH PROMOTES DRAINAGE OFF OF THE LINER AND AWAY FROM THE TWCA.
6. TO MINIMIZE DAMAGE TO THE TWCA DURING LOADING AND UNLOADING OF EXCAVATED MATERIALS, CONTRACTOR SHALL TAKE CARE WHEN OPERATING DIRECTLY ON THE CLEAN FILL LAYER TO AVOID DAMAGING LINER.
7. THICKNESS OF CLEAN FILL SHALL BE FIELD-DETERMINED BY ENGINEER BASED ON SITE CONDITIONS AND CONSTRUCTION OPERATIONS.
8. CONTRACTOR SHALL INSPECT, MONITOR AND MAINTAIN TWCA BERM SAND LINER THROUGHOUT CONSTRUCTION ACTIVITIES.

1 TEMPORARY WASTE CONTAINMENT AREA

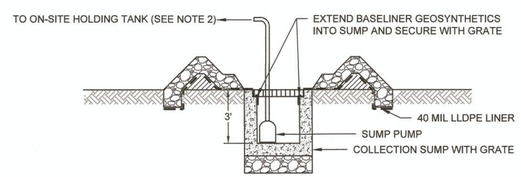
NOT TO SCALE



PLAN



PROFILE



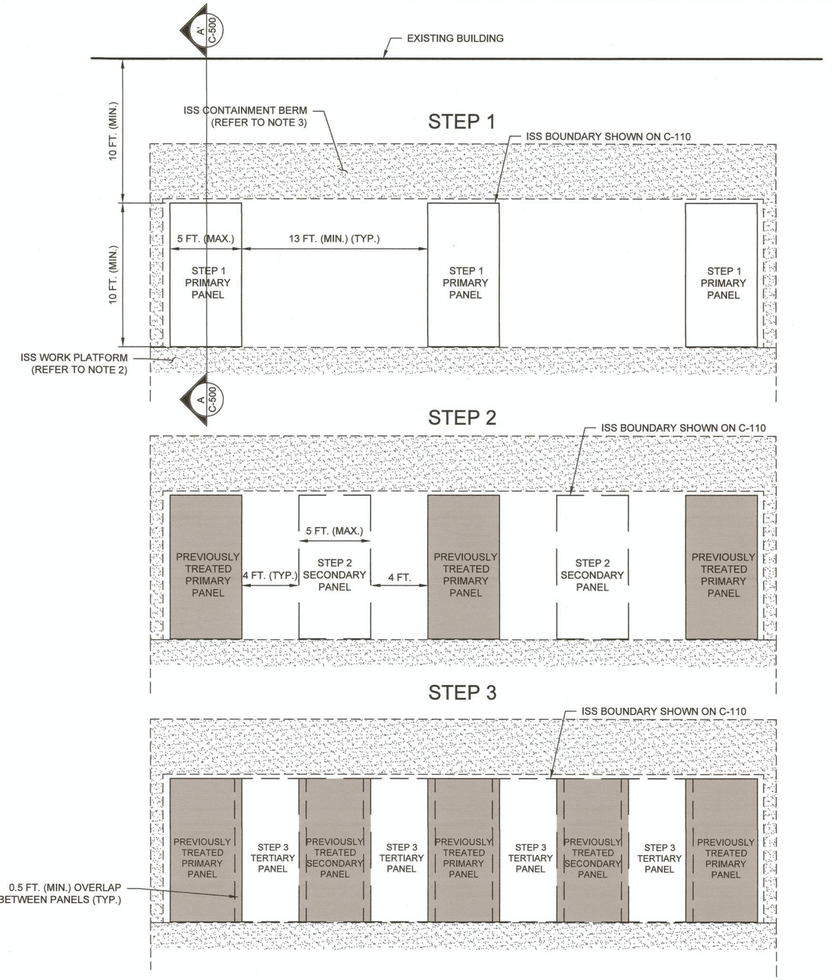
SUMP PROFILE

NOTES:

1. REFER TO SPECIFICATION SECTIONS 01 52 20 FOR EQUIPMENT AND MATERIAL DECONTAMINATION, INCLUDING MATERIAL AND INSTALLATION REQUIREMENTS FOR THE DECONTAMINATION PAD.
2. WATER COLLECTED FROM THE COLLECTION SUMP SHALL BE MANAGED IN ACCORDANCE WITH SPECIFICATION SECTION 31 70 00.

2 DECONTAMINATION PAD

NOT TO SCALE



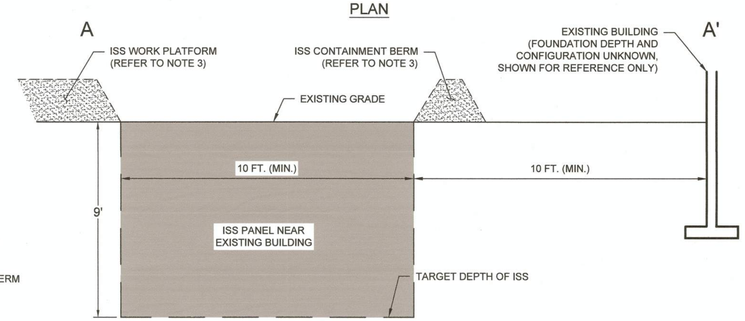
ISS PANEL INSTALLATION SEQUENCE

1 - PRIMARY PANEL TO BE TREATED FIRST AND ALLOWED TO CURE.
2 - SECONDARY PANEL. DO NOT MIX UNTIL PRIMARY PANELS ATTAIN AN UNCONFINED COMPRESSIVE STRENGTH OF 25 PSI.
3 - TERTIARY PANEL. DO NOT MIX UNTIL SECONDARY PANELS ATTAIN AN UNCONFINED COMPRESSIVE STRENGTH OF 25 PSI.

NOTES:

1. ISS TREATMENT NEAR THE EXISTING BUILDING SHALL FOLLOW THE PRIMARY, SECONDARY, AND TERTIARY PANEL SEQUENCE SHOWN.
2. DO NOT CONDUCT ISS IN AREAS BEYOND THE PRIMARY, SECONDARY, AND TERTIARY PANELS UNTIL THE TERTIARY PANELS HAVE ATTAINED A MINIMUM UNCONFINED COMPRESSIVE STRENGTH OF 25 PSI.
3. CONFIGURATION AND THICKNESS OF ISS WORK PLATFORM AND ISS CONTAINMENT BERM TO BE DESIGNED BY CONTRACTOR AND INCORPORATED INTO SUBSEQUENT DESIGN SUBMISSION.

PLAN



DETAIL SECTION A-A'

3 ISS NEAR EXISTING BUILDING DETAIL

NOT TO SCALE

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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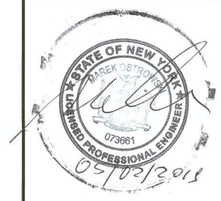


MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-500.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	---

CIVIL

REMEDIATION DETAILS

DRAWING NUMBER
C-500

SHEET NUMBER
20 OF 24

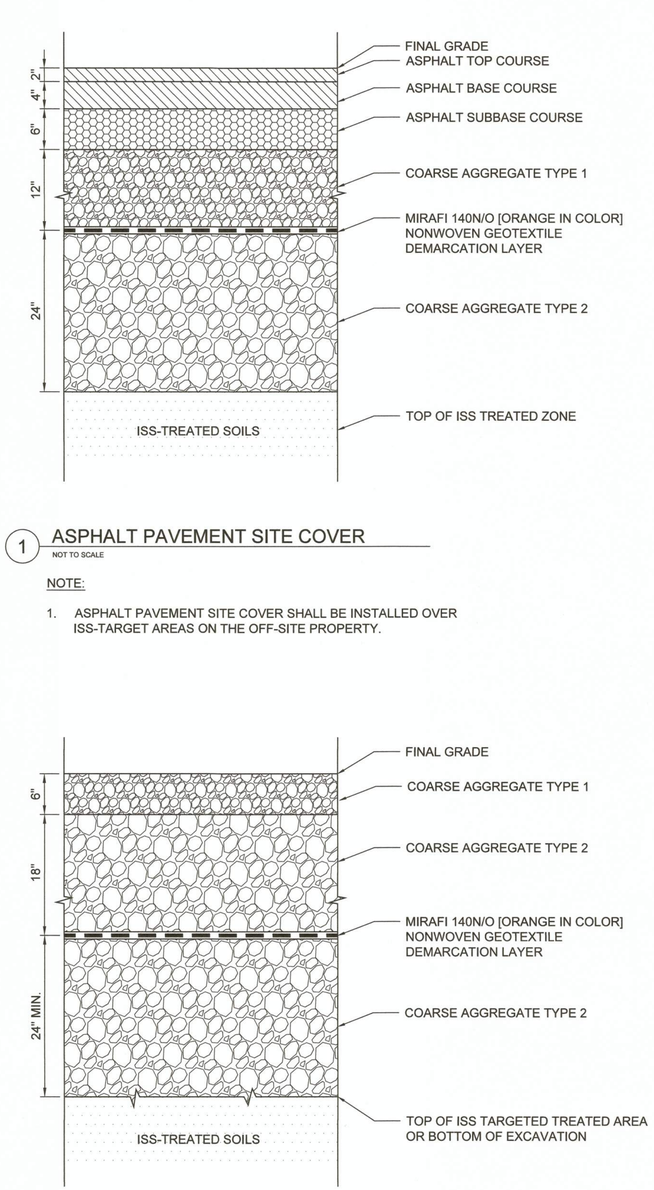
Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\100%-DESIGN2-SHEETS\C-CIVIL FILENAME: C-500.DWG PLOT DATE: 5/1/2019 1:35 PM CAD USER: ROBERT NEAR

1 ASPHALT PAVEMENT SITE COVER

NOT TO SCALE

NOTE:

1. ASPHALT PAVEMENT SITE COVER SHALL BE INSTALLED OVER ISS-TARGET AREAS ON THE OFF-SITE PROPERTY.

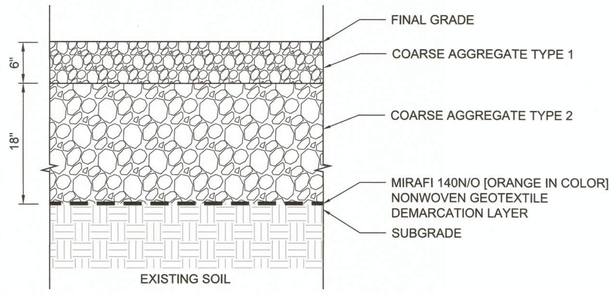


2 CRUSHED STONE SITE COVER (ISS AND EXCAVATION AREAS)

NOT TO SCALE

NOTE:

1. CRUSHED STONE SITE COVER SHALL BE INSTALLED WITHIN LIMITS OF ISS-AREA AND TARGETED SOIL EXCAVATION AREA. SEE DRAWING C-400 AND C-401 FOR LOCATIONS OF ISS AND EXCAVATION AREAS.

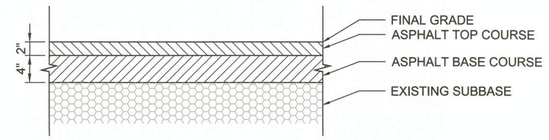


3 CRUSHED STONE SITE COVER IN CENTRAL/CORE AREA

NOT TO SCALE

NOTE:

1. WITHIN THE CENTRAL/CORE AREA, THE REMAINING AREA OUTSIDE LIMITS OF ISS AND SOIL EXCAVATION SHALL RECEIVE A 2-FOOT SITE COVER. EXISTING SOIL SHALL BE EXCAVATED TO 2 FEET BELOW GRADE TO INSTALL SITE COVER.

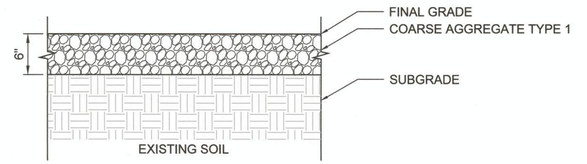


4 ASPHALT PAVEMENT WITHIN RESTORATION AREA

NOT TO SCALE

NOTE:

1. REFER TO DRAWING C-112 FOR ASPHALT PAVEMENT RESTORATION AREAS.

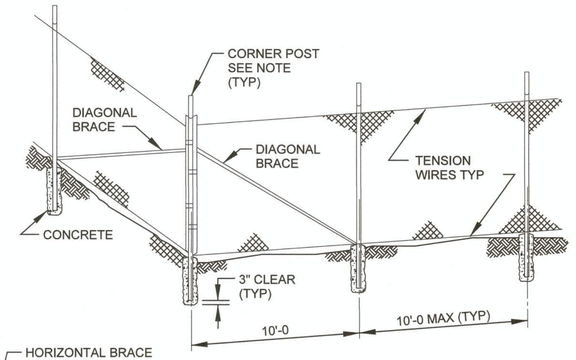


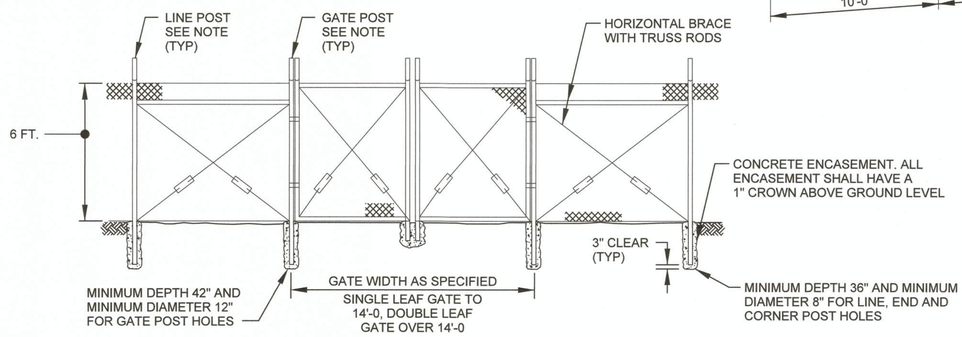
5 CRUSHED STONE RESTORATION

NOT TO SCALE

NOTE:

1. REFER TO DRAWING C-112 FOR CRUSHED STONE RESTORATION AREAS.





NOTE:
PROVIDE POST CAP WHERE EXTENSION ARMS ARE NOT SPECIFIED

6 CHAIN LINK FENCE AND GATE DETAIL

NOT TO SCALE

GENERAL NOTE:

1. FOR FENCE AND GATE MATERIAL AND INSTALLATION SPECIFICATIONS, SEE SPECIFICATION SECTION 323113.

Brown AND Caldwell

BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN STREET
VILLAGE OF PATCHOGUE, NY

REMEDIAL DESIGN DRAWINGS (100%)

REVISIONS

REV	DATE	DESCRIPTION
0	02/12/18	95% RDR SUBMITTAL TO NYSDEC
1	05/01/19	100% RDR SUBMITTAL TO NYSDEC

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-501.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	----

CIVIL

SITE RESTORATION DETAILS

DRAWING NUMBER
C-501

SHEET NUMBER
21 OF 24

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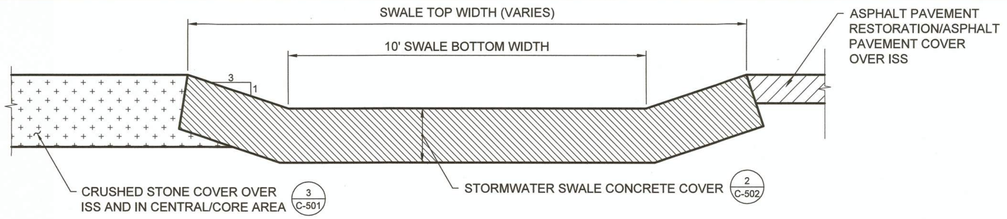
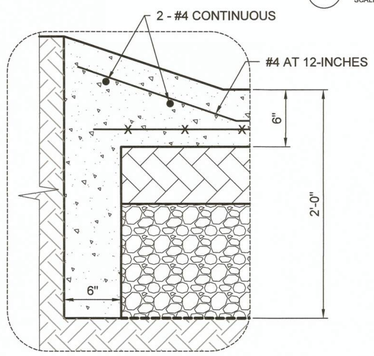
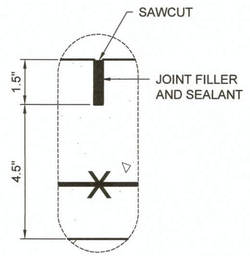


1 STORMWATER SWALE DETAIL
SCALE: NTS



CURTAIN WALL
SCALE: NTS



CONTRACTION JOINT
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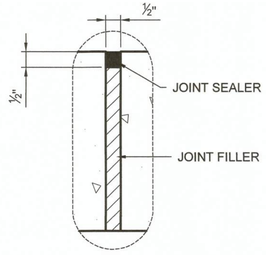

ISOLATION JOINT
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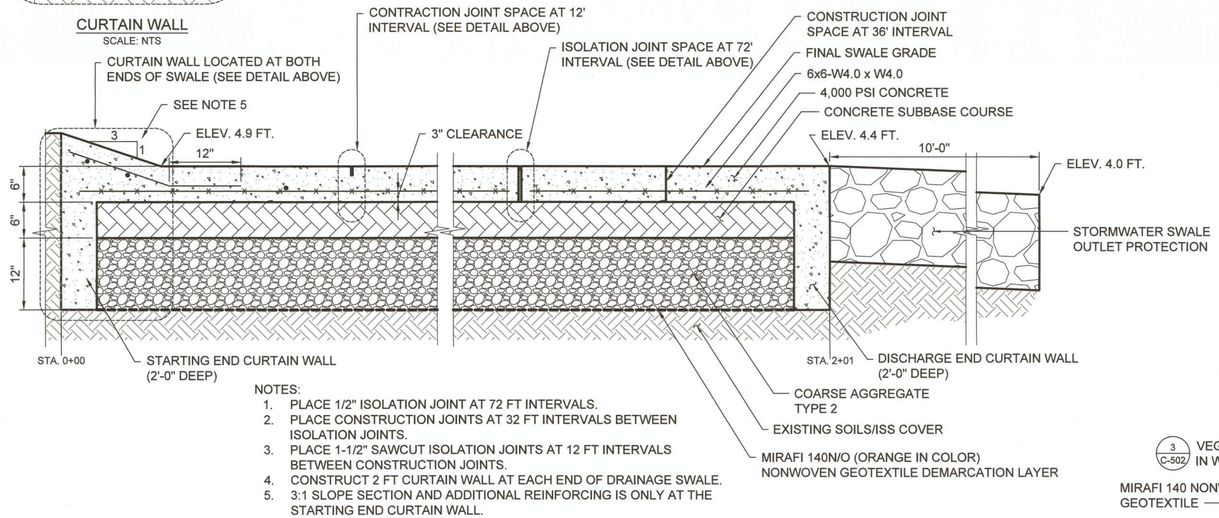
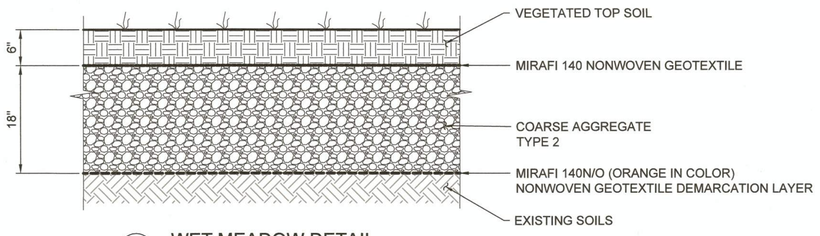
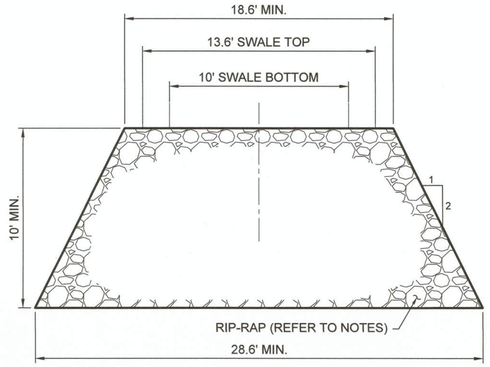


NOTES:
1. PLACE 1/2" ISOLATION JOINT AT 72 FT INTERVALS.
2. PLACE CONSTRUCTION JOINTS AT 32 FT INTERVALS BETWEEN ISOLATION JOINTS.
3. PLACE 1-1/2" SAWCUT ISOLATION JOINTS AT 12 FT INTERVALS BETWEEN CONSTRUCTION JOINTS.
4. CONSTRUCT 2 FT CURTAIN WALL AT EACH END OF DRAINAGE SWALE.
5. 3:1 SLOPE SECTION AND ADDITIONAL REINFORCING IS ONLY AT THE STARTING END CURTAIN WALL.

2 STORMWATER SWALE CONCRETE DETAIL (PROFILE VIEW)
SCALE: NTS

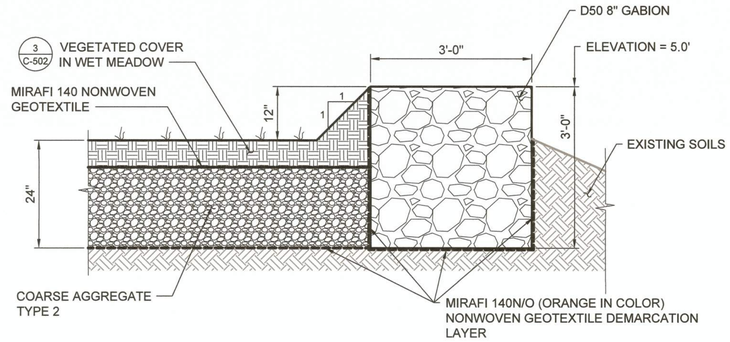


3 WET MEADOW DETAIL
SCALE: NTS

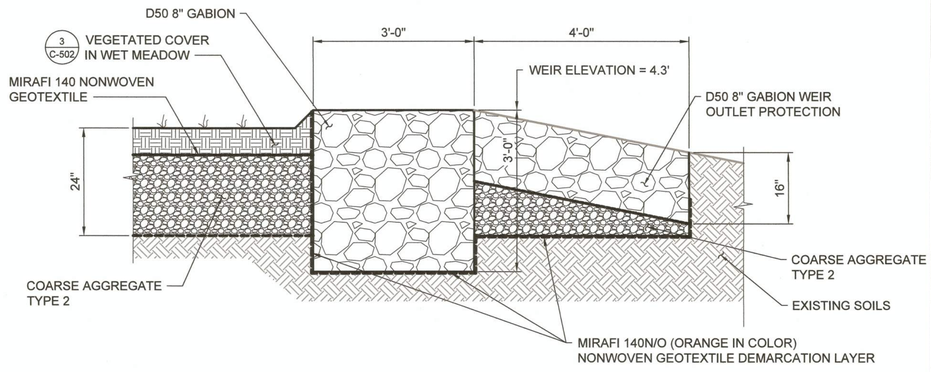


NOTES:
1. MEDIUM RIPRAP DIAMETER (D50) = 8 INCHES.
2. APRON THICKNESS (2 * D50) = 16 INCHES
3. RIPRAP SHALL BE PLACED ON MIRAFI 140 NONWOVEN GEOTEXTILE.

4 STORMWATER SWALE OUTLET PROTECTION
SCALE: NTS



5 WET MEADOW GABION SIDEWALL DETAIL
SCALE: NTS



6 WET MEADOW GABION WEIR DETAIL
SCALE: NTS

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BROWN AND CALDWELL ASSOCIATES
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REMEDIAL DESIGN DRAWINGS (100%)

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LINE IS 2 INCHES AT FULL SIZE

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DRAWN:	A. SANTIAGO / R. NEAR
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CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI
FILENAME	C-502.DWG
BC PROJECT NUMBER	153021
CLIENT PROJECT NUMBER	—

CIVIL

STORMWATER MANAGEMENT DETAILS

DRAWING NUMBER
C-502

SHEET NUMBER
22 OF 24

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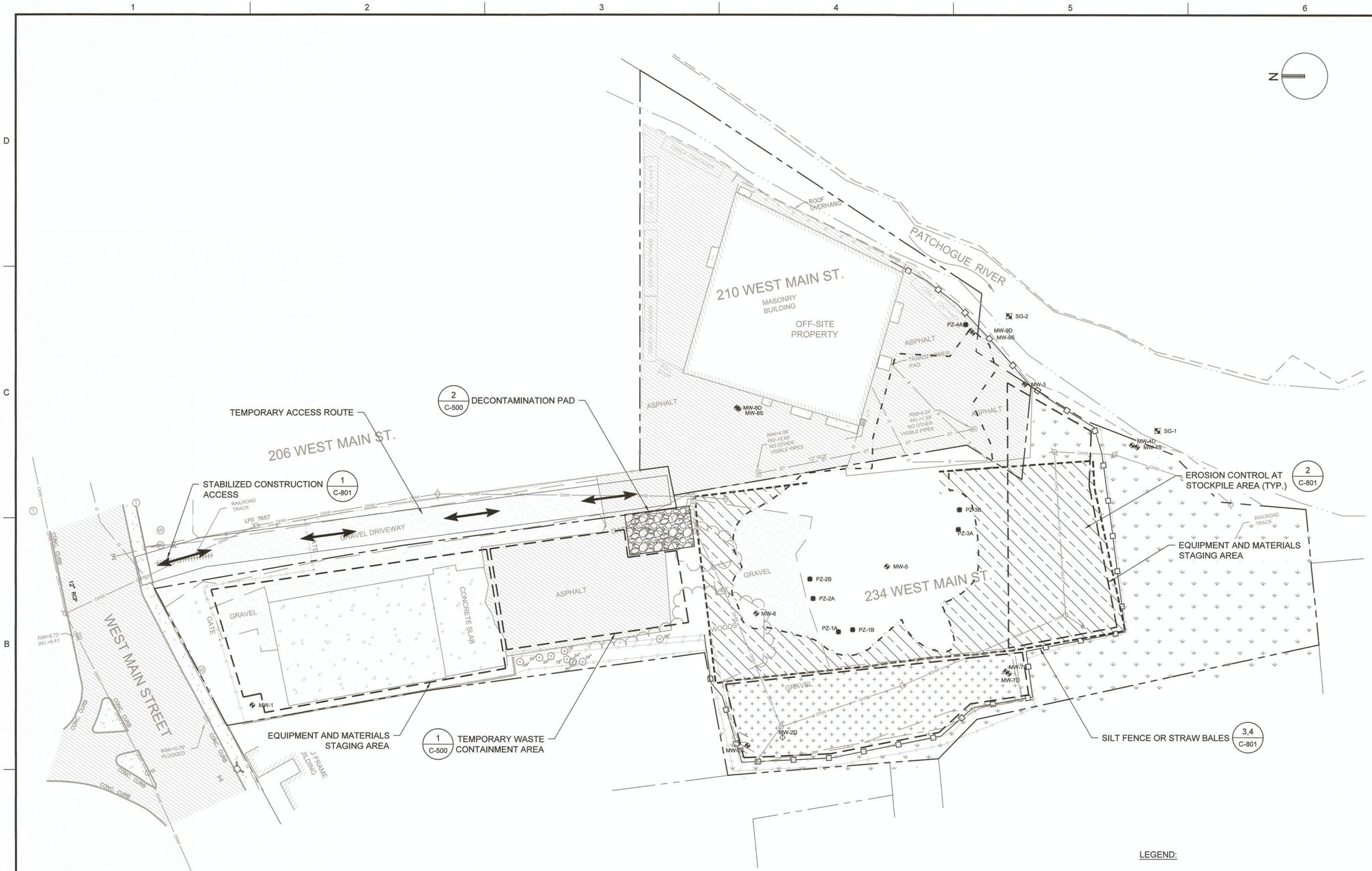

SOIL EROSION AND SEDIMENT CONTROL PLAN

0 30 60
SCALE IN FEET

LEGEND:

- SILT FENCE OR STRAW BALES
- SITE ACCESS
- POTENTIAL TEMPORARY WASTE CONTAINMENT AREA AND EQUIPMENT AND MATERIALS STAGING AREA
- DECONTAMINATION PAD
- LIMIT OF REMEDIATION AREA

NOTES:

1. CONTRACTOR SHALL INSTALL SOIL EROSION AND SEDIMENT CONTROL MEASURES PRIOR TO THE START OF INTRUSIVE ACTIVITIES IN ACCORDANCE WITH THE REQUIREMENTS OF THE TECHNICAL SPECIFICATIONS AND THE NEW YORK STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROLS.
2. DURING ISS IMPLEMENTATION, STORMWATER CONTROLS SHALL BE INSTALLED TO PREVENT STORMWATER RUN-ON INTO THE ISS AREA AND TO CONTAIN ISS-RELATED SWELL.

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STATE OF NEW YORK
MAREK OSTROWSKI
073661
LICENSED PROFESSIONAL ENGINEER
05/02/2019

MAREK OSTROWSKI,
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N.Y. LIC NO. 073661

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CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-800.DWG

BC PROJECT NUMBER
153021

CLIENT PROJECT NUMBER

CIVIL

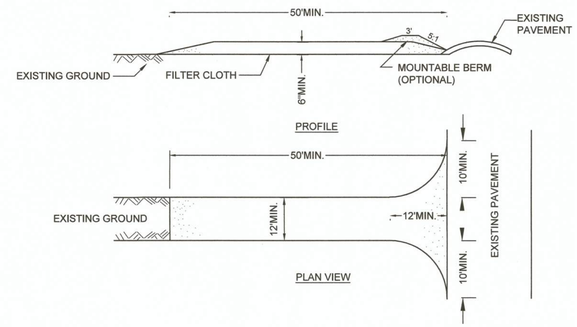
SOIL EROSION AND SEDIMENT CONTROL PLAN

DRAWING NUMBER
C-800

SHEET NUMBER
23 OF 24

GENERAL ESC NOTES:

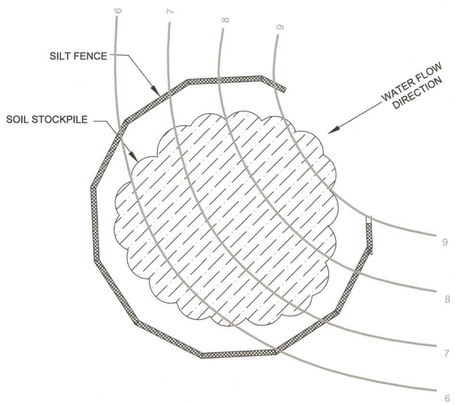
1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL (LATEST EDITION).
2. ALL EROSION AND SEDIMENT CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
3. PHYSICALLY MARK LIMITS OF LAND DISTURBANCE ON THE SITE WITH TAPE, SIGNS, OR ORANGE CONSTRUCTION FENCE, SO THAT WORKERS CAN SEE THE AREAS TO BE PROTECTED.
4. DIVERT OFFSITE RUNOFF FROM HIGHLY ERODIBLE SOILS AND STEEP SLOPES TO STABLE AREAS.
5. CLEAR ONLY THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION ACTIVITY. LARGE PROJECTS SHOULD BE CLEARED AND GRADED AS CONSTRUCTION PROGRESSES. AREAS EXCEEDING TWO ACRES IN SIZE REQUIRE ADHERENCE TO A SEQUENCING PLAN.
6. RE-STABILIZE DISTURBED AREAS AS SOON AS POSSIBLE AFTER CONSTRUCTION IS COMPLETED. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN FOURTEEN (14) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, SHALL IMMEDIATELY RECEIVE A TEMPORARY SEEDING AND MULCHING. MAINTENANCE MUST BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION.
7. FOR ACTIVE CONSTRUCTION AREAS SUCH AS BORROW OR STOCKPILE AREAS, ROADWAY IMPROVEMENTS AND AREAS WITHIN 50 FT. OF A BUILDING UNDER CONSTRUCTION, A PERIMETER SEDIMENT CONTROL SYSTEM CONSISTING, FOR EXAMPLE, OF SILT FENCING, SHALL BE INSTALLED AND MAINTAINED TO CONTAIN SOIL. EXPOSED DISTURBED AREAS ADJACENT TO A CONVEYANCE THAT PROVIDES RAPID OFFSITE DISCHARGE OF SEDIMENT, SUCH AS A CUT SLOPE AT AN ENTRANCE, SHALL BE COVERED WITH PLASTIC OR GEOTEXTILE TO PREVENT SOIL LOSS UNTIL IT CAN BE STABILIZED.
8. STABILIZED CONSTRUCTION ENTRANCES SHALL BE MAINTAINED TO CONTROL VEHICLE TRACKING MATERIAL OFF SITE.
9. ON THE CUT SIDE OF ROADS, DITCHES SHALL BE STABILIZED IMMEDIATELY WITH ROCK RIP-RAP OR OTHER NON-ERODIBLE LINERS (E.G. ROLLED EROSION CONTROL PRODUCTS), OR WHERE APPROPRIATE, VEGETATIVE MEASURES SUCH AS SOD.
10. PERMANENT SEEDING SHOULD OPTIMALLY BE UNDERTAKEN IN THE SPRING FROM MARCH THROUGH MAY, AND IN LATE SUMMER AND EARLY FALL FROM SEPTEMBER TO OCTOBER 15. DURING THE PEAK SUMMER MONTHS AND IN THE FALL AFTER OCTOBER 15, WHEN SEEDING IS FOUND TO BE IMPRACTICABLE, AN APPROPRIATE TEMPORARY MULCH SHALL BE APPLIED. PERMANENT SEEDING MAY BE UNDERTAKEN DURING THE SUMMER IF PLANS PROVIDE FOR ADEQUATE WATERING. TEMPORARY SEEDING WITH RYE CAN BE UTILIZED THROUGH NOVEMBER.
11. ALL SLOPES STEEPER THAN 3:1 (H:V), OR 33.3%, AS WELL AS PERIMETER DIKES, SEDIMENT BASINS OR TRAPS, AND EMBANKMENTS SHALL UPON COMPLETION, BE IMMEDIATELY STABILIZED WITH SOD, SEED AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES.
12. TEMPORARY SEDIMENT TRAPPING DEVICES SHALL NOT BE REMOVED UNTIL PERMANENT STABILIZATION IS ESTABLISHED IN ALL CONTRIBUTORY DRAINAGE AREAS. SIMILARLY, STABILIZATION SHALL BE ESTABLISHED PRIOR TO CONVERTING SEDIMENT TRAPS/BASINS INTO PERMANENT (POST-CONSTRUCTION) STORMWATER MANAGEMENT PRACTICES.
13. WHERE TEMPORARY WORK ROADS OR HAUL ROADS CROSS STREAM CHANNELS, ADEQUATE WATERWAY OPENINGS SHALL BE CONSTRUCTED USING SPANS, CULVERTS, WASHED ROCK BACKFILL, OR OTHER ACCEPTABLE, CLEAN METHODS THAT WILL ENSURE THAT ROAD CONSTRUCTION AND THEIR USE DO NOT RESULT IN TURBIDITY AND SEDIMENT DOWNSTREAM. ALL CROSSING ACTIVITIES AND APPURTENANCES ON STREAMS REGULATED BY ARTICLE 15 OF THE ENVIRONMENTAL CONSERVATION LAW SHALL BE IN COMPLIANCE WITH A PERMIT ISSUED PURSUANT TO ARTICLE 15 OF THE ECL, AS REQUIRED.
14. CONTRACTOR AND SUB-CONTRACTOR PERSONNEL SHALL UNDERSTAND THE ESC PLAN AND, IF A NYSDEC SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITY IS APPLICABLE, PERSONNEL SHALL SIGN THE CERTIFICATION STATEMENT REQUIRED BY PERMIT.
15. CONTRACTOR SHALL DESIGNATE RESPONSIBILITY FOR THE ESC PLAN TO ONE INDIVIDUAL.
16. INSPECTION OF ESC COMPONENTS SHALL BE CONDUCTED TO DETERMINE WHEN ESC MEASURES NEED MAINTENANCE OR REPAIR. PAY PARTICULAR ATTENTION TO INSPECTIONS REQUIRED AFTER RAINFALL. THE INSPECTION PROGRAM SHALL ALSO STATE THE COMPLETION OF IDENTIFIED REPAIR AND MAINTENANCE ITEMS.
17. A SUB-BASE COURSE SHALL BE APPLIED IMMEDIATELY FOLLOWING ROUGH GRADING AND INSTALLATION OF IMPROVEMENTS TO STABILIZE STREETS, ROADS, DRIVEWAYS, AND PARKING AREAS.
18. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC RIGHT-OF-WAYS SHALL BE REMOVED IMMEDIATELY.
19. CONDUIT OUTLET PROTECTION MUST BE INSTALLED AT ALL REQUIRED OUTFALLS PRIOR TO THE DRAINAGE SYSTEM BECOMING OPERATIONAL.
20. UNFILTERED DEWATERING IS NOT PERMITTED. NECESSARY PRECAUTIONS MUST BE TAKEN DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER.
21. SHOULD THE CONTROL OF DUST AT THE SITE BE NECESSARY, THE SITE WILL BE SPRINKLED UNTIL THE SURFACE IS WET, TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED OR MULCH SHALL BE APPLIED AS REQUIRED TO CONTROL DUST.
22. STOCKPILE AND STAGING LOCATIONS ESTABLISHED IN THE FIELD SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE ESC PLAN.



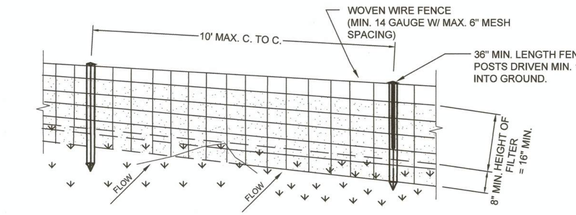
1 STABILIZED CONSTRUCTION ACCESS DETAIL
NOT TO SCALE

STABILIZED CONSTRUCTION ACCESS NOTES:

1. STONE SIZE - USE 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. FILTER CLOTH - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACTED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE (I.E., ON THE DECONTAMINATION PAD).
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH PRECIPITATION EVENT.



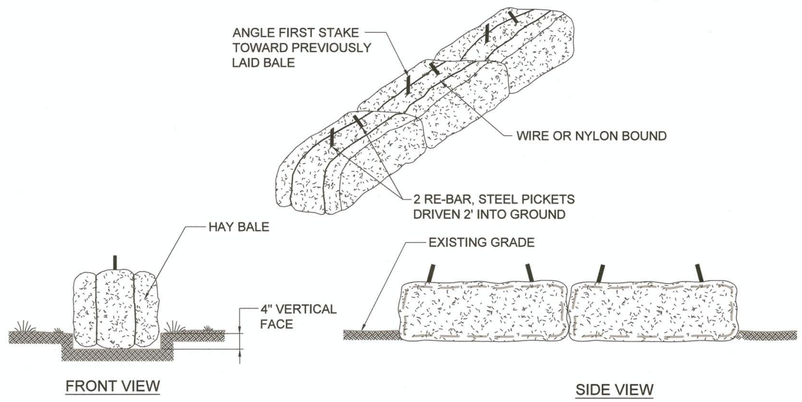
2 EROSION CONTROL AT STOCKPILE AREA
NOT TO SCALE



3 SILT FENCE DETAIL
NOT TO SCALE

SILT FENCE NOTES:

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE, RE-BAR, OR HARDWOOD.
2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 14 GAUGE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER- LAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE, OR APPROVED EQUIVALENT.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.



4 HAY BALE SEDIMENT BARRIER DETAIL
NOT TO SCALE

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2 PARK WAY, SUITE 2A
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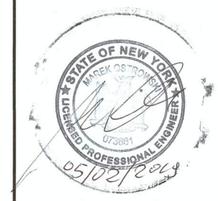

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CIVIL

EROSION AND SEDIMENT CONTROL DETAILS AND NOTES

DRAWING NUMBER
C-801

SHEET NUMBER
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Appendix B: Construction Quality Assurance Project Plan (CQAPP)

Construction Quality Assurance Project Plan
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 153021

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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Appendix A Quality Assurance Project Plan

Project Directory

Contact information for personnel working on the implementation of the Remedial Action (RA) at the Patchogue (West Main St.) Site is listed in this section. **Emergency Contact information can be found in the project-specific Health and Safety Plan.**

Project Owner: National Grid

Sarah Aldridge
Project Manager Site Investigation and
Remediation Department
National Grid
175 East Old Country Road
Hicksville, NY 11801

Phone: (516) 545-2586
Mobile: (860) 334-0554

NG Duly Appointed Field Representative: To Be Determined (TBD) [1]

TBD
Phone: (xxx) xxx-xxxx
Fax: (xxx) xxx-xxxx

TBD
Phone: (xxx) xxx-xxxx
Fax: (xxx) xxx-xxxx

TBD
Phone: (xxx) xxx-xxxx
Fax: (xxx) xxx-xxxx

Design Engineering Firm[1]: Brown and Caldwell Associates

3 Marcus Boulevard, Suite 106
Albany, NY 12205
Phone: (518) 560-5910
Fax: (518) 560-5920

2 Park Way, Suite 2A
Upper Saddle River, NJ 07458
Phone: (201) 574-4700
Fax: (201) 236-1607

The following lists Engineering Firm personnel for the project:

- Keith Bogatch, P.E. (Upper Saddle River, NJ office) – Project Manager
- Marek Ostrowski , P.E. (Upper Saddle River, NJ office) – Engineer of Record
- Marek Ostrowski, P.E. (Upper Saddle River, NJ office) – Project Engineer
- Jonathan Howland, P.E. (Albany, NY office) – Geotechnical Engineer
- Robert O'Neill, P.G. (Upper Saddle River, NJ office) – Project Hydrogeologist

[1] One firm may fulfill the roles of the Field Representative/Construction Manager and CQA Firm. Furthermore, the Design Engineering Firm can serve as either or both the Field Representative/Construction Manager and/or the CQA Firm.

CQA Firm[1]: To Be Determined (TBD)

TBD	TBD	TBD
Phone: (xxx) xxx-xxxx	Phone: (xxx) xxx-xxxx	Phone: (xxx) xxx-xxxx
Fax: (xxx) xxx-xxxx	Fax: (xxx) xxx-xxxx	Fax: (xxx) xxx-xxxx

The following lists CQA personnel for the project:

- TBD – Project Manager
- TBD – Engineer of Record
- TBD – CQA Site Manager (a.k.a., Construction Observer)
- TBD – Other CQA Personnel

Remedial Action Contractor: TBD

TBD	TBD	TBD
Phone: (xxx) xxx-xxxx	Phone: (xxx) xxx-xxxx	Phone: (xxx) xxx-xxxx
Fax: (xxx) xxx-xxxx	Fax: (xxx) xxx-xxxx	Fax: (xxx) xxx-xxxx

The following lists Contractor personnel for the project:

- TBD – Project Manager
- TBD – Site Superintendent
- TBD – Site Health and Safety Officer

Section 1

Introduction

This Construction Quality Assurance Project Plan (CQAPP) has been prepared by Brown and Caldwell Associates (BC) to present the Construction Quality Assurance (CQA) procedures associated with the Remedial Action (RA) for the Patchogue (West Main Street) Site located in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (hereafter referred to as the "Site").

The Remedial Design (RD) for the RA is presented in the Remedial Design Report (RDR) for the Site and includes construction drawings and specifications.

The CQAPP is divided into the following sections:

- Introduction
- Project Organization
- General Project Control and Organization
- Remedial Action CQA
- Documentation

This CQAPP has been prepared to be consistent with National Grid's Site Investigation and Remediation (SIR) Manual, including requirements identified for the role of the Field Representative and Construction Observer.

1.1 Background

Site background is presented in the Remedial Design Report "Remedial Design Report (90-95% Submission), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" prepared by Brown and Caldwell Associates and submitted to the NYSDEC in October 2017.

1.2 Summary of Remedial Activities

The remedial activities will include the following:

- Selective Demolition;
- On-Site Water Handling and Off-Site Disposal;
- Installation of Temporary Shoring;
- Excavation;
- In-Situ Solidification;
- Backfilling and Compaction;
- Construction of Environmental Cap; and
- Site Restoration.

These activities are further described in the Remedial Design Report "Remedial Design Report (90-95% Submission), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" prepared by Brown and Caldwell Associates and submitted to the NYSDEC in October.

1.3 Definitions and Terms

Construction Quality Control (CQC) and Construction Quality Assurance (CQA) are defined as follows:

- CQC refers to those actions taken by the Contractor, Subcontractors, suppliers and testing agencies so that the materials and quality of work meet the requirements of the RA Construction Drawings (referred to as the "Drawings") and the RA Technical Specifications (referred to as the "Specifications").
- CQA refers to the means and actions taken by the CQA Consultant and testing agencies to assess the conformance of the RA implementation activities to this CQAPP, the Drawings, and the Specifications. CQA is provided by a party autonomous of the RA Contractor in charge of implementing the RA activities.

1.4 Scope of Construction Quality Assurance Plan

This CQAPP addresses the CQA procedures for the RA implementation and is to be used by the project CQA personnel in conjunction with the Drawings and Specifications to assess the conformance of the RA implementation with the RD.

This CQAPP does not address CQC procedures, installation specifications, or selection of materials or other components, since the CQC requirements are addressed by the Drawings and Specifications. CQC will be the responsibility of the selected RA Contractor.

This CQAPP does not address quality assurance requirements associated with sampling, analysis, and data quality of environmental samples. The "Generic Quality Assurance Project Plan for Site Investigations at Non-Owned Former MGP Sites" (QAPP) (Foster Wheeler, November 2002), which has served as the QAPP for investigation activities at the Site, will also serve as the QAPP for sampling and analysis performed during RA activities. The QAPP is included as Appendix A to this CQAPP.

Section 2

Project Organization

This section identifies the project team organization and qualifications.

2.1 Project Team

2.1.1 Project Owner

The Project Owner is responsible for the Project Site. For this project, the term "Project Owner" refers to National Grid.

2.1.2 National Grid Duly Appointed Field Representative

The Project Owner will assign an on-Site Duly Appointed Field Representative (Field Representative) who is responsible for acting on behalf of the Owner during field construction and serving as the construction manager. The Field Representative for this project is TBD.

The role of the Duly Appointed Field Representative is to act on behalf of the Project Owner during field construction. This person shall be on Site on a daily basis as directed by the Project Owner and will serve as liaison between the Project Owner, Design Engineer, CQA Firm, Regulatory Agency Representative, and the RA Contractor on all matters relating to the Project.

The Field Representative/Construction Manager shall perform construction management activities, which may include, but are not limited to:

- Monitoring and coordinating the performance of the field activities by the Contractor and other parties as necessary;
- Providing on-Site field oversight of all aspects of the remedial activities required by the Contract Documents;
- Maintain a working understanding of the technical submittals provided by the Contractor to the Design Engineer and CQA Firm, including the status of such submittals in terms of their acceptability to the Design Engineer and CQA Firm.
- Monitoring and documenting that the Contractor's field activities are in conformance with the design documents based on field observations and input from the Design Engineer and/or CQA Firm. To the extent possible, resolve nonconformance items with the Contractor, involving as necessary the Design Engineer and/or CQA Firm. Any unresolved issues are to be brought to the attention of the Owner.
- Monitoring technical, quality, safety, and environmental compliance and working with the Design Engineer and/or CQA Firm and Contractor to correct deficiencies;
- Monitoring the Contractor's compliance with the project schedule, identifying if the project schedule will not be met, working with the Contractor to the extent possible to remedy schedule delays, and notifying the Project Owner of the schedule status and any unresolved delays;
- Reviewing and verifying the accuracy of invoices and providing a written recommendation for payment to the Project Owner;
- Attending, conducting, and documenting project progress meetings;
- Preparing progress reports as required and reviewing Daily Logs prepared by the CQA Firm;

- Providing document control; and
- Providing community relations management for on-Site personnel, as authorized by the Project Owner.

Note: One firm may fulfill the roles of the Field Representative/Construction Manager and CQA Firm. Furthermore, the Design Engineering Firm can serve as either or both the Field Representative/Construction Manager and/or the CQA Firm.

2.1.3 Design Engineering Firm/Design Engineer

The Design Engineering Firm is responsible for the preparation of the RD, including Drawings, Specifications, and supporting project plans (including the CQAPP), and providing guidance and interpretation on technical matters or issues regarding the approved RD during RA implementation. For this project, the Design Engineering Firm or "Design Engineer" is Brown and Caldwell Associates (BC). If needed, the Design Engineer may also provide technical support to the CQA Firm for interpreting field and laboratory testing data, assuring construction activities are in accordance with the RD drawings, and making final determinations of the acceptability of materials and/or installed work.

2.1.4 Construction Quality Assurance Firm

The CQA Firm is a party independent from the RA Contractor or suppliers who is responsible for managing, coordinating, and implementing the CQA activities as outlined in this CQAPP. The CQA Firm is responsible for documenting the RA implementation activities.

The CQA Firm provides CQA personnel who are located at the Site throughout the implementation of the RA activities. The CQA Firm will involve the Design Engineer where appropriate. The role/duties of the CQA personnel are presented in the following sections.

The CQA Firm will be responsible for:

- Administering the CQAPP (i.e., assigning and managing the CQA personnel, reviewing field reports, and providing engineering review of CQA-related issues);
- Providing quality control of the CQA personnel, including Site visits;
- Gaining understanding of Drawings and Specifications;
- Reviewing changes to the Drawings and Specifications;
- Gaining understanding of other Site-specific documentation and overseeing the implementation of project work plans, including:
  - Community Air Monitoring Plan (CAMP)
  - Maintenance and Protection of Traffic Plan (MPTP)
  - Waste Management Plan (WMP)
  - Stormwater Pollution Prevention Plan (SWPPP)
  - Contractor-prepared plans, including the Contractor Health and Safety Plan, Contractor Construction Management Plan, Contractor Contingency Plan, Dust and Odor Control Plan, and Vehicular and Pedestrian Traffic Control Plan.
  - Suppliers', manufacturers' and installers' product specifications and data;
- Attending the construction meeting(s);
- Reviewing the CQA and CQC documentation generated through RA implementation; and
- Preparation of the Final Engineering Report (FER).

2.1.4.1 CQA Site Manager (Construction Observer)

The CQA Site Manager (a.k.a., Construction Observer) is an employee of the CQA Firm and their role, including their support personnel, includes the following responsibilities:

- Act as the on-Site representative of the CQA Firm;
- Attend and participate in the pre-construction walkover and meeting with the Contractor and other parties;
- Attend and participate in the Site mobilization meeting;
- Maintain written records of field activities, including daily logs of the work performed and photographs of the work in progress;
- Collect appropriate documentation from the Contractor for inclusion in the FER. Documentation generated by the Contractor includes, but is not limited to, daily contractor field notes, analytical results of sampling activities conducted by the Contractor (e.g., waste characterization data), and other documentation required by the RD to be submitted by the Contractor;
- Obtain digital photographs of the ongoing project activities taken at key times and locations during the work. Digital photographs will be maintained in the project files;
- Observe the Contractor's performance to determine if the remedial activities are being conducted in conformance with the requirements of the Contract Documents.
- Provide notification to the Field Representative/Construction Manager if deviations or modifications from the Design Documents are identified;
- Confirm the necessity for additional work (as identified by the Contractor) to the Field Representative/Construction Manager and evaluate whether the Contractor has performed additional work consistent with the requirements of the Design Documents;
- Perform visual observations of environmental and Site control systems installed by the Contractor (e.g., erosion and sedimentation controls, decontamination areas, materials and equipment staging areas, access roads, noise and dust controls) and document these observations in the daily logs;
- Monitor the Contractor's development of as-built drawings documenting the construction activities, including documentation of in-field modifications;
- Attend daily safety meetings along with other on-Site personnel. The daily safety meetings are discussed in the Health and Safety Plan (HASP);
- Attend the weekly progress meetings;
- Identify the need for and attend problem or work deficiency resolution meetings.
- Attend the substantial completion meeting; and
- Conduct a Site post-restoration walkover to observe and document post-remediation conditions following Site restoration and the Contractor's demobilization from the Site. Prepare and distribute a memorandum summarizing the walkover.

2.1.5 RA Contractor

The RA Contractor (also referred to herein as the "Contractor") is the remediation Contractor selected to implement the RA. The RA Contractor is responsible for implementing the RA work in accordance with the Drawings and Specifications. The RA Contractor is also responsible for any work performed by Subcontractors of the RA Contractor.

2.1.6 Analytical Laboratory

The Analytical Laboratory represents an independent analytical laboratory (i.e., independent from the Project Owner, Design Engineer, CQA Consultant, and other project team entities) that is responsible for conducting tests to analyze the chemical composition of samples collected from the Site and submitted

to the Analytical Laboratory. Samples will be collected from location(s) designated by the CQA Firm for shipment to the Analytical Laboratory under strict chain-of-custody protocols. The laboratory will communicate directly with the Contractor regarding the analytical results and reporting. The laboratory will be responsible for providing all labels, sample jars, field blank water, trip blanks, shipping coolers, and laboratory documentation.

2.1.7 Soils Laboratory

The Soils Laboratory represents an independent laboratory (i.e., independent from the Project Owner, Design Engineer, CQA Firm, and other project team entities) that is responsible for conducting tests in the laboratory on samples of soil and geotechnical materials. Samples will be collected from location(s) designated by the CQA Firm for shipment to the Soils Laboratory under strict chain-of-custody protocols.

2.1.8 Surveyor

The Surveyor represents an independent surveyor (i.e., independent from the Project Owner, Design Engineer, CQA Firm, and other project team entities) that is, at minimum, responsible for establishing control points, providing control during RA implementation, and providing final record documentation for all portions of the RA work.

2.1.9 Suppliers

The suppliers are responsible for the production of the materials identified in Drawings and Specifications to be used during implementation of the RA work.

2.1.10 Transporter(s)

The transporter(s) are those responsible for transportation of the materials from the supplier(s) to and from the Site or for transportation of materials from the Site to an off-Site location (e.g., waste haulers).

2.1.11 TSD Facility(s)

The Treatment, Storage, and/or Disposal (TSD) facility(s) represent the facilities identified to receive waste materials transported from the Site.

2.2 Qualifications

The following qualifications are required of entities involved with the remedial design and construction.

2.2.1 Field Representative/Construction Manager

The Field Representative/Construction Manager shall have experience working on similar projects and shall possess in-field construction management experience. The Field Representative/Construction Manager qualifications shall meet the specific requirements of the Project Owner.

2.2.2 Design Engineer

The Design Engineer will be an engineer, registered as a professional engineer in the State of New York and working for an engineering firm that is authorized to provide engineering services in the State of New York. The Design Engineer must have a history which demonstrates familiarity with the type of construction activities to be performed for this project, including design methods and procedures provided in the RD.

2.2.3 Construction Quality Assurance Firm

The CQA Firm will be an engineering firm with engineer(s), registered as a professional engineer(s) in the State of New York and authorized to provide engineering services in the State of New York. The CQA Firm must have demonstrated experience in CQAPP preparation and implementation and providing field oversight for activities specifically related to the RD/RA. The Design Engineer may also serve as the CQA Firm.

2.2.4 RA Contractor

The RA Contractor and/or Subcontractor(s) working on the RA shall be on National Grid's approved Contractor list and shall have demonstrated experience in successfully performing remediation construction and ISS projects of similar scope and scale.

2.2.5 Analytical Laboratory

The Analytical Laboratory will have experience in performance of the required laboratory tests, meet applicable regulatory requirements, and shall be certified by the New York State Department of Health Environmental Laboratory Accreditation Program (ELAP).

2.2.6 Soils Laboratory

The Soils Laboratory will have experience in performance of the required laboratory tests, meet applicable regulatory requirements, and will be familiar with ASTM and other applicable standards. The Soils Laboratory will be capable of providing test results in accordance with the requirements of the technical specifications.

2.2.7 Surveyor

The certifying surveyor is to be retained by the RA Contractor. The certifying surveyor will be a registered land surveyor in the State of New York and be employed by a surveying firm authorized to provide surveying services in the State of New York.

2.2.8 Supplier(s)

Supplier(s) will be able to provide construction materials and qualified personnel to meet the demands of the project. The supplier will be required to submit certification(s) of specified materials required in the RD drawings and specifications.

2.2.9 Transporter

Waste haulers shall be authorized to transport waste materials in New York State, shall comply with all local, state, and federal regulations pertaining to waste transportation, and shall be a National Grid-approved waste hauler. All personnel responsible for the loading/unloading and transport of materials shall have appropriate training and certifications.

2.2.10TSD Facility

TSD facilities shall be authorized to accept waste materials from New York State, shall comply with all local, state, and federal regulations pertaining to waste TSD, and shall be a National Grid-approved TSD facility. All personnel responsible for handling waste materials shall have appropriate training and certifications.

Section 3

General Project Control and Coordination

This section identifies the activities that will be implemented to provide overall project control and coordination, including project meetings, inspections, testing, and documentation.

3.1 Meetings

To provide requisite quality during the RA implementation, clear, open channels of communication are essential. Project meetings are a critical element in the establishment of communication throughout the RA implementation. This section will describe meetings to be held throughout the RA implementation to provide coordination between entities responsible for the successful completion of the RA.

3.1.1 Pre-Construction/Site Mobilization Meeting

A Site Mobilization Meeting will be held at the Site prior to initiation of RA activities by the RA Contractor. The meeting will be attended by representatives from the Project Owner, Field Representative/ Construction Manager, Design Engineer, CQA Firm, RA Contractor, Subcontractor(s), and NYSDEC or their representative. Items addressed at the Site Mobilization Meeting include:

- Summary of work;
- Summary of RD Documents and Contract Documents;
- Use of premises by Project Owner and Contractor and Limit of Work;
- Property Owner requirements;
- Project Owner requirements;
- Review the responsibilities of each part;
- Review lines of authority and communication;
- Discuss, at a minimum, the following project details:
  - Construction facilities;
  - Temporary controls;
  - Temporary utilities;
  - Utility management and protection and perimeter cut and cap;
  - RA implementation and work sequencing;
  - Construction quality control;
  - Surveying; and
  - Security and housekeeping procedures.
- Project Schedule;
- Subcontractors; and
- Procedures for maintaining record documents.

The meeting will be documented by the Field Representative/Construction Manager. A summary of meeting minutes will be provided to the meeting attendees.

3.1.2 Weekly Progress Meetings

A weekly progress meeting will be held and attended by the Field Representative/Construction Manager, the CQA Site Manager, RA Contractor, and potentially other Project Team members. The progress meeting will be used to discuss the current progress of the project, planned activities for the next week, any changes or revisions to the RA work, and issues or problems. The Field Representative will log the issues, problems, or questions and the resolutions arising at the progress meeting. Any matter requiring action which is raised in the progress meeting will be reported to the appropriate entities.

3.1.3 Problems or Work Deficiency Meetings

A special meeting will be held when and if a problem or deficiency is present or likely to occur. The meeting will be attended by the Field Representative/Construction Manager, the CQA Site Manager, the RA Contractor, and potentially other Project Team members. If the problem requires a design modification, the Design Engineer will also be present. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The meeting will be documented by the Field Representative. A summary of meeting minutes will be provided to the meeting attendees.

3.1.4 Substantial Completion Meeting

A Substantial Completion Meeting will be held at the Site when RA construction is substantially complete. The meeting will be attended by the Field Representative/Construction Manager, the CQA Site Manager, RA Contractor, and potentially other Project Team members. The meeting will be used to discuss the status of RA construction, any outstanding items, plans for completing RA construction, and demobilization. The meeting will be documented by the Field Representative. A summary of meeting minutes will be provided to the meeting attendees.

3.2 Inspections

Inspections will be performed by the CQA personnel associated with the CQA Firm to document the quality of RA implementation and verify that the work is completed in accordance with RD documents.

3.2.1 Pre-Construction Inspection

A pre-construction inspection shall be performed by the CQA Site Manager, Field Representative/Construction Manager, and the RA Contractor to document the existing conditions at the Site. The inspection shall note and thoroughly document the condition of Site cover materials, buildings, utilities, vegetation, and any other Site conditions that could be affected by RA implementation. The results of the inspection will be documented by the CQA Site Manager in an inspection report, which will be reviewed by the Field Representative/Construction Manager. The inspection report will be provided to the inspection attendees and Project Owner.

3.2.2 Construction Monitoring

The CQA Site Manager will perform daily on-Site inspection and documentation of RA construction activities, including Site preparation, installation and status of temporary facilities and controls, RA implementation, waste management, and restoration.

As discussed in Section 2.1, the CQA Site Manager and CQA personnel shall:

- Maintain written records of field activities, including daily logs of the work performed and photographs of the work in progress;
- Collect appropriate documentation from the Contractor for inclusion in the FER including, but not limited to, daily contractor field notes, analytical results of sampling activities conducted by the Contractor (e.g., waste characterization data), and other documentation required by the RD to be submitted by the Contractor;
- Obtain digital photographs of the ongoing project activities taken at key times and locations during the work. Digital photographs will be maintained in the project files;
- Observe the Contractor's performance to determine if the remedial activities are being conducted in conformance with the requirements of the Contract Documents;
- Provide notification to the Field Representative/Construction Manager if deviations or modifications from the Design Documents are identified;
- Confirm the necessity for additional work (as identified by the Contractor) to the Field Representative/Construction Manager and evaluate whether the Contractor has performed additional work consistent with the requirements of the Design Documents;
- Perform visual observations of environmental and Site control systems installed by the Contractor (e.g., erosion and sedimentation controls, decontamination areas, materials and equipment staging areas, access roads, noise and dust controls) and document observations in the daily logs; and
- Monitor the Contractor's development of as-built drawings documenting the construction activities, including documentation of in-field modifications.

3.2.3 Post-Restoration Inspection

A post-restoration inspection (walk-through) will be conducted by the CQA Site Manager to observe and document post-remediation conditions following Site restoration and the Contractor's demobilization from the Site. The inspection will be used to verify the completeness of the RA. Following the Site walkover, the CQA Site Manager will prepare and distribute an inspection report summarizing the walkover.

The results shall be provided to the RA Contractor and the Field Representative, in order to develop a plan and schedule for completing outstanding work items. Following completion of outstanding items, a follow-up inspection may be required to verify completion of outstanding work items. If a follow-up inspection is performed the results shall be documented in an addendum to the post-restoration inspection report.

3.3 Documentation

CQA documentation during RA construction includes the following:

- Meeting Minutes from project meetings identified in Section 3.1;
- Inspection Reports from inspections identified in Section 3.2;
- Daily Field Reports from daily construction monitoring identified in Section 3.2;
- Test reports and documentation provided by the RA Contractor;

- Monthly Progress Reports for submittal to NYSDEC; and
- Final Engineering Report (FER) for submittal to NYSDEC.

CQA documentation is discussed in greater detail in Section 5 of this CQAPP.

Section 4

Remedial Action CQA

This section of the CQAPP addresses the components of the Site-wide RA and outlines the CQA procedures to be used by the CQA personnel for verifying the implementation of those RA components, including materials testing, field testing, field inspections, and correction of deficiencies. As discussed in Section 1, this CQAPP does not address CQC procedures, installation specifications, or selection of materials or other components, since the CQC is addressed by the Drawings and Specifications and the implementation is the responsibility of the selected RA Contractor.

As discussed in Section 1, this CQAPP does not address quality assurance requirements associated with sampling, analysis, and data quality of environmental samples. The "Generic Quality Assurance Project Plan for Site Investigations at Non-Owned Former MGP Sites" (QAPP) (Foster Wheeler, November 2002), which has served as the QAPP for investigation activities at the Site, will also serve as the QAPP for sampling and analysis performed during RA activities. The QAPP is included as Appendix A to this CQAPP.

4.1 Construction Materials CQA

This section identifies the CQA procedures for the primary materials to be used or incorporated into the construction activities. For materials not specifically addressed by this section, it shall be confirmed prior to importing the material to the Site and incorporating the material into the work that the material(s) conforms to the requirements identified in the Drawings and Specifications.

Refer to other subsections within this Section for the CQA requirements for placement of these materials.

4.1.1 Imported Fill Materials CQA

Imported fill materials identified for this project include:

- Crushed Stone Aggregate.

The CQA Firm shall confirm that the RA Contractor has provided the QC documentation for fill materials as required in the Specifications. This includes required documentation on fill materials suppliers, quality, and geotechnical properties. Fill materials imported to the Site shall meet the requirements set forth in 6 NYCRR 375-6.7(d), DER-10 Section 5.4(e), and the Specifications.

Prior to importing fill materials from a source, the CQA personnel responsibilities include the following:

- Review and retain RA Contractor's submittals pertaining to fill materials and check for conformance to the Specifications, including requirements for material quality, gradation, and other properties;
- Request additional testing, as needed, to document conformance with the Specifications;
- Once the RA Contractor has provided the required information to support the use of fill material from a source, coordinate with Project Owner to transmit the required information to the NYSDEC Project Manager for approval of the source of the material before it is used on the Site;
- If a Beneficial Use Determination (BUD) has been issued by the NYSDEC for the re-use of fill materials imported from off-Site (e.g., thermally treated soil), then confirm that sampling, testing, approvals, and placement of the material shall also comply with the BUD; and

- After receiving approval of the source from the NYSDEC, provide a written response to the RA Contractor indicating approval of the fill material for use on the Site. This response shall also identify on-going testing requirements to support continued use of material from the source (i.e., analyses, sample frequency). **No fill materials shall be imported to the Site until NYSDEC approval is obtained for the source and the Contractor is authorized in writing by the CQA personnel.**

During fill material importing, the CQA personnel responsibilities include the following:

- Obtain, review, and retain copies of Bills of Lading to document that the material delivered was from an approved source and to document the imported quantity of imported material;
- Visually inspect fill material being imported to the Site;
- Check that source material testing is being conducted at the frequency required by the Specifications and as required by the NYSDEC; and
- Review and retain RA Contractor's submittals pertaining to the imported fill material, including the results of additional testing required to support on-going importing and use of fill material from a source.

4.1.2 Material Re-Use CQA

During the excavation activities, excavated soil will be field screened (visual, olfactory, and PID screening) and, based on the results from field screening by National Grid's on-Site CQA personnel in consultation with NYSDEC, the soil shall be segregated for off-Site treatment/disposal (herein referred to as Category 1 Soil), further testing (herein referred to as Category 2 Soil), or possible on-Site re-use (herein referred to as Category 3 Soil). Category 2 and 3 soils that will not be re-used will be disposed of off-Site. Refer to Section 4.7.1 for field screening of excavated soil.

Prior to re-use of excavated soil, the CQA personnel responsibilities include the following:

- Confirm that the RA Contractor has properly segregated the excavated soil and collected composite samples at the minimum frequency identified above and in the Specifications;
- Document correspondence with NYSDEC personnel regarding observed soil quality and categorization of soil;
- Review and retain copies of analytical testing on Category 2 Soil;
- Based on results from analytical testing, coordinate with the Field Representative, CQA Firm, Project Owner, and RA Contractor on the subsequent management of Category 2 soil (i.e., re-use or off-Site treatment/disposal);
- Request additional testing, as needed, to document conformance with the Specifications; and
- **No soil materials shall be re-used at the Site until the Contractor is authorized in writing by the CQA personnel.**

During activities that involve soil re-use, the CQA personnel responsibilities include the following:

- Document that any material re-used is taken from a stockpile authorized for re-use;
- Document the weight of material re-used (as measured by an on-Site truck scale);
- Visually inspect soil material being re-used at the Site;
- Check that material testing is being conducted at the frequency required by the Specifications and as required by the NYSDEC; and
- Review and retain RA Contractor's submittals pertaining to the re-use of soil, including the results of analytical testing.

4.1.3 Asphalt Pavement Materials CQA

Asphalt pavement materials identified for use on this project may include:

- Subbase Material;
- Hot Mix Asphalt (HMA) Base Course;
- HMA Binder Course; and
- HMA Top Course.

The CQA Firm shall confirm that the RA Contractor has provided the QC documentation for asphalt pavement materials as required in the Specifications. This includes required documentation on material suppliers, gradation, and certifications of conformance to NYSDOT specifications.

Prior to importing asphalt pavement materials from a source, the CQA personnel responsibilities include the following:

- Review and retain RA Contractor's submittals pertaining to asphalt materials and check for conformance to the Specifications, including requirements for material quality, gradation, and other properties;
- Request additional testing, as needed, to document conformance with the Specifications; and
- Once the RA Contractor has provided the required information to support the use of asphalt pavement materials, provide a written response to the RA Contractor indicating approval or rejection of the asphalt materials. **No asphalt materials shall be used at the Site until the Contractor is authorized in writing by the CQA personnel.**

During asphalt paving activities, the CQA personnel responsibilities include the following:

- Obtain, review, and retain copies of any Bills of Lading to document that the material delivered was from the approved source and to document the imported quantity of materials;
- Visually inspect asphalt materials being imported to the Site; and
- Review and retain RA Contractor's submittals pertaining to the asphalt materials.

4.1.4 Geosynthetics Materials CQA

Geosynthetics materials identified for use on this project may include:

- Non-woven geotextile as a separation layer between a surface cap and compacted subgrade;
- Non-woven geotextile beneath compacted asphalt pavement subbase; and
- Non-woven geotextile and membrane liner incorporated into baseliner of the Waste Staging Area and decontamination pad.

The CQA Firm shall confirm that the RA Contractor has provided the QC documentation for geosynthetics materials as required in the Specifications. This includes required documentation on material suppliers, material properties, and any certifications/warranties from the suppliers.

Prior to importing geosynthetics materials to the Site, the CQA personnel responsibilities include the following:

- Review and retain RA Contractor's submittals pertaining to geosynthetics and check for conformance to the Specifications, including requirements for material type, thickness, and other properties;
- Request additional testing, as needed, to document conformance with the Specifications; and

- Once the RA Contractor has provided the required information to support the use of geosynthetics, provide a written response to the RA Contractor indicating approval or rejection of the geosynthetics. **No geosynthetics shall be used at the Site until the Contractor is authorized in writing by the CQA personnel.**

While geosynthetics materials are being imported to the Site, the CQA personnel responsibilities include the following:

- Obtain, review, and retain copies of any shipping records to document that the material delivered was from the approved supplier and to document the imported quantity of materials;
- Visually inspect geosynthetics being imported to the Site;
- Review and retain RA Contractor's submittals pertaining to the geosynthetics;
- Confirm that the RA Contractor is storing materials per the manufacturer's recommendations; and
- Confirm that each roll/sheet is marked or tagged to identify the Manufacturer's name, product identification, lot or batch number, roll/sheet number, roll/sheet weight, and roll/sheet dimensions.

4.2 Site Preparation CQA

Site preparation includes pre-mobilization activities and activities performed after mobilization but prior to RA implementation. Site preparation activities may be performed concurrently with other components of the RA implementation as the remediation progresses from one area to the next.

During Site Preparation activities, the CQA personnel responsibilities include the following:

- Perform and document the results of the pre-construction inspection;
- Document that utility markout activities have been completed;
- Document that pre-remediation surveying has been completed to stake out remediation areas and temporary facilities;
- Document the installation of temporary facilities (refer to Section 4.3);
- Document the installation and deployment of temporary controls (refer to Section 4.4);
- Document work zone delineation has been completed; and
- Document the abandonment/protection of monitoring wells in accordance with Drawings and Specifications.

4.3 Temporary Facilities CQA

Temporary facilities implemented during Site preparation shall include office trailers, temporary utilities, equipment staging areas, material staging areas, decontamination areas and pads, waste staging areas, and temporary access road(s).

Potential locations for temporary facilities are shown on the Drawings and are subject to change. The final location of temporary facilities shall be in an area approved by the Project Owner.

4.3.1 Office Trailer

The field office shall be furnished and installed by the RA Contractor and shall meet the requirements identified in the Specifications.

CQA personnel responsibilities include the following:

- Document that the office trailer conforms to the requirements outlined in the Specifications;
- Document the size and location of the office trailer and amenities; and
- Document any related issues/resolutions.

4.3.2 Temporary Utilities

The RA Contractor shall be responsible for providing temporary utilities at the Site to facilitate RA construction and service temporary facilities in accordance with the Specifications.

CQA personnel responsibilities include the following:

- Document that temporary utility installation conforms to the requirements outlined in Specifications;
- Document the type and location of temporary utilities; and
- Document any related issues/resolutions.

4.3.3 Equipment and Material Staging Areas

Equipment staging areas shall be established by the RA Contractor at locations approved by the Project Owner. Equipment staging areas shall be located to facilitate equipment ingress and egress, allow for proper sequencing of the RA work, and minimize the impact to on-Site traffic and operations. Construction equipment shall be mobilized on an as-needed basis.

Material staging areas refers to staging areas for materials to be incorporated in the RA work. Materials staging does not include waste staging. Material staging areas shall be established by the RA Contractor at locations approved by the Project Owner. Material staging areas shall be located to facilitate equipment ingress and egress, allow for proper sequencing of the RA work, and minimize the impact to on-Site traffic and operations. The material staging areas shall be physically segregated from waste material staging to prevent cross-contamination or commingling of materials.

CQA personnel responsibilities include the following:

- Document that equipment and material staging areas are established in the approved locations;
- Document the location and dimensions of staging areas; and
- Document any related issues/resolutions.

4.3.4 Decontamination Pad

Decontamination pad(s) shall be constructed by the RA Contractor as part of the Site preparation activities at location(s) approved by the Project Owner. The purpose of the pad(s) will be to provide a location to remove dirt, debris and any other potentially contaminated material from vehicles or equipment prior to departure from the work zones.

CQA personnel responsibilities include the following:

- Document Decontamination Pad construction conforms to the requirements outlined in the Drawings, Specifications, and project-specific Health and Safety Plans;
- Document the location, dimensions, and construction details of the Decontamination Pad;
- Document decontamination activities and associated waste management; and
- Document any related issues/resolutions.

4.3.5 Waste Staging Area

The Waste Staging Area shall be constructed by the RA Contractor as part of the Site preparation activities at a location approved by the Project Owner. The purpose of the waste staging area is to provide a location for handling, screening, segregating, stockpiling, and conditioning potentially impacted media generated during the RA activities, including soil, debris, pipes, and liquids. The Waste Staging Area shall be located so as to facilitate equipment ingress and egress, allow for proper sequencing of the RA work, minimize the impact to on-Site traffic and operations, and minimize the potential for off-Site

impacts. The Waste Staging Area shall include a staging pad or multiple pads (e.g., for soil and debris staging), staging area for tanks (e.g., for liquid storage), and a staging area for drums. The Waste Staging Area construction shall meet the requirements identified in the Drawings and Specifications.

CQA personnel responsibilities include the following:

- Document that Waste Staging Area construction conforms to the requirements outlined in the Drawings and Specifications;
- Document the location, dimensions, and construction details of the Waste Staging Areas;
- Inspect and document subgrade conditions before geosynthetics installation, and report any issues to the Field Representative/Construction Manager and RA Contractor;
- Inspect geosynthetics materials for damages. Report any damages or flaws to the Field Representative/Construction Manager and RA Contractor;
- Document that geosynthetics are handled in accordance with Manufacturer requirements and the Specifications;
- Record geosynthetics roll/batch identifier and the location of placement;
- Inspect and document geosynthetics seaming activities;
- Observe and document geosynthetics testing activities and review and retain geosynthetics testing reports. Report non-conformance to the Field Representative/Construction Manager and RA Contractor;
- Request re-testing if result do not comply with Specifications;
- Document waste staging procedures; and
- Document any related issues/resolutions.

4.4 Temporary Controls CQA

Temporary controls shall be implemented during Site preparation and during RA activities. Temporary controls, which are discussed in the following subsections, include stormwater management, erosion and sediment controls, dust, odor, and vapor controls, and Site security.

4.4.1 Stormwater Management and Erosion and Sediment Controls

Stormwater management and Erosion and Sediment Control (ESC) during RA implementation shall be performed in accordance with the SWPPP. A prominent component of the SWPPP is the Erosion and Sediment Control (ESC) Plan, which includes provisions for ESC during construction activities.

Prior to commencement of land disturbance and demolition activities, temporary erosion and sediment control (ESC) measures shall be installed. The elements of the proposed ESC measures shall be designed and installed in accordance with the New York State Standards and Specifications for Erosion and Sediment Control (NYSSSESC).

ESC measures shall be employed utilizing Best Management Practices (BMPs) including silt fencing, hay bale dikes, storm drain inlet protection, stabilized construction entrances/exits and dust control measures. The ESC measures shall be installed as indicated in the Drawings, Specifications, and approved SWPPP.

CQA personnel responsibilities include the following:

- Document stormwater control and ESC measures procedures conform to the requirements outlined the Drawings, Specifications, and the SWPPP;
- Document the type, location, and construction details of ESC measures;
- Document the results of inspection activities; and

- Document any related issues/resolutions.

4.4.2 Dust, Odor, and Vapor Monitoring and Controls

Air monitoring shall be performed during the implementation of the remedial actions to protect the health and safety of Site workers (work-zone air monitoring) and to confirm that air impacts from Site-related activities are not migrating off-Site (perimeter air monitoring). The monitoring program shall include monitoring for vapors, odors, and dust. Air monitoring shall be performed in accordance with Health and Safety Plans (HASPs) (i.e., work zone air monitoring), the Community Air Monitoring Plan (CAMP), and the Dust and Odor Control Plan.

Air emission controls shall be implemented pro-actively and in response to the results from air monitoring. The requirements for dust, odor, and vapor control are addressed in the Specifications.

CQA personnel responsibilities include the following:

- Document that dust, odor, and vapor monitoring and controls conform to the requirements outlined the Specifications, CAMP, OCP, and Site-specific HASPs;
- Obtain and retain copies of Daily Air Monitoring Reports associated with CAMP implementation and air monitoring data provided by the RA Contractor;
- Document the air monitoring activities;
- Document the use of control measures;
- Document exceedances of action levels and associated response actions; and
- Document any related issues/resolutions.

4.4.3 Site Security

Site security shall be required at the Site 24 hours per day and seven days per week. Site security shall be the responsibility of the RA Contractor and may be performed by the RA Contractor's personnel or a subcontracted security company.

Site workers, Subcontractors and visitors shall be required to sign a daily log. A list of persons authorized for Site entry shall be maintained at the Site entrance.

The RA Contractor shall also install temporary chain link fencing with gates and locks to secure the active working areas, material staging areas, waste staging areas, and decontamination pads.

CQA personnel responsibilities include the following:

- Document that Site security measures conform to the requirements outlined the Specifications;
- Document the Site security measures employed, including the location of fencing; and
- Document any related issues/resolutions.

4.5 Utility Protection and Perimeter Utility Cut and Cap CQA

Utilities (overhead and underground utilities) within the work area or affected by the work shall be identified and protected, temporarily isolated, relocated, or abandon, as appropriate, prior to and/or during RA implementation in accordance with the Drawings and Specifications. All work performed on utilities shall be in accordance with applicable requirements from utility purveyors.

Soil generated from utility protection/re-routing activities shall be managed in accordance with the Specification.

CQA personnel responsibilities include the following:

- Document that utility protection and cut and cap measures conform to the requirements outlined the Drawings and Specifications;
- Document the utility protection and cut and cap measures employed and location of utility protection and cut and cap work;
- Document correspondence with utility purveyors;
- Document waste management of materials generated during utility protection and cut and cap work (refer to Section 4.11); and
- Document any related issues/resolutions.

4.6 Structure Demolition CQA

Subsurface structures or foundations that are located within the remediation areas shall be inspected and demolished, if necessary, in accordance with the Drawings and Specifications. The demolition of structures shall be sequenced with remediation activities to reduce the area of bare soil that is exposed. If present, fill or waste materials shall be removed from structures and pipes entering the structures shall be drained. CQA personnel shall visually inspect structures to confirm that waste materials have been removed to the extent practical.

Waste materials shall be managed in accordance with the Specifications. Following inspection, the foundations and structures shall then be demolished, as necessary, to facilitate their removal from the subsurface.

CQA personnel responsibilities include the following:

- Document that structure demolition conforms to the requirements outlined in the Drawings, Specifications, and approved Contractor Construction Management Plan;
- Document the location, materials of construction, and dimensions of structures;
- Document the presence of contents within the structure and the nature of structure contents;
- Estimate and document the quantity of waste materials;
- Coordinate with the RA Contractor, CQA Firm, Project Owner, and the treatment/disposal facility on the waste characterization requirements;
- Document the collection of waste characterization samples (refer to Section 4.11);
- Visually inspect structures to confirm that waste materials have been removed to the extent practical and document the inspection results;
- Document the demolition activities;
- Inspect the demolition debris to determine subsequent management (refer to Section 4.6.1);
- Estimate and document the quantity of demolition debris; and
- Document any related issues/resolutions.

4.6.1 Field Screening of Masonry/Concrete Debris

Masonry/concrete debris resulting from demolition of surface and subsurface structures and foundations shall be field screened for visual indications of NAPL and, based on the results from field screening by CQA personnel in consultation with NYSDEC, the debris shall be segregated into two main categories:

- **Category 1 Debris: Debris containing visible tar or NAPL** - debris in Category 1 shall be stockpiled separately for off-Site disposal. The debris shall be crushed to manageable size (and to meet the disposal facility acceptance criteria), characterized, and transported off-Site for disposal.

- **Category 2 Debris: Debris containing no visible tar or NAPL** – debris in Category 2 shall be stockpiled for subsequent on-Site crushing (to six-inch minus size) and re-use as backfill material within the excavation areas and below the two-foot bgs elevation (i.e., to allow for a minimum of two feet of imported fill material at the surface). Category 2 debris that will not be re-used will be disposed of off-Site in the same manner as Category 1 debris.

CQA personnel responsibilities include the following:

- Coordinate with NYSDEC personnel on the categorization of debris;
- Coordinate with RA Contractor on the segregation, staging, and conditioning of debris;
- Perform the CQA requirements identified in Section 4.11 for the off-Site treatment/disposal of debris;
- Document any related issues/resolutions.

4.7 Excavation CQA

The horizontal and vertical limits of the proposed excavation are depicted on the Drawings. The shoring and stabilization requirements are also shown on the Drawings and addressed by the Specifications.

Excavation shall be completed to remove soil to the horizontal and vertical limits indicated on the Drawings). Sequencing of the excavation and backfill may be conducted to limit excavation shoring requirements, reduce surface water run-on, reduce vapors/odors, and to provide sufficient area for materials staging and soil handling during the excavating, segregating, stockpiling, loading and backfill activities. The excavation limits may be expanded during RA based on field observations and in consultation with the NYSDEC. However, the additional excavation shall not extend beneath existing buildings that shall remain in place. Applicable field observations that would provide a basis for laterally or vertically extending the excavation in MGP-impacted areas include the following:

- Soil partially to fully saturated with NAPL;
- NAPL extensively (or continuously) coating soil materials; and
- NAPL flowing into excavations.

Conversely, soils that shall not be subject to excavation as a result of the following observations (in the absence of any of the observations listed above) include the following:

- Hardened or brittle tar;
- Sporadic intervals of NAPL-coated soil grains;
- Sporadic blebs, droplets, or small lenses of NAPL;
- Stained soils; and
- Sheen on water in excavation.

CQA personnel responsibilities include the following:

- Document the completion of Site preparation activities, including utility markout, temporary facilities installation, temporary controls installation, monitoring well decommissioning, and pre-excavation surveying;
- Document clearing and grubbing and surface demolition activities;
- Document that excavation activities conforms to the requirements outlined in the Drawings, Specifications, and approved Contractor Construction Management Plan;
- Document the excavation sidewall stabilization methods (sloping and shoring) and installation. Document that excavation stabilization methods conform with the requirements outlined in the Drawings and the Specifications;

- Document the presence of structures or pipes and mitigation of such features;
- Field screen the excavated soil to determine subsequent management of excavated materials (refer to Section 4.7.1);
- Document that saturated soils are staged adjacent to the excavation area and allowed to drain by gravity back into the excavation until the soil is suitable for handling;
- Determine the extent of the excavation based on field observations and in consultation with the CQA Firm, Project Owner, and NYSDEC;
- Document the completion of progress and final surveying to document excavation limits;
- Estimate and document the quantity of excavated materials;
- Coordinate with the RA Contractor, Construction Manager, CQA Firm, Project Owner, and the treatment/disposal facility on the waste characterization requirements;
- Document the collection of waste characterization samples (refer to Section 4.11); and
- Document any related issues/resolutions.

4.7.1 Field Screening of Excavated Soil

During the excavation activities, excavated soil shall be field screened (visual, olfactory, and PID screening) and, based on the results from field screening by on-Site CQA personnel in consultation with NYSDEC, the soil shall be segregated into three main categories.

- **Category 1 Soil: Soil containing visible tar or NAPL** - soil in Category 1 shall be stockpiled for subsequent waste characterization and off-Site treatment/disposal.
- **Category 2 Soil: Soil without visible tar or NAPL that exhibits odor or elevated PID readings** – soil in Category 2 shall be stockpiled and composite samples shall be collected and analyzed for total PAHs, reactive cyanide and reactive sulfide. If one or more of these analytes meet the MGP source material criteria as described in the RDR, then the soil shall be segregated for off-Site treatment/disposal and may be combined with Category 1 soil. If each of the analytes does not meet MGP source material criteria, then the soil may be combined with Category 3 soil for possible re-use as backfill within the excavation area and below the two-foot bgs elevation (i.e., to allow for a minimum of two feet of imported clean fill material at the surface).
- **Category 3 Soil: Soil without visible tar or NAPL, odor, or elevated PID readings** – soil in Category 3 shall be stockpiled for possible re-use as backfill within the excavation area and below the two-foot bgs elevation (i.e., to allow for a minimum of two feet of imported fill material at the surface).

As indicated above, soil from Category 3 will be eligible for re-use and soil from Category 2 will be eligible for re-use only after sampling and analytical testing indicates that the soil does not meet MGP source material criteria. Sampling Category 2 soil to determine its eligibility for re-use shall consist of one composite soil sample per approximately 500 cubic yards (i.e., composite discrete grab samples collected from 3 to 5 locations biased toward areas with the relatively higher degree of impacts for impacts based on field screening). Category 2 and 3 soils that will not be re-used will be disposed of off-Site.

CQA personnel responsibilities include the following:

- Coordinate with NYSDEC personnel on the categorization of excavated soil;
- Coordinate with RA Contractor on the segregation, staging, and conditioning of excavated material;
- Estimate and document the quantity of soil in each category;
- Perform the material CQA requirements identified in Section 4.1.2 for re-use of excavated soil;
- Perform the CQA requirements identified in Section 4.11 for the off-Site disposal of excavated soil; and

- Document any related issues/resolutions.

4.8 ISS CQA

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 limits of ISS are shown on the Design Drawings. The soil will be mixed in place with Portland cement and/or other materials to form a low permeability, 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 performing ISS is defined in the project specifications. The Contractor will be responsible for verifying that the prepared grout mixture, the grout volume added, and the in-situ mixing are as specified in the design.

CQA personnel responsibilities include the following:

- Review and retain copies of ISS daily records provided by the RA Contractor;
- Document that the reagents used to prepare the grout satisfy the requirements of the Specifications;
- Document that the grout is mixed according to the Specifications and approved work plan;
- Document that the ISS column/cell layout is in accordance with the Drawings and approved work plan;
- Document that the overlap between adjacent ISS columns/cells satisfies the requirements of the Specifications;
- Document the amount of grout constituents added to each ISS column/cell satisfies the requirements of the Specifications;
- Document that the depth of each ISS column/cell conforms with that shown on the Drawings and approved work plan;
- Document any subsurface obstructions including the nature of the obstruction, location, and approximate dimensions;
- Document that each ISS cell is a homogeneous mixture of soil and grout based on visual inspection of samples taken at discrete depths according to the Specifications;
- Document that ISS mix samples are taken, prepared and cured according to the Specifications and approved work plan;
- Document that samples are sent out for laboratory verification testing in accordance with the Specifications, CQCPP, and approved work plan;
- Document that core samples are taken according to the Specifications and the “NYSDEC Guidance for Quality Control Coring on In-Situ Solidification Projects”;
- Inspect and document the core samples and document that samples satisfy the performance criteria identified in the Specifications, which are consistent with the “NYSDEC Guidance for Quality Control Coring on In-Situ Solidification Projects”;
- Notify the Field Representative/Construction Manager and Design Engineer when ISS mix sample observation/testing results or core sample inspection results do not satisfy the performance standards identified in the Specifications;
- Document that the horizontal and vertical limits of ISS treatment are as specified on the Drawings;
- Document that the alternating pattern and dimensions (i.e., top elevation, bottom elevation, length, and width) of ISS cells mixed adjacent to sensitive receptors are in accordance with the Design Drawings and Specifications; and

- Document any related issues/resolutions or corrective actions.

4.9 Backfilling and Fill Placement CQA

Backfilling of excavation areas and placement of fill materials (including the environmental cap) shall be performed using either imported materials or materials generated from on-Site that are approved for use as backfill. Refer to Section 4.1 for fill materials and the associated CQA requirements.

During fill placement, CQA personnel responsibilities include the following:

- Document that backfilling and fill placement is performed in accordance with the requirements outlined in the Drawings, Specifications, and approved Contractor Construction Management Plan;
- Execute the CQA requirements identified in Section 4.1 during the use of fill materials to confirm and document that material quality is maintained;
- Inspect excavation areas prior to backfill to confirm and document that conditions are suitable for fill placement per the Specifications;
- Document the placement and compaction of fill materials. Document the lift height and confirm compliance with Specifications. Document material compaction (compaction method, equipment, and number of passes) and compaction testing and confirm compliance with Specifications;
- Document the that the material and placement of geotextile material is in accordance with drawings and Specifications;
  - Inspect and document subgrade conditions before geosynthetics installation. Report any issues to the Field Representative/Construction Manager and RA Contractor;
  - Inspect geosynthetic materials for damage. Report any damage or flaws to the Field Representative/Construction Manager and RA Contractor;
  - Document that geosynthetics are handled in accordance with Manufacturer requirements and the Specifications;
  - Record geosynthetics roll/batch identifier and the location of placement;
  - Inspect and document geosynthetics seaming activities;
  - Observe and document geosynthetics testing activities and review and retain geosynthetics testing reports. Report non-conformance to the Field Representative/Construction Manager and RA Contractor; and
  - Request re-testing if results do not comply with Specifications;
- Document the sequencing of backfilling activities;
- Document the quantity of fill materials placed; and
- Document any related issues/resolutions.

4.10 Asphalt Pavement Placement CQA

Asphalt pavement shall be installed at the locations indicated on the Drawings. During asphalt paving activities, CQA personnel responsibilities include the following:

- Document that asphalt paving is performed in accordance with the requirements outlined in the Drawings, Specifications, and approved Contractor Construction Management Plan;
- Execute the CQA requirements identified in Section 4.1 during the use of asphalt pavement materials to confirm and document that material quality is maintained;
- Inspect subgrade areas prior to paving to confirm and document that conditions are suitable for paving per the Specifications;

- Document the placement and compaction of asphalt pavement materials. Document the lift height and confirm compliance with Specifications. Document material compaction and compaction testing and confirm compliance with Specifications;
- Document the that the material and placement of geotextile material is in accordance with drawings and Specifications;
  - Inspect and document subgrade conditions before geosynthetics installation and report any issues to the Field Representative/Construction Manager and RA Contractor;
  - Inspect geosynthetic materials for damage. Report any damage or flaws to the Field Representative/Construction Manager and RA Contractor;
  - Document that geosynthetics are handled in accordance with Manufacturer requirements and the Specifications;
  - Record geosynthetics roll/batch identifier and the location of placement;
  - Inspect and document geosynthetics seaming activities;
  - Observe and document geosynthetics testing activities and review and retain geosynthetics testing reports. Report non-conformance to the Field Representative/Construction Manager and RA Contractor; and
  - Request re-testing if results do not comply with Specifications;
- Document the quantity of asphalt pavement materials placed; and
- Document any related issues/resolutions.

4.11 Waste Management CQA

Waste materials generated during RA activities shall be staged in a designated Waste Staging Area(s). The major waste streams to be generated during RA include:

- Soil/Sludge Containing Visible Tar or NAPL or soil/sludge that meets MGP source material criteria, as described in of the RDR;
- Tar/NAPL-Impacted Masonry/Concrete Debris;
- Wastewater from the waste staging area, decontamination pad and ISS area;
- NAPL;
- Miscellaneous Debris and Waste; and
- ISS swell.

Waste Management shall be performed in accordance with applicable regulations, Specifications, Waste Management Plan, and approved and treatment/disposal facility requirements.

For Waste Management activities, CQA personnel responsibilities include the following:

- Document that waste management is performed in accordance with applicable regulations, Waste Management Plan and Specifications;
- Document waste conditioning activities and confirm compliance with Specifications;
- Document the collection of waste characterization samples at the required frequency;
- Review and retain analytical reports for waste characterization samples;
- Coordinate with the RA Contractor, CQA Firm, Project Owner, and the treatment/disposal facility during waste profiling;
- Review and retain copies of waste management documentation (manifests, bills of lading, disposal certificates, weight tickets);

- Estimate and document the quantity of waste materials (utilize on-Site truck scale, flow meters/totalizers, and other available information);
- Review and retain weekly Waste Tracking Reports prepared by the RA Contractor; and
- Document any related issues/resolutions.

4.12 Site Breakdown, Final Restoration, and Demobilization CQA

After remedial action activities are completed, Site breakdown, final restoration, and demobilization shall be performed. During this phase, the CQA personnel shall:

- Confirm and document that RA activities and restoration activities (including re-establishment of utilities) are completed;
- Confirm and document that all temporary controls and facilities have been removed from the Site;
- Confirm and document that all waste management activities have been completed;
- Perform and document the results of the post-restoration inspection;
- Document the final Site cleaning;
- Document the final Site conditions; and
- Document any related issues/resolutions.

Section 5

Documentation

The CQA Site personnel will collect and review documentation from the RA Contractor and will prepare documentation that verifies that construction quality requirements have been addressed and satisfied.

This section details the documentation associated with the CQA activities.

5.1 Document Management

The CQA documentation will be maintained in the field office. While the CQA Site Manager is responsible for implementing and maintaining the document management system, each member of the CQA team is responsible for document management. Without the collective cooperation of every member of the team, document management and control cannot be effective.

All project documentation shall include the date, project name, location, and the preparer's name and affiliation.

Electronic files from the field office server and digital job photo storage will be backed up on a weekly basis and maintained at secure off-Site location. These data files will be copied monthly and sent to the CQA Firm to be stored as permanent record.

5.2 CQA Documentation

5.2.1 Daily Field Reports

Standard reporting procedures will include preparation of a Daily Field Report by the CQA Site Manager, which include the following information:

- Date;
- Weather Conditions;
- On-Site personnel (including visitors)
- Equipment used;
- Description and location of work performed (reference to Drawings as appropriate);
- Description and summary of testing results;
- Summary of off-Site materials received, including quality control documentation;
- Summary of waste materials transported off-Site, including quality control documentation;
- Issues/resolutions;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and
- The CQA Site Manager or CQA Monitor(s)'s signature.

Attachments to the Daily Field Report may include, as appropriate:

- Field sketches or reduced-scale plans marked-up;
- Photographs;
- Testing results;

- Summary tables (e.g., imported material quantities or exported waste material quantities); and
- Any other documentation to convey the day's RA activities.

Daily Field Reports will be submitted daily to the Field Representative/Construction Manager and the CQA firm.

5.2.2 Meeting Minutes

Meeting minutes provided by the Field Representative for meetings identified in Section 3.1 and any other project construction meetings shall be reviewed by all parties and retained in the on-Site files. Any omissions or discrepancies in the meeting minutes shall be communicated to the Field Representative for resolution.

5.2.3 Inspection Reports

Site Inspection Reports, which document specific Site inspection activities identified in Section 3.2 and any other inspections completed during RA construction, shall be retained in the on-Site files.

5.2.4 ISS Quality Assurance and Documentation

The CQA Site Manager shall take daily field notes on operation aspects of the ISS operations, including column/cell start and stop times, number of passes, columns/cells sampled, batch plant CQA testing, proportion verifications and down times of the ISS rig. Those notes shall be compared daily with the Contractor's Daily Reports for any inconsistencies. Daily ISS volumes shall be reconciled with Contractors QC Officer and mutually agreed upon.

The CQA Site Manager shall also maintain an up to date ISS column/cell as-built drawing indicating columns/cells completed for each day, columns/cells sampled, and total columns/cells completed to date.

5.2.5 Memoranda of Discussion with RA Contractor and Subcontractor

A memorandum will be prepared, as needed, summarizing discussions between the CQA Site Manager and RA Contractor. The memorandum will include the following information:

- Date, project name, location, and other identification;
- Names of parties to discussion;
- Relevant subject matter or issues;
- Activities planned;
- Constraints or suggestions;
- Schedule; and
- Signature of the CQA Site Manager.

5.2.6 Problem or Work Deficiency Sheets

Sheets shall be prepared, as needed, to document problem or work deficiencies and their resolutions. These memoranda shall include:

- An identifying Drawing sheet number for cross-referencing and document control;
- A description of the situation or deficiency;
- The location and probable cause of the situation or deficiency;
- How and when the situation or deficiency was found or located;
- Documentation of the response to the situation or deficiency;
- Final results of any responses;

- Any measures taken to prevent a similar situation from occurring in the future; and
- The signature of the CQA Site Manager.

The CQA Firm and the Field Representative shall be made aware of any significant recurring non-conformance with the RD/RA plans and technical specifications. The CQA Firm shall then assess the cause of the non-conformance and recommend appropriate changes in RD and/or technical specifications. When this type of evaluation is made, the results shall be documented and any revision to RD and/or technical specifications shall be approved by the Project Owner, Design Engineer, and NYSDEC (as appropriate).

5.2.7 Surveying

Certification surveying will be performed to provide documentation for record drawings, to verify quantities of materials, to verify that the geometric requirements of the RA are met, and that erosion and sediment control measures have been achieved. The RA Contractor will be responsible for the work and coordination with the surveyor. The RA Contractor is also responsible for providing all information to the CQA Firm.

5.2.8 Photographic Records

Digital photographs taken during RA construction will be cross-referenced with Daily Field Reports, Inspection Reports, Problem or Work Deficiency sheets, or other project documentation.

These photographs will serve as a visual record of work progress, problems and mitigation activities. The basic file will contain numbered digital photographs and a record log with the following information:

- Photograph number;
- Date taken; and
- Description of activities in the photograph.

At the completion of the project, a photographic log will be prepared that documents the key stages of the RA construction.

5.2.9 Design and/or Technical Specification Deviations

Design and/or technical specifications changes may be required during the RA implementation activities. In such cases, the CQA Site Manager will notify the CQA Firm and the Field Representative/Construction Manager.

Design and/or technical specifications changes will be made only with the written agreement of the CQA Firm, the Design Engineer, and/or the Project Owner, and will take the form of an addendum to the RD and/or Specifications.

5.2.10 Monthly Progress Reports

The CQA Firm or the Field Representative/Construction Manager will prepare monthly progress reports for submittal to NYSDEC.

Per NYSDEC “Technical Guidance for Site Investigation and Remediation” (DER-10), the progress reports shall report on the progress of the remedial actions accomplished during the reporting period and, at a minimum, discuss the following items:

1. Any request for modifications to the approved RD must be identified in the progress report, along with the status of the requested modifications.

2. The periodic progress report should include:
   a. a discussion of project progress and significant activities during the reporting period, including the status of any requisite permits;
   b. a discussion of pending/planned significant project activities during the next two months, unless another time frame is authorized;
   c. the approved remedial action schedule and proposed modifications to the remedial action schedule, resulting from new information and/or unforeseen conditions;
   d. a discussion of any problems or delays in the implementation of the remedial action relative to the work and/or the remedial action schedule;
   e. proposed actions to correct any identified problems, including how to mitigate any adverse schedule impacts;
   f. any additional, pertinent documentation that is available (e.g., photographs) that helps communicate progress/issues facing the project;
   g. a summary of sample results from the reporting period;
   h. a summary of waste characterization testing; and
   i. a summary of waste management activities.

A draft of the Monthly Progress Reports shall be submitted electronically to the Project Owner within one week after the specified reporting period. The report shall be finalized after incorporating comments from the Project Owner and potentially other project team members and submitted electronically to the NYSDEC Department of Environmental Remediation (DER) Project Manager.

5.2.11 Final Engineering Report

As per the requirements of NYSDEC DER-10, Chapter 5, Section 5.8, the implementation of the Site-wide RA described in this RDR will be documented in a FER, prepared by the CQA Firm. The FER will be certified by a Professional Engineer licensed in the State of New York and will include, but not be limited to, the following:

- Description of the remedy as constructed pursuant to the approved RD;
- Description of problems encountered during construction and a discussion of their resolution;
- Description of changes to the design documents and a description as to why the changes were made;
- Quantities and concentrations of contaminants removed or treated;
- Listing of the waste streams, quantity of materials disposed and facility where such materials were disposed;
- Restoration actions;
- List of the remedial action objectives applied to the remedial action;
- Description of the applicable areas of RA compliance identified in Section 5.4 of DER-10, including air monitoring results, RA performance documentation, Site restoration, fill source quality (off-Site sources and on-Site re-use), and monitoring well decommissioning;
- "As-built" drawings bearing a NYS Professional Engineer's or Surveyor's stamp and signature on each drawing; and
- Waste management documentation.

A draft of the FER shall be submitted electronically to the Project Owner within a timeframe that conforms to the project schedule. The report shall be finalized after incorporating comments from the Project Owner and potentially other project team members and submitted NYSDEC.

Appendix A: Quality Assurance Project Plan (QAPP)

GENERIC
QUALITY ASSURANCE PROJECT PLAN

FOR

SITE INVESTIGATIONS

AT NON-OWNED FORMER MGP SITES

Prepared for:
Niagara Mohawk
300 Erie Boulevard West
Syracuse, New York

Prepared By:
Foster Wheeler Environmental Corporation
One Park Place
300 South State Street, Suite 620
Syracuse, New York

NOVEMBER 2002

Reviewed and Approved by: _____ _____
(Project Quality Assurance Manager) (Signature) (Date)

Site Specific
Revisions Attached: Supplement No. _____ Date _____

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1.0 GENERAL

This Generic Quality Assurance Project Plan (QAPP) has been prepared to specify procedures that will provide data of known, documented quality, and which will be legally defensible, should the need exist. This document specifically supplements the Generic Field Sampling Plan (FSP), also attached as an appendix to the Site-Specific Work Plan. To the extent discrepancies exist between this Generic QAPP and the Site-Specific Work Plan, the Site-Specific Work Plan shall control.

2.0 PROJECT DESCRIPTION

The project sites are Former Non-owned Manufactured Gas Plant (MGP) sites. The purpose of the investigations is to gather sufficient data to enable the New York State Department of Environmental Conservation (NYSDEC) and Niagara Mohawk, a National Grid Company (NM) to characterize chemical substances which are or may be present at the Sites and to enable the NYSDEC and NM to determine whether such substances pose a significant threat to public health or the environment.

The data collected as a result of these investigations will be used to support the Site Characterizations and Remedial Investigation/Feasibility Studies (RI/FS) as described in the Site-Specific Work Plans. The types, numbers, and locations of environmental samples to be collected are also described in the Site-Specific Work Plans. Field procedures for all environmental sampling activities are detailed in the FSP.

3.0 PROJECT ORGANIZATION

The project organization is described in detail in the Site-Specific Work Plan. The project organization describes the relationship between the NM Project Manager, NYSDEC Project Manager, NM's Engineering Consultant, and subcontractors (e.g. laboratories, data validators, drillers, etc.).

For the purpose of quality control, the Engineering Consultant's Project Quality Assurance Manager (PQAM) will be responsible for review of data upon receipt from the analytical laboratory. The PQAM will assure that data validation screening is performed by trained and experienced data validators using the applicable criteria specified in the NYSDEC 2001 Analytical Services Protocol (ASP). For the purposes of this document, all references to ASP indicate the 2001 NYSDEC Analytical Services Protocol. The specific requirements for data validation screening are given in Section 9.3. The PQAM will be responsible for ensuring that all analytical data are in conformance with requirements of this QAPP.

4.0 QA/QC OBJECTIVES FOR MEASUREMENT OF DATA

The overall quality assurance (QA) objective for the project is to develop and implement procedures which will provide data of known, documented quality. Field and laboratory quality assurance/quality control (QA/QC) requirements defined in the NYSDEC ASP and other applicable guidelines ensure acceptable levels of data quality will be maintained throughout the sampling and analysis program.

The QA/QC objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. The data reduction, validation, and reporting scheme is presented in Figure 1. The quality assurance samples to be collected (type and frequency of collection) are specified in the Site-SpecificWork Plans.

4.1 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), and relative range are common. For this project, precision will be evaluated by recording duplicate measurements of the same parameter on similar sample aliquots under the same conditions and calculating the relative percent difference (RPD) between the values. The formula for calculating RPD is presented in Section 13.2.

RPDs can only be calculated when the duplicate samples both contain detectable concentrations of the analyte. If an analyte is considered not detected at the detection limit, then RPD cannot be calculated. Instead, the results of the analysis of the two-spiked laboratory samples will be used to determine precision.

Measurement data for this project will include field data as well as laboratory analytical data. Laboratory precision will be performed according to the requirements described in the associated analytical methods. The field measurement data may include immunoassay polycyclic aromatic hydrocarbon (PAH) and/or polychlorinated biphenyl (PCB) screening, pH, conductivity, temperature, turbidity, organic vapor readings, and water level measurements. The objective for precision of field data collection methods is to take replicate (minimum of two for every 20 samples) measurements for field parameters to determine the reproducibility of the measurements.

Precision of the immunoassay screening will be evaluated by the field analysis of replicate samples as equivalent levels of PAHs/PCBs. As the screening is not quantitative (i.e., the screening determines if the constituents are present above or below standard values and does not provide a numeric result), RPDs cannot be calculated on the field-analyzed samples. Therefore, measurement of equivalent levels of constituent (i.e., detected below the same standard or within the same range of two standards) will be considered as denoted precision of the screening test.

For the pH meter, precision will be tested by multiple readings in the medium of concern. Consecutive

readings should agree within 0.1 pH units after the instrument has been field calibrated with standard buffers before each use. The thermometer will be visually inspected prior to each use to ensure its condition is satisfactory. Consecutive measurements of a given sample should agree to within 1°Celsius. After calibration, the conductivity meter will be tested for precision at ± 1% of full-scale, depending on the meter/scale. The organic vapors will be measured using a Photovac Microtip (or equivalent) photoionization detector (PID). Daily background and upwind readings of drilling and sampling activities will be measured prior to commencing work and at periodic intervals throughout each day's activities. The natural variation/fluctuation in measurements at background or upwind locations will be used for baseline background values, and the variability will be noted. Water level indicator readings will be precise within 0.01 feet for duplicate measurements or additional water level measurements will be collected to determine whether the difference is due to operator or instrument error. Turbidity measurements will be calibrated to a precision of ± 2% nephelometric turbidity units (NTUs).

4.2 Accuracy

Accuracy is a measure of the difference between a measured value and the "true" or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity, which is recovered, or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes that are close to the detection limits are less accurate because they are affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument or other variables and thus will be more accurate.

The accuracy of laboratory-measured data will be evaluated by determining the percent recovery of both matrix and blank spike samples as described in Section 13.1. For the measurement of organics by gas chromatography (GC) or GC/mass spectroscopy (MS), the recovery of a surrogate spiked into each sample, blank, and standard will also be used to assess accuracy.

Accuracy between the immunoassay screening and the laboratory analytical results will be evaluated by the confirmatory testing of 10 percent (i.e., one in ten) of the environmental samples at the off-site laboratory. The rate of potential false positives and negatives should be less than 15 percent. Screening samples will not be spiked in the field by the addition of known parameter concentrations. However, the confirmatory samples sent to the off-site laboratory will undergo surrogate spiking and recovery evaluation and, to the extent possible, may be chosen as the site-specific matrix spike sample(s) for additional accuracy determination.

The objective for accuracy of the other field measurements is to achieve and maintain factory equipment specifications for the field equipment. Field measurements cannot be assessed for accuracy by spiking the medium with the analytical parameter and measuring the increase in response;

therefore, these instruments can only be assessed for accuracy by the response to a known sample (such as a calibration standard) used to standardize them. The pH meter, conductivity meter, and turbidity meter are calibrated with solutions traceable to the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards).

All volatile organic detectors (such as the PID) will be calibrated to an appropriate standard daily prior to use.

4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, or analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the FSP. Laboratory sample containers will be thoroughly cleaned in accordance with procedures outlined in Section 5.2. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated through the analysis of field duplicate samples, coded to ensure the samples are treated and analyzed as separate samples. The analytical laboratory will make every reasonable effort to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received. Many means of homogenization expose the sample to significant risk of contamination or loss through volatilization, and these should be avoided if possible.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank/duplicate and chain-of-custody procedures are presented in Sections 5.3 and 6.1.

4.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. The QC objective for completeness is generation of valid data for 100 percent of the analysis requested. Any data deficiencies and their impact on project goals will be evaluated during data validation and discussed in the Data Usability Summary Report (DUSR) (see Section 9.3.2).

4.5 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Ensuring traceability of all analytical standards and/or source materials to USEPA or NIST;
- Verifying all calibrations with an independently prepared standard from a source other than that used for calibration;
- Using standard reporting units and reporting formats including the reporting of QC data;
- The validation of all analytical results, including the use of data qualifiers in all cases where appropriate; and
- The requirement that all validated flags be used any time an analytical result is used for any purpose whatsoever.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

5.0 SAMPLING PROCEDURES

5.1 Sampling Program

The objective of the sampling program is to provide current data concerning the presence and nature and extent of contamination of groundwater, surface water, soils (surface and subsurface), and/or sediment. Sampling and analysis may include as identified in the Site-SpecificWork Plan:

- groundwater samples
- surface water samples
- sediment samples
- surface and/or subsurface soil samples
- air samples

5.2 Sampling Procedures and Handling

Sample Container Preparation

Sample containers will be properly washed and decontaminated by the factory or laboratory prior to use. All preservatives will be added to containers prior to shipment by the laboratory. The types of containers and preservation techniques are shown in Table 1. Records of the sources of bottles and preservatives will be kept by the analytical laboratory.

Methods of Sampling

As a minimum, sampling procedures will be in accordance with the most recent NYSDEC or USEPA guidelines and/or regulations, as appropriate. Alternate techniques will be utilized when such guidelines and/or regulations are inappropriate or non-existent. Alternate techniques will be implemented only after consultation with NYSDEC, whenever possible.

Referenced sampling procedures are listed below. All procedures will be the latest in effect as of the date of this Generic QAPP.

- USEPA - 600-4-79-020, "Methods for Chemical Analysis of Water and Wastes"
- National Water Well Association - "Manual of Ground-water Sampling Procedures"
- USEPA - 600-4-83-040, "Characterization of Hazardous Waste Sites - a Methods Manual: Volume II. Available Sampling Methods"
- USEPA - OSWER - 9950.1 "RCRA Ground-water Monitoring Technical Enforcement Guidance Document"
- USEPA - 540/S-95/504, "Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures"

- NYSDEC – "Technical and Administrative Guidance Memoranda" (TAGMs)

All sampling methods are explained in detail in the FSP.

5.3 Quality Assurance Samples

Field Quality Control Samples

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. The blanks will include:

Trip Blank - A trip blank will be prepared by the laboratory, and will consist of 40-ml volatile organic analysis (VOA) vials containing distilled, deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for which analysis for Target Compound List (TCL) volatiles or benzene, toluene, ethylbenzene and total xylenes (BTEX) is planned. The trip blank will be analyzed for TCL volatile organic compounds or BTEX to assess any contamination introduced as a result of sampling and transport, , handling and storage.

Equipment Blank - Equipment blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix as specified in the Site-SpecificWork Plan. Equipment blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory, which has passed through or over the sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to collecting a sample. The equipment blanks will be analyzed for the same parameters as the matrix being sampled.

In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike (MS)/matrix spike duplicates (MSD)/matrix duplicates (MD).

The duplicates will consist of:

Field Duplicate - To determine the reproducibility and homogeneity of samples, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise. The frequency of collection of these samples is one per 20 field samples as specified in the Site-SpecificWork Plans. The criteria for assessing coded field duplicates are given in Section 6.0.

Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate (MS/MSD/MD) - MS/MSD/MD samples (MSD for organics; MD for inorganics) will be collected at a frequency of one pair per 20 field samples per seven day sample delivery group (SDG). The reproducibility and homogeneity of the samples can be assessed by determining the

RPD for both spike and non-spike compounds as described in Section 13.0. The MS, MSD, and MD samples should be Site-Specific, unless otherwise authorized by the Engineering Consultant's Project Manager and/or PQAM after consultation with NM and NYSDEC personnel whenever possible.

6.0 SAMPLE TRACKING AND CUSTODY

Sample chain-of-custody (COC) will be initiated by the laboratory with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling the samples will be minimized.

In-situ or on-site monitoring data will be controlled and entered in permanent logbooks. Personnel involved in the COC and transfer of samples will be trained on the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity will be provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 2. A sample will be considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with custody seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

6.1 Field Sample Custody

A COC record will accompany the sample from time of collection to receipt by the analytical laboratory. If samples are split and sent to different laboratories, COC records will be sent with each sample. Figure 3 is a typical example of a chain-of-custody record. The "remarks" column will be used to record specific considerations associated with sample acquisition such as: sample type, container type, sample preservation methods, and analyses to be performed. Two copies of this record will accompany the samples to the laboratory. The laboratory will maintain one file copy, and the completed original will be returned to the Engineering Consultant's Project Manager.

Individual sample containers, provided by the laboratory, will be used for shipping/couriering samples. The shipping containers are insulated, and ice will be used to maintain samples at approximately four degrees Celsius until samples are returned and in the custody of the laboratory. All sample bottles within each shipping container will be individually labeled and controlled.

Each sample shipping container will be assigned a unique identification number by the laboratory, and will be marked with indelible ink on the outside of the shipping container. This number will be recorded on the COC record. The field sampler will indicate each individual sample designation/location number in the space provided on the appropriate COC form for each sample collected. The shipping container will then be closed, and a seal provided by the laboratory affixed to the latch. This seal must be broken to open the container. Tampering may be indicated if the seal

is broken before receipt at the laboratory. The laboratory will contact the FOL or Engineering Consultant's Project Manager, and the associated samples will not be analyzed if tampering is apparent.

6.2 Laboratory Sample Custody

The FOL will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The laboratory sample program will meet the following criteria:

- The laboratory will designate a sample custodian who is responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of any discrepancy in documentation, the laboratory will immediately contact the Engineering Consultant's Project Manager and/or PQAM as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. That assessment will be recorded as part of the incoming COC procedure.
- The samples will be stored in a secured area at a temperature of approximately four degrees Celsius until analyses are to commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking form will accompany the laboratory report and will become a permanent part of the project records.

6.3 Sample Tracking System

A sample tracking system will be implemented to monitor the status of sampling events and laboratory analysis of samples. Sample numbers, types, analytical parameters, sampling dates, and sample delivery group (SDG) designations for samples, and required due dates for receipt of analytical results will be entered into the system. The Engineering Consultant's Project Manager will use the tracking system to monitor the project sampling schedules and the status of analytical reports, and to implement any penalty clauses for late delivery per standard laboratory subcontracts when necessary.

A description of the sample tracking system follows:

1. For each day that samples are collected, the Field Operations Lead (FOL) or designee will complete a COC form (Figure 3) and a Daily Status and Monitoring Report (Figure 4) listing all appropriate samples.
2. The FOL or designee will retain the client copy of the COC, and forward the laboratory copy of the COC with the sample shipment.
3. The FOL or designee will fax copies of the completed COC form and Daily Status and Monitoring Report to the Engineering Consultant's PM. The Engineering Consultant's PM or a designated employee will confirm sample shipment with the laboratory and resolve any sample transfer issues.
4. The status of analytical results will be tracked by the Engineering Consultant's PM or designee using the information provided on the completed COC form and Daily Status and Monitoring Report. The information shall be summarized in a computerized database, as warranted.

Upon receipt of the analytical results from the laboratory, the Engineering Consultant's PM or designee will review the data package for completeness and contract compliance. The Engineering Consultant's PM will then forward the result package to the data validator for validation. The data validator shall be required to submit a complete set of validated data to the Engineering Consultant's PM within 60 days of receipt of the data package report.

The Engineering Consultant's Project Manager or a designated representative will maintain day-to-day contact with the laboratory concerning specific samples and analyses directly or by assignment.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 Field Instrumentation Calibration

The FOL will be responsible for ensuring that instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to their specific calibration protocols/procedures.

All field measurement instruments must be calibrated according to the manufacturer's instructions prior to the commencement of the day's activities. Exceptions to this requirement shall be permitted only for instruments that have fixed calibrations pre-set by the equipment manufacturer. Calibration information shall be documented on instrument calibration and maintenance log sheets or in a designated field logbook. The calibration information (log sheet or logbook) shall be maintained at the site during the on-site investigation and, once the field work is completed, shall be placed in the Engineering Consultant's project files. Information to be recorded includes the date, the operator, and the calibration standards (concentration, manufacturer, lot number, expiration date, etc.). All project personnel using measuring equipment or instruments in the field shall be trained in the calibration and usage of the equipment, and are personally responsible for ensuring that the equipment has been properly calibrated prior to its use.

In addition, all field instruments must undergo response verification checks at the end of the day's activities and at any other time that the user suspects or detects anomalies in the data being generated. Verification checks may also be performed at the request of NM or NYSDEC representatives. The checks consist of exposing the instrument to a known source of analyte (e.g., the calibration solution), and verifying a response. If an unacceptable instrument response is obtained during the check (i.e., not within specifications), the data shall be labeled suspect, the problem documented in the site logbook, and appropriate corrective action taken.

Any equipment found to be out of calibration shall be re-calibrated. When instrumentation is found to be out of calibration or damaged, an evaluation shall be made to ascertain the validity of previous test results since the last calibration check. If it is necessary to ensure the acceptability of suspect items, the originally required tests shall be repeated (if possible), using properly calibrated equipment, to acquire replacement data for the measurement in question.

Any instrument consistently found to be out of calibration shall be repaired or replaced within 24 hours or field work will be terminated until the malfunctioning equipment is repaired/replaced.

7.2 Laboratory Instrumentation Calibration

Personnel at the laboratory will be responsible for ensuring that analytical instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to specific protocols/procedures.

Off-site laboratory equipment shall be calibrated using certified/nationally recognized standards and according to the applicable methodologies and the laboratory Standard Operating Procedures (SOPs).

In addition, these methods/procedures specify the appropriate operations to follow during calibration or when any instrument is found to be out of calibration.

8.0 ANALYTICAL PROCEDURES

All off-site laboratory samples will be analyzed according to the methods provided in Exhibit D of the NYSDEC ASP. QA/QC procedures given in Exhibit E and I of the ASP will be followed. Regardless of the method used, all analytical and extraction holding times must meet the NYSDEC ASP requirements for that analytical group (i.e., volatile analyses, including BTEX, have a holding time of seven days, if unpreserved). Holding times will be calculated from verified time of sample receipt at the laboratory. For NYSDEC ASP, samples must be received at the laboratory within 48 hours of sample collection. The analytical laboratory chosen for the project will be certified, and must maintain certification, under the New York State Department of Health's Environmental Laboratory Approval Program for analyses of solid and hazardous waste. The breakdown of investigative samples is detailed in the Site-Specific Work Plan. Laboratory analytical methods and quantitation limits are presented in Tables 2 and 3 of this Generic QAPP. The method detection limits (MDLs) for the analytes will be specified by the laboratory selected for the project based on its most recent MDL studies, and subject to approval by the NYSDEC.

Field screening samples will be analyzed according to the NYSDEC ASP and the manufacturer's instructions. Unless site-specific requirements dictate a change in concentration limits (which would be explained within the Site-Specific Work Plan), the standard levels for the PAH and PCB screening will be 1 ppm and 10 ppm. The test system user shall be technically qualified individual who has received training in the immunoassay analysis requirements, procedures and potential risks prior to field screening of samples. Use of the field screening test kits will only occur in a controlled environment, following the storage and handling procedures outlined in the NYSDEC ASP and the manufacturer's instructions. Additional technical information on the field screening testing are presented in Attachments 1 and 2.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the ASP.

The data package provided by the laboratory will contain all items specified in the ASP, as appropriate to the analyses performed. Category B reporting will be used.

9.1 Chain-of-Custody Records

Completed copies of the COC records accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the report of analytical testing.

9.2 Data Handling

One complete copy and one additional copy of the analytical data summary report will be provided by the laboratory. One set of the analytical data will be forwarded directly to the data validator by the laboratory. The Engineering Consultant's Project Manager will immediately arrange for filing of the complete package, after the QA/QC reviewer checks the package to ensure all deliverables have been

provided. The second data summary report will be used to generate summary tables. These tables will form the foundation of a working database for assessment of the site contamination condition.

The Engineering Consultant's Project Manager will maintain close contact with the QA/QC reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA/QC review has been completed, the Engineering Consultant's Project Manager may direct the team leaders or others to initiate and finalize the analytical data assessment.

9.3 Data Validation

9.3.1 Full Data Validation

Data validation is a basic step in the control and processing of the project data generated by the laboratory. The data validation process will consist of a systematic review of the analytical results and QC documentation, and will be performed in accordance with the guidelines identified in Section 9.3.1. All off-site laboratory data will undergo full validation, unless otherwise stated in the Site-Specific Work Plan. On the basis of this review, the data validator will make judgments and express concerns and comments on the quality and limitations of specific data, as well as on the validity of the overall data package. The data validator will prepare documentation of his or her review and conclusions in a Data Usability Summary Report (DUSR; see Section 9.3.2).

The data validator will inform the Engineering Consultant's Project Manager of data quality and limitations, and assist the Project Manager in interacting with the laboratory to correct data omissions and deficiencies. The laboratory may be required to rerun or resubmit data depending on the extent of the deficiencies, and their importance in meeting the data quality objectives within the overall context of the project. The validated laboratory data will be reduced into a computerized tabulation which will be suitable for inclusion in the Site Characterization and RI Reports and will be designed to facilitate comparison and evaluation of the data. The data tabulations will be sorted by classes of constituents and by sample matrix. Each individual table will present the following information:

- Sample matrix, designations, and locations;
- Sample dates;
- Constituents for which positive results were obtained;
- Reported constituent concentrations in the field and/or trip blanks associated with the samples;
- Constituent concentration units;
- Name and location of laboratory which performed the analyses;
- Data qualifiers provided by the laboratory; and
- Data qualifiers and comments provided by the data validator, if any.

9.3.1 Data Usability Summary Report (DUSR)

A Data Usability Summary Report (DUSR) will be prepared after reviewing and evaluating the analytical data. The parameters to be evaluated in reference to compliance with the analytical method protocols includes all sample chain-of-custody forms, holding times, raw data (instrument print out data and chromatograms), calibrations, blanks, spikes, controls, surrogate recoveries, duplicates and sample data. If available, the field sampling notes should also be reviewed and any quality control problems should be evaluated as to their effect on the usability of the sample data.

The DUSR will describe the samples and analysis parameters reviewed. Data deficiencies, analytical method protocol deviations and quality control problems will be described and their effect on the data will be discussed in the DUSR.

Resampling/reanalysis recommendations, if applicable, will be made. Data qualifications are documented for each sample analyte following the NYSDEC ASP guidelines.

This work will be performed by trained and experienced data validators who meet the NYSDEC

approval criteria. The Environmental Scientist preparing the DUSR must submit a resume to the NYSDEC Quality Assurance Unit documenting relevant experience in environmental sampling and analysis methods and data review and documentation of a Bachelors Degree in Natural Science or Engineering. The results of the data validation screening (i.e. missed holding times or data rejected due to blank contamination) will be incorporated into the data summary tables used in the final investigative report. The DUSR identifies data gaps caused by non-compliant or rejected data, and will indicate what steps have been or will be taken to fill these gaps.

10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

10.1 Quality Assurance Batching

Each set of samples will be analyzed concurrently with calibration standards, method blanks, MS, MSD or MD, and QC check samples (if required by the protocol). The MS/MSD/MD samples will be designated by the field personnel. If no MS/MSD/MD samples have been designated, then the laboratory must contact the Project Quality Assurance Officer (PQAO) or Engineering Consultant's Project Manager for corrective action.

10.2 Organic Standards and Surrogates

All standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or earlier based upon data indicating deterioration.

10.3 Laboratory Quality Control Samples

The quality control samples included are detailed below.

Method Blanks/Preparation Blanks: Analyses for organic compounds (method blank) and inorganics (preparation blank) include a blank analysis of the laboratory reagent water. The blank is analyzed with each set of samples or more often as required to verify that contamination has not occurred during the analytical process. The concentration of target compounds in the blanks must be less than or equal to the method detection limits specified in the ASP for the selected method of analysis.

Matrix Spike/Matrix Spike Duplicate Analysis - This analysis is used to determine the effects of matrix interference on analytical results. Spikes of analytes are added to aliquots of sample matrix in the manner specified in the ASP. Selected samples are spiked to determine accuracy as a percentage recovery of the analyte from the sample matrix and precision as RPD between the MS and MSD samples. A matrix duplicate is prepared in the same manner as the matrix spike sample.

Analytical Duplicate Samples - Replicate samples are aliquots of a single sample that are split on arrival at the laboratory, or upon analysis. Significant differences between two replicates, split in a controlled laboratory environment, will result in flagging the affected analytical results.

Surrogate Spike Analyses - Surrogate spike analyses are used to determine the efficiency of recovery of organic analytes in the sample preparations and analyses. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method.

Laboratory Control Sample/ (Spike Blank) - For each method which requires a laboratory control sample (LCS) or spike blank, a LCS spike blank will be prepared with each quality control batch and analyzed according to criteria specified in the ASP. These samples support an assessment of the ability of the analytical procedure to generate a correct result without matrix effects or interference affecting the analysis.

11.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

Quality assurance audits may be performed by the Project Quality Assurance Manager (PQAM) or personnel designated by the PQAM. The PQAM and his or her designees function as an independent body and report directly to Engineering Consultant's quality assurance management. The PQAM may plan, schedule, and approve system and performance audits based upon the Engineering Consultant's procedure customized to the project requirements. These audits may be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). At times, the PQAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits.

Formal audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by lead auditors after gathering and evaluating all resultant data. Items, activities, and documents determined by lead auditors to be in noncompliance will be identified at exit interviews conducted with the involved management. Noncompliances will be logged, documented, and controlled through audit findings which are attached to and are a part of the integral audit report. These audit finding forms will then be directed to management to satisfactorily resolve the noncompliance in a specified and timely manner. All audit checklists, audit reports, audit findings, and acceptable resolutions must be approved by the PQAM prior to issue. QA verification of acceptable resolutions will be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the PQAM will close out the audit report and findings.

It is the Engineering Consultant's Project Manager's overall responsibility to verify that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Engineering Consultant's Project Manager within 15 days of completion of the audit. Serious deficiencies must be reported to the Engineering Consultant's Project Manager within 24 hours.

Serious deficiencies identified during an audit will be reported to NM and NYSDEC as part of the DUSR or Site investigation and/or RI Reports.

11.1 System Audits

System audits, performed by the PQAM or designated auditors, may encompass evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Engineering Consultant's Project Manager requests the PQAM to perform unscheduled audits, these activities will be instituted.

11.2 Performance Audits

In accordance with the requirements for NYSDOH ELAP CLP certification, the laboratory will participate in all performance evaluation testing.

Also, one field audit may be performed by the PQAM or designated auditor during collection of the field samples to verify that field samplers are following established sampling procedures. Performance of a field audit will be based on the type of investigation activities being performed, the length of the field project, and any available information concerning prior inspections of the project or sampling team. The Site-Specific Work Plan will provide details on the performance of a field audit.

12.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

12.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators. Analytical instruments will be serviced at intervals recommended by the manufacturer. An instrument repair/maintenance log book will be kept for each instrument, and this log will be available on-site during field activities and, at the completion of the investigation, be placed in the project files. Entries include the date of service, type of problem encountered, corrective action taken, and initials and affiliation of the person providing the service.

The instrument use log book will be monitored by the analysts to detect any degradation of instrument performance. Changes in response factors or sensitivity are used as indications of potential problems. These are brought to the attention of the laboratory supervisor and preventive maintenance or service is scheduled to minimize down time. Back-up instrumentation and an inventory of critical spare parts are maintained to minimize delays in completion of analyses.

Use of equipment in need of repair will not be allowed, and field work will be terminated until the malfunction is repaired or the instrument replaced.

12.2 Schedules

Written procedures, where applicable, will identify the schedule for servicing critical items in order to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange any necessary and prompt service as required. Service to the equipment, instruments, tools, gauges, etc. shall be performed by qualified personnel.

12.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools, and gauges are used at the sites. The Engineering Consultant's Project Manager or the PQAM may audit these records to verify complete adherence to these procedures.

12.4 Spare Parts

Where appropriate, a list of critical spare parts will be identified by the operator in consultation with the equipment manufacturer. These spare parts will be stored for availability and use in order to reduce the downtime. In lieu of maintaining an inventory of spare parts, a service contract for rapid instrument repair or backup instruments will be available.

13.0 ASSESSMENT PROCEDURES FOR DATA ACCEPTABILITY

Procedures used to assess data precision and accuracy will be in accordance with the appropriate laboratory method, and as periodically updated.

13.1 Accuracy

The percent recovery is calculated as below:

$$\% = \frac{Ss - So}{S} \times 100$$

So = The background value, i.e.; the value obtained by analyzing the sample

S = Concentration of the spike added to the sample

Ss = Value obtained by analyzing the sample with the spike added

% = Percent Recovery

13.2 Precision

The relative percent difference (RPD) is calculated as below:

$$RPD = \frac{|V1 - V2|}{0.5\ (V1 + V2)} \times 100$$

V1, V2 = The two values obtained by analyzing the duplicate samples

13.3 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the total amount expected to be obtained under ideal conditions. A target of 100 percent completeness, calculated for each analysis method, has been established as the overall project objective.

$$PC = \frac{NA}{NI} \times 100$$

where:

PC = Percent completeness
NA = Actual number of valid analytical results obtained
NI = Theoretical number of results obtainable under ideal conditions

14.0 CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted on-site, at the laboratory, or at a subcontractor location, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the FOL, Engineering Consultant's Project Manager, and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action. All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality.

At a minimum, corrective actions may be initiated:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined deficient
- When equipment or instrumentation is found faulty
- When samples and test results are questionably traceable
- When quality assurance requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/inter-field comparison studies
- As required by NM
- As required by NYSDEC ASP, 2001

Procedure Description

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities.

Work may be audited at Engineering Consultant's office, Site, laboratory, and subcontractor locations by the PQAM and/or designated auditor. Items, activities, or documents ascertained to be in noncompliance with quality assurance requirements will be documented and corrective actions mandated through audit finding sheets attached to the audit report. Audit findings are logged,

maintained, and controlled by the PQAM (Section 11.0).

Technicians assigned quality assurance functions will also control noncompliance corrective actions by having the responsibility of issuing and controlling the appropriate Corrective Action Request Form (Figure 5). All project personnel may identify a noncompliance; however, the technician is responsible for documenting, numbering, logging, and verifying the closeout action. It is the Engineering Consultant's Project Manager's responsibility to verify that all recommended corrective actions are produced, accepted, and received in a timely manner.

The Corrective Action Request (CAR) identifies the adverse condition, reference document(s), and recommended corrective action(s) to be administered. The issued CAR is directed to the responsible manager in charge of the item or activity for action. The individual to whom the CAR is addressed returns the requested response promptly to the technician in charge, affixing his signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The technician maintains the log for status control of CARs and responses, confirms the adequacy of the intended corrective action, and verifies its implementation. The technician will issue and distribute CARs to specified personnel, including the originator, responsible project management involved with the condition, the Engineering Consultant's Project Manager, involved subcontractor, and the FOL, at a minimum. CARs are transmitted to the project file for the records.

15.0 QUALITY ASSURANCE REPORTS

Quality assurance reports to management may consist of the reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and the data validation report.

At the end of the project, the PQAM may submit a lessons leaned report to the Engineering Consultant's Project Manager which will discuss the QA activities. That report may include discussions of any conditions adverse or potentially adverse to quality, such as responses to the findings of any field or laboratory audits; any field, laboratory, or sample conditions which necessitated a departure from the methods or procedures specified in this QAPP; field sampling errors; and any missed holding times or problems with laboratory QC acceptance criteria; and the associated corrective actions undertaken. This report shall not preclude immediate notification to project management of such problems when timely notice can reduce the loss or potential loss of quality, time, effort, or expense.

These reports, if prepared, shall be reviewed by the Engineering Consultant's Project Manager for completeness and the appropriateness of any corrective actions, and they shall be retained in the project files.

In the final investigative report, laboratory and field QC data will be presented, including a summary of QA activities and any problems and/or comments associated with the analytical and sampling effort. Any corrective actions taken in the field, results of any audits, and any modifications to laboratory protocols will be discussed.

Attachment 1

NYSDEC ASP Methods 4035 (PAHs) and 4020 (PCBs)

Attachment 2

Field PAH and PCB Soil Test Technical Guides and Test Kit Instructions

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL Volatile Organic Compounds (by 2001-1)		
Acetone	10	10
Benzene	10	10
Bromodichloromethane	10	10
Bromoform	10	10
Bromomethane	10	10
2-Butanone	10	10
Carbon disulfide	10	10
Carbon tetrachloride	10	10
Chlorobenzene	10	10
Chloroethane	10	10
Chloroform	10	10
Chloromethane	10	10
Dibromochloromethane	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethane	10	10
1,1-Dichloroethene	10	10
1,2-Dichloroethene (cis and trans)	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
trans-1,3-Dichloropropene	10	10
Ethylbenzene	10	10
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Methylene chloride	10	10
Styrene	10	10
1,1,2,2-Tetrachloroethane	10	10
Tetrachloroethene	10	10
Toluene	10	10
1,1,1-Trichloroethane	10	10
1,1,2-Trichloroethane	10	10
Trichloroethene	10	10
Vinyl chloride	10	10
Total Xylenes	10	10

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2)		
Base/Neutral Extractables		
Acenaphthene	10	330
Acenaphthylene	10	330
Anthracene	10	330
Benzo(a)anthracene	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(g,h,i)perylene	10	330
Benzo(a)pyrene	10	330
bis(2-Chloroethoxy)methane	10	330
bis(2-Chloroethyl)ether	10	330
bis(2-ethylhexyl)phthalate	10	330
4-Bromophenyl phenyl ether	10	330
Butyl benzyl phthalate	10	330
Carbazole	10	330
4-Chloroaniline	10	330
2-Chloronaphthalene	10	330
4-Chlorophenyl phenyl ether	10	330
Chrysene	10	330
Dibenz(a,h)anthracene	10	330
Dibenzofuran	10	330
Di-n-butylphthalate	10	330
1,2-Dichlorobenzene	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
3,3'-Dichlorobenzidine	10	330
Diethyl phthalate	10	330
Dimethyl phthalate	10	330
2,4-Dinitrotoluene	10	330

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.)		
2,6-Dinitrotoluene	10	330
Di-n-octylphthalate	10	330
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadiene	10	330
Hexachloroethane	10	330
Indeno(1,2,3-cd)pyrene	10	330
Isophorone	10	330
2-methyl Naphthalene	10	330
Naphthalene	10	330
2-Nitroaniline	25	800
3-Nitroaniline	25	800
4-Nitroaniline	25	800
Nitrobenzene	10	330
N-Nitroso-diphenylamine	10	330
N-Nitroso-dipropylamine	10	330
2,2' Oxybis(1-chloropropane)	10	330
Phenanthrene	10	330
Pyrene	10	330
1,2,4-Trichlorobenzene	10	330

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.) **Acid Extractables (cont.)**		
4-Chloro-3-methylphenol	10	330
2-Chlorophenol	10	330
2,4-Dichlorophenol	10	330
2,4-Dimethylphenol	10	330
4,6-Dinitro-2-methylphenol	25	800
2,4-Dinitrophenol	25	800
2-Methylphenol	10	330
4-Methylphenol	10	330
2-Nitrophenol	10	330
4-Nitrophenol	25	800
Pentachlorophenol	25	800
Phenol	10	330
2,4,5-Trichlorophenol	25	800
2,4,6-Trichlorophenol	10	330
NYSDEC ASP TCL Pesticides and PCBs (by 2001-3)		
Aldrin	0.05	1.7
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Chlordane (alpha &/or gamma)	0.05	1.7
4,4'-DDD	0.10	3.3
4,4'-DDE	0.10	3.3
4,4'-DDT	0.10	3.3
Dieldrin	0.10	3.3
Endosulfan I	0.05	1.7
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Pesticides and PCBs (by 2001-3, Cont.)		
Endrin	0.10	3.3
Endrin Aldehyde	0.10	3.3
Endrin Ketone	0.10	3.3
Heptachlor	0.05	1.7
Heptachlor Epoxide	0.05	1.7
Methoxychlor	0.50	17.0
Toxaphene	5.0	170.0
Aroclor-1016	1.0	33.0
Aroclor-1221	2.0	67.0
Aroclor-1232	1.0	33.0
Aroclor-1242	1.0	33.0
Aroclor-1248	1.0	33.0
Aroclor-1254	1.0	33.0
Aroclor-1260	1.0	33.0
NYSDEC ASP TAL Metals and Cyanide (by CLP-M)		
Aluminum	200	
Antimony	60	
Arsenic	10	
Barium	200	
Beryllium	5	
Cadmium	5	
Calcium	5000	
Chromium	10	
Cobalt	50	
Copper	25	
Iron	100	
Lead	3	
Magnesium	5000	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd.)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TAL Metals and Cyanide (by CLP-M) (Cont.)		
Manganese	15	
Mercury	0.2	
Nickel	40	
Potassium	5000	
Selenium	5	
Silver	10	
Sodium	5000	
Thallium	10	
Vanadium	50	
Zinc	20	
Cyanide	10	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

These CRQLs are the instrument detection limits obtained in pure water that must be met using the procedure in Exhibit E. The quantitation limits for samples may be considerably higher depending on the sample matrix.

TABLE 1
SAMPLE CONTAINERIZATION

Analysis	Bottle Type	Preservation[1]	Holding Time[2]
Aqueous Samples			
Volatile Organics (BTEX)	40 ml glass vial with Teflon-lined septa	Cool to 4°C	7 days
PCBs/Pesticides	1000 ml amber glass	Cool to 4°C	5 days*
Semivolatile Organics (PAHs)	1000 ml amber glass	Cool to 4°C	5 days*
Metals	1000 ml polyethene	HNO_3 to pH <2	6 months (Mercury 26 days)
Cyanide	1000 ml polyethene	NaOH to pH >12	12 days
Soil & Sediment Samples			
Volatile Organics (BTEX)	Wide-mouth glass w/ teflon-lined septa [3]	Cool to 4°C	7 days
Semivolatile Organics (PAHs)	Wide-mouth glass w/ teflon cap [3]	Cool to 4°C	5 days*
Pesticide/PCBs	Wide-mouth glass w/ teflon cap [3]	Cool to 4°C	5 days*
Metals, Cyanide	Wide mouth glass w/ teflon cap [3]	Cool to 4°C	Metals - 6 months Mercury - 26 days Cyanide - 12 days

NOTES

1. All samples to be preserved in ice at 4°C during collection and transport.
2. Days from verified time of sample receipt (VTSR) by the laboratory.
3. Sized appropriately for the analytical method.
4. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in containerization requirements, the Site-Specific Work Plan (which will include this information) will take precedence.

* Extraction of water samples for pesticides/PCB analysis by separating funnel must be completed within five days of VTSR. Continuous liquid-liquid extraction is the required extraction for water samples for semivolatiles. Continuous liquid-liquid extraction of water samples, or sonication or soxhlet procedures for semivolatile and pesticides/PCB analyses, shall be started within five days. If a re-extraction and reanalysis must be performed, the extraction must start within 10 days and completed within 12 days of VTSR. Extracts of either water or soil/sediment samples must be analyzed within 40 days of VTSR.

TABLE 2
LABORATORY ANALYSIS PROGRAM

Matrix	Parameter [1]	Analytical Method [2]
Water	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	PCBs and Pesticides	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
Soil & Sediments	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	Pesticides and PCBs	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
	TCLP	Method 1311; Method Series 7000, 8000
Waste Characteristics		Methods 1010/1020A; 9040B/9041A; Section 7.3

NOTES

1. Abbreviations: BTEX = Benzene, Toluene, Ethylbenzene, Xylene; VOCs = Volatile organic compounds; SVOCs = Semivolatile organic compounds; PAHs = Polycyclic aromatic Hydrocarbons; TCLP = Toxicity Characteristic Leaching Procedure; PCBs = Polychlorinated Biphenyls; CLP = Contract Laboratory Program.
2. NYSDEC Analytical Services Protocol, 2001, Category B deliverables.
   Analyses must meet NYSDEC ASP holding time specified for Methods in Exhibit I Part II.
3. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in analytical requirements, the Site-Specific Work Plan (which will include this information) will take precedence

* BTEX and PAH analyses must meet NYSDEC ASP holding time specified for Methods 2001-1 and 2001-2, respectively.

FIGURE 1

DATA REDUCTION, VALIDATION AND REPORTING

Figure 1

DATA REDUCTION, VALIDATION & REPORTING SCHEME

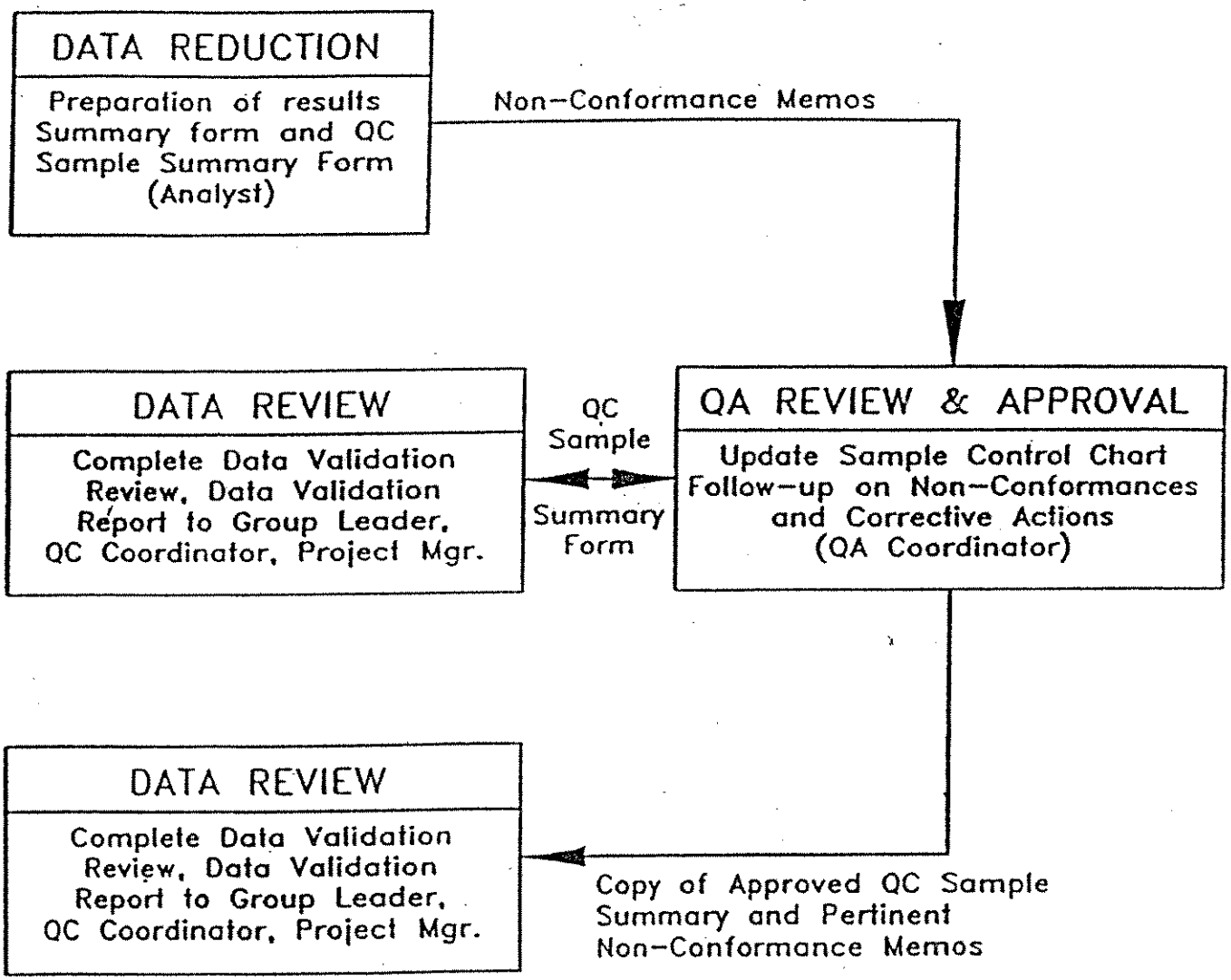
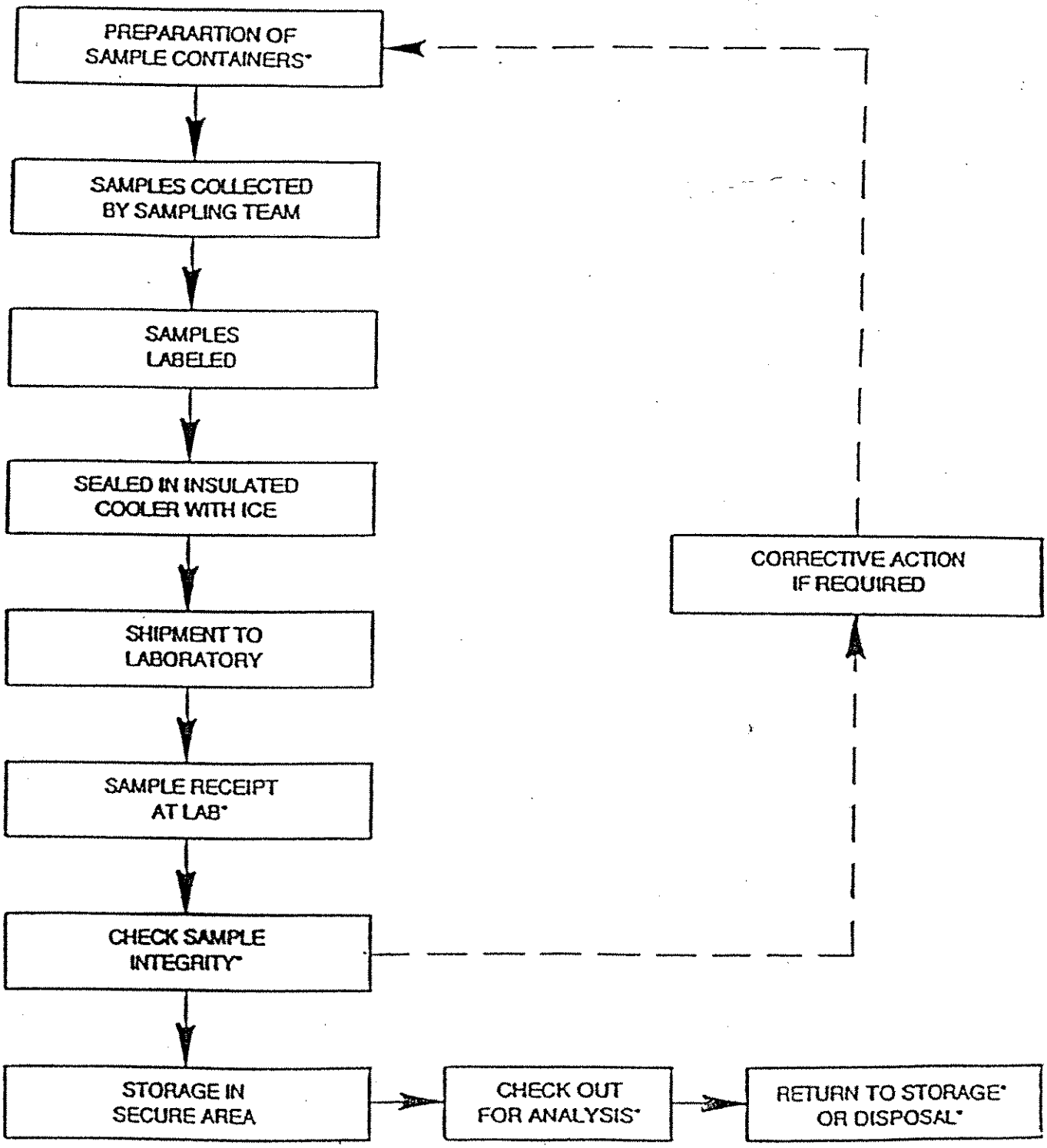


FIGURE 2

SAMPLE CUSTODY

Figure 2

SAMPLE CUSTODY



* Requires sign-off on Chain of Custody Form.

FIGURE 3

CHAIN-OF-CUSTODY RECORD

Severn Trent Laboratories
200 Monroe Turnpike
Monroe CT 06468
Tel: (203) 261-4458
Fax: (203) 268-5346

Committed To *Your* Success

CHAIN OF CUSTODY RECORD

PAGE OF NO.

STL JOB #:

CLIENT:

PROJECT ID:

STL PROJECT MGR:

RUSH ☐ YES ☐ NO DUE DATE

BOTTLE SET #	CLIENT SAMPLE ID.	DATE / TIME SAMPLED	MATRIX	LAB (STL)	QC (Y / N)	TESTS / METHOD / BOTTLE TYPE AND PRESERVATION								SAMPLE REMARKS
						FIELD FILTERED / CIRCLE Y or N								
						Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

MATRIX CODES

A - AIR
AQ - AQUEOUS
C - COMPLEX
D - DRUM WASTE
OI - OIL
S - SOIL
SL - SLUDGE
W - WIPE
O - OTHER
FB - FIELD BLANK
TB - TRIP BLANK

BOTTLES PREPARED BY	DATE / TIME	BOTTLES REC'D BY	DATE / TIME
SIGNATURE		SIGNATURE	
SAMPLES COLLECTED BY	DATE / TIME	RECEIVED IN LAB BY	DATE / TIME
SIGNATURE		SIGNATURE	

REMARKS ON SAMPLE RECEIPT

☐ BOTTLES INTACT ☐ CUSTODY SEALS
☐ PRESERVED ☐ SEALS INTACT
☐ CHILLED ☐ SEE REMARKS

LABORATORY COPY

FIGURE 4

DAILY STATUS AND MONITORING REPORT

DAILY STATUS & MONITORING REPORT
Niagara Mohawk SIR & MSA Programs

Date:_____ Site Name:_____

Project Manager:_____ Project Field Operations Lead:_____

Description of Field Work Performed:

_____

_____

_____

_____

Media	Sample Number	Types of Analyses	Sample Sent to Lab? (Y/N)	Comments

Means of Sample Shipment to Laboratory? Name and Location of Laboratory:

_____

_____

_____

_____

Issues/Concerns Raised:

_____

_____

_____

_____

Work to be Performed Tommorrow:

_____

_____

_____

_____

Name of Preparer:_____

FIGURE 5

CORRECTIVE ACTION REQUEST FORM

Figure 5

CORRECTIVE ACTION REQUEST	CAR NO. _____ DATE _____
PROJECT NO./TITLE _____ _____ _____ TASK NO./TITLE _____ _____	REFERENCE(S) _____ _____ REPLY DUE DATE _____
SUBJECT _____ _____	PREPARED BY _____
DESCRIPTION OF CONDITION	APPROVED BY _____ PROJECT MANAGER
_____ _____ _____ _____ _____	
CAUSE AND CORRECTIVE ACTION (Include Effective Date) _____ _____ _____ _____ _____ _____ _____ _____	
_____ TASK MANAGER DATE	_____ PROJECT QA OFFICER DATE	_____ PROJECT MANAGER DATE
CLOSEOUT ACTION _____ _____ _____ _____ _____ _____ _____ _____	
_____ PROJECT QA OFFICER DATE	_____ PROJECT MANAGER DATE	SEE REVERSE SIDE FOR INSTRUCTIONS

ATTACHMENT 1

ENSYS FIELD PAH AND PCB SOIL TEST TECHNICAL GUIDES AND TEST KIT INSTRUCTIONS

STRATEGIC DIAGNOSTICS INC.

PAHEnSys® 12T SOIL TEST SYSTEM 70613

RAPID IMMUNOASSAY SCREEN

User's Guide

This method correctly identifies 95% of samples that are PAH-free and those containing 1ppm or greater of PAHs. A sample that develops less color than the standard is interpreted as positive. It contains PAHs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PAHs.

IMPORTANT NOTICE

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of PAHs. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLE SHOOTING GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

Wash Step - Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. *Solution*: Make sure that the operator washes four times vigorously.

Pipette Calibration - An out-of-calibration pipette may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution*: Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipette is out of calibration is if the gold barrel is loose and will turn. (When set on 30 µl there should be about 1/4 of an inch between the white plunger and the end of the clear pipette tip.)

Air bubbles in the pipette - the presence of air bubbles in the pipette tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution*: quickly examine the pipette tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if necessary.

Mixing - Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution*: observe the mixing times in the instructions and to mix with sufficient force to ensure that the liquid is homogeneous.

Timing - it is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the test. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

Addition of Drops - it is important to carefully count the drops added to color development steps. The addition of ±1 drop to the instructed 5 drops can cause variability in the results RIGHT AROUND THE DETECTION LEVELS OF INTEREST. One drop less could result in a darker color (a less dilute solution) and result in a false negative. One drop more could result in a lighter color (a more dilute solution) and result in a false positive

Wiping the Tubes - wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

Mixing Lot #'s - never mix lots! Each kit's components are QC'd together for optimal performance and may give inaccurate results with components from other kits, that are not of the same lot #. Also, the user must NEVER mix components from different types of kits (ex: Petro kit buffer tubes can't be used with a PAH kit).

Storage and Operating Temperatures - temperature requirements are very important and should be strictly adhered to. This information can be found in the kit User's Guide.

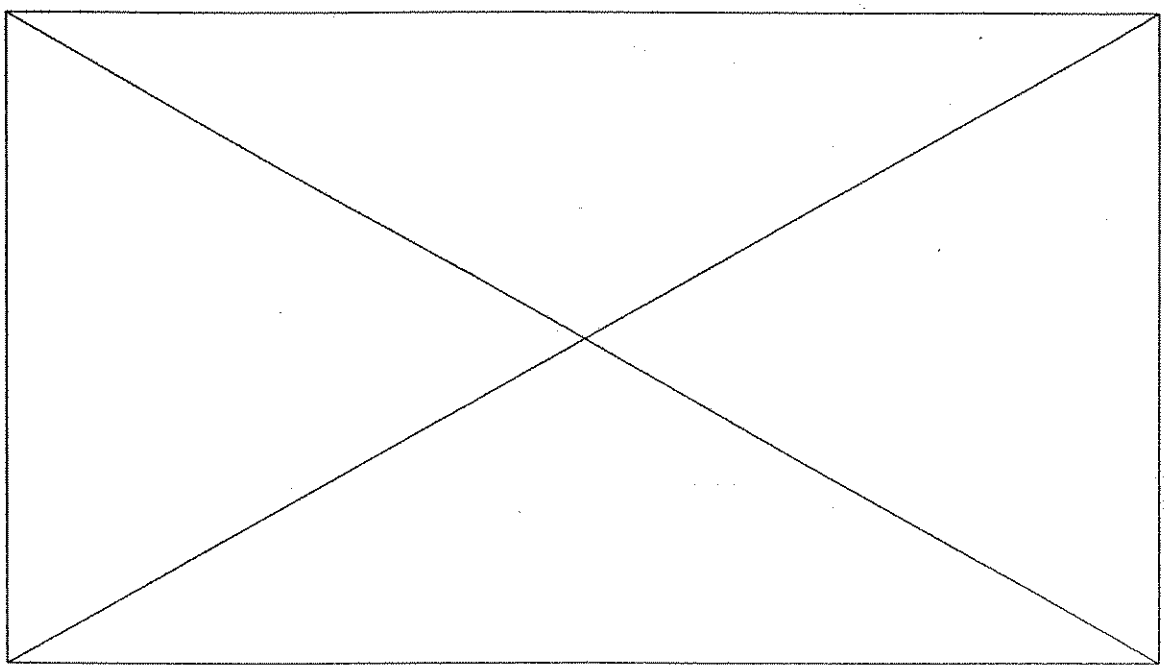
Shelf-life - each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- **Mechanical pipette tips**
- **Stop solution**
- **Standard vial**
- **4 antibody coated tubes**
- **Substrate A**
- **Filtration barrel & plunger**
- **1 and 10 ppm**
- **dilution ampules**
- **Substrate B**
- **Bulb pipette**
- **4 blue buffer tubes**
- **4 conjugate tubes**



READ BEFORE PROCEEDING

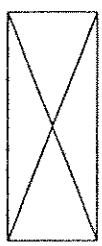
- Follow diagram above to setup workstation.
- Items that you will need that are not provided in the test kit include:
  a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PAHs at 1 and 10 ppm.

PAH Standard

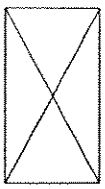
Ampule Cracker

TEST PREPARATION

- Label amber vial "PAH standard" and the current date; Standard is usable for up to 2 weeks from this date. Open PAH Standard ampule by slipping ampule cracker over top, and then breaking top at scored neck. Transfer to empty amber vial with bulb pipette. Always cap tightly when finished using Standard.



Bulb Pipette

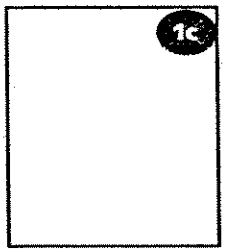


Amber Vial

PHASE 1 SAMPLE EXTRACTION & PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

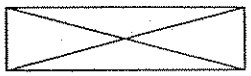


1a Place unused weigh boat on pan balance.

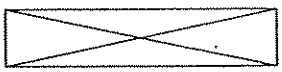
1b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c Weigh out 10 + / - 0.1 grams of soil.

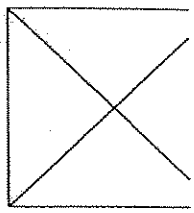
1d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Pan balance

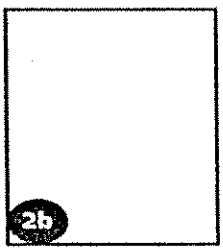


Wooden spatula



Weigh Boat

EXTRACT PAHS

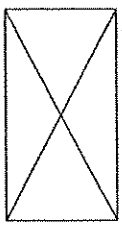


2a Uncap extraction jar and place on flat surface. Without contacting solvent, puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

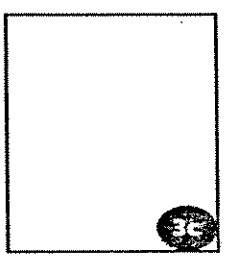
2c Recap extraction jar tightly and shake **vigorously** for one minute.

2d Allow to settle for one minute. Repeat steps **1a -2c** for each sample to be tested.



Sample extraction jar

FILTER SAMPLE

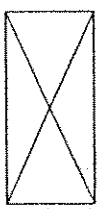


3a Remove lid from extraction jar.

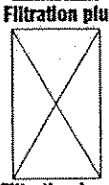
3b Disassemble filtration plunger from filtration barrel.

3c Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer **at least** 1/2 bulb capacity into filtration barrel. **Do not use more than one full bulb.**

3d Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).



Filtration plunger



Filtration barrel

Bulb pipette

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM FOR DETECTION LEVELS OTHER THAN 1 & 10PPM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.

2. At your request, your kit may include extra dilution ampules to reach high detection levels.

3. **EVERY AMPULE PROVIDED MUST BE USED!**

If there are any questions concerning the dilution procedure please call Technical Services before running the samples to help avoid costly mistakes.
1-800-544-8881.

EXAMPLE:

Lowest ppm	Intermediate ppm	Highest ppm	Dilution Ampules

NOTE: Your order may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Label the glass conjugate and plastic antibody coated tubes with a permanent marking pen.
- When using the mechanical pipette always withdraw and dispense below the liquid level. Instructions for operating the Mechanical Pipette are found on page 13.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE AND BUFFER SAMPLE FOR 1 PPM AND 10 PPM DETECTION LEVELS

4a Uncap enough blue buffer, conjugate, and antibody coated tubes for Samples and Standards.

4b Empty a blue buffer tube into each conjugate tube.

4c Assemble new tip onto mechanical pipette.

4d Open 1 and 10 ppm dilution ampules by slipping ampule cracker over tip, and then breaking top at scored neck.

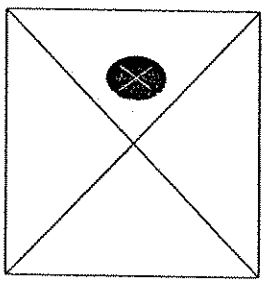
PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

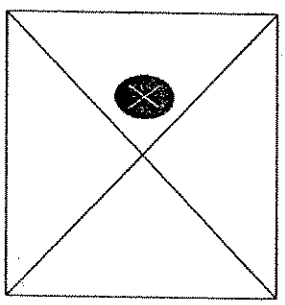
DILUTE AND BUFFER SAMPLE

4e Withdraw 75 µL of filtered sample using mechanical pipette and dispense below the liquid level in 1 ppm dilution ampule. Gently shake ampule for 5 seconds.

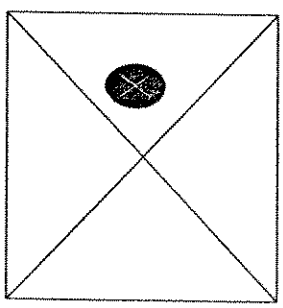
4f Withdraw 75 µL of diluted sample from the 1 ppm dilution ampule and dispense below the liquid level in the 10 ppm dilution ampule. Gently shake ampule for 5 seconds.



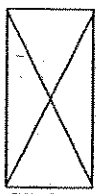
4g Withdraw 75 µL of diluted sample from 10 ppm dilution ampule and dispense below the liquid level in corresponding conjugate tube. Always wipe tip after dispensing into conjugate tube. Withdraw 75µL of 1ppm sample and dispense into corresponding conjugate tube.



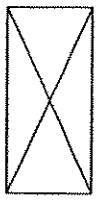
4h Assemble new tip onto mechanical pipette and withdraw 75µl of PAH Standard and dispense below the liquid level in two conjugate tubes. Immediately replace cap on PAH Standard vial.



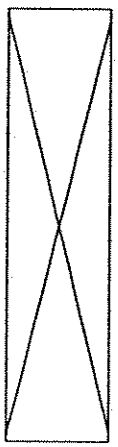
4i Gently shake conjugate tubes for 5 seconds.



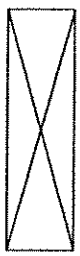
Dilution ampules (1 & 10 ppm)



Plastic Safety Sleeve



Mechanical pipette



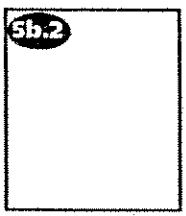
Mechanical pipette tip

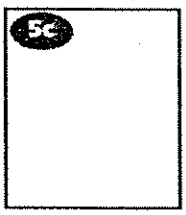
READ BEFORE PROCEEDING

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM CONJUGATE TUBE TO ANTIBODY COATED TUBE





5a. Set timer for 10 minutes.

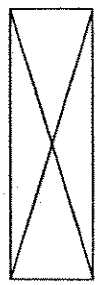
5b. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding conjugate tubes.

2. **Start timer and immediately** invert **all** connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

5d. Disconnect and discard the smaller glass conjugate tubes. [It is not important to worry about drops of liquid adhering to lips of tubes].



Antibody coated tubes (contained in resealable "zip-seal" aluminized pouch)

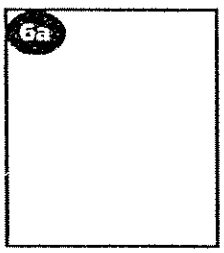
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

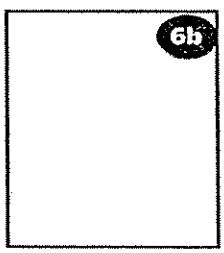
DILUTE AND BUFFER SAMPLE

4e Withdraw 75 µL of filtered sample using mechanical pipette and dispense below the liquid level in 1 ppm dilution ampule. Gently shake ampule for 5 seconds.

4f Withdraw 75 µL of diluted sample from the 1 ppm dilution ampule and dispense below the liquid level in the 10 ppm dilution ampule. Gently shake ampule for 5 seconds.



4g Withdraw 75 µL of diluted sample from 10 ppm dilution ampule and dispense below the liquid level in corresponding conjugate tube. Always wipe tip after dispensing into conjugate tube. Withdraw 75µL of 1ppm sample and dispense into corresponding conjugate tube.



Wash bottle

4h Assemble new tip onto mechanical pipette and withdraw 75µl of PAH Standard and dispense below the liquid level in two conjugate tubes. Immediately replace cap on PAH Standard vial.

4i Gently shake conjugate tubes for 5 seconds.

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

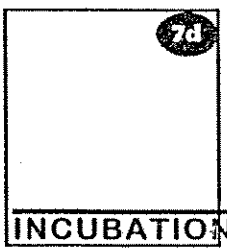
READ BEFORE PROCEEDING

- This phase of the procedure requires critical timing and care in handling the antibody coated tubes.

ADD ENZYME

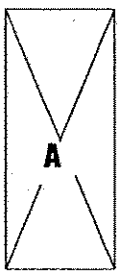
6a Dispense first drop from enzyme dropper into liquid waste container.

Note: before dispensing drops, tap capped tip on hard surface to avoid dispensing air bubbles.

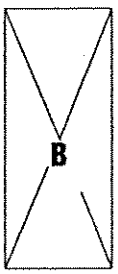


6b Dispense 3 drops of enzyme into each blue buffer tube by squeezing the dropper.

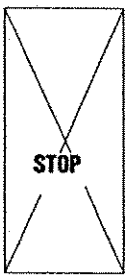
6c Shake buffer tubes for 5 seconds.



Substrate A



Substrate B



Stop

INCUBATION

7a Set timer for 10 minutes.

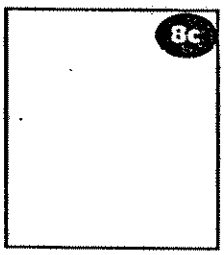
7b Start timing and immediately pour solution from each blue buffer tube into appropriate antibody coated tube.

7c When pouring is complete, gently shake all 4 tubes for 5 seconds.

PHASE 4 INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



8a Wipe outside of all antibody coated tubes.

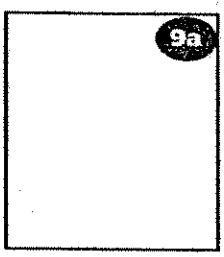
8b Place both Standard tubes in photometer.

8c Switch tubes until the photometer reading is negative or zero. Record reading.

If reading is greater than - 0.3 in magnitude , results are outside QC limits. Retest the sample(s).

8d Remove and discard tube in right well. The tube in the left well is the more conservative standard and should be used.

MEASURE SAMPLE



9a Place 1 ppm tube in right well of photometer and record reading shown on display.

If photometer reading is negative or zero, PAHs are present.

If photometer reading is positive, concentration of PAHs are less than 1 ppm.

9b Place 10 ppm tube in right well of photometer and record reading shown on display.

If photometer reading is negative or zero, PAHs are present.

If photometer reading is positive, concentration of PAHs are less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

How It Works

Standards, Samples, and color-change reagents are added to test tubes coated with a chemical specific to PAHs. The concentration of PAHs in an unknown **Sample** is determined by comparing its color intensity with that of a **Standard.**

Note: PAHs concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PAHs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after its expiration date.
- Each analysis must include 2 **Standards,** with no more than a total of 12 antibody coated tubes.
- Do not exceed incubation periods prescribed by the specific steps.
- Results may not be valid if photometer reading for **Standards** exceed 0.3 in magnitude.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If liquid from the extraction jar, or PAH Standard comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 40° F/4 °C and less than 90° F/32° C.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

System Description

Each PAH RISc Soil Test System contains enough material to perform four complete tests, each at 1 and 10 ppm.

The PAH RISc Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free:

1-800-544-8881.

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PAH-free soil and soil containing 1 ppm and 10 ppm of PAHs were tested with the EnSys® PAH analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PAHs. Either a 1 ppm or a 10 ppm sample that has developed more color than the standard is interpreted as negative. It contains less than the indicated level of PAHs (1 ppm or 10 ppm).

The company does not guarantee that the results with the EnSys® PAH Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

Strategic Diagnostics Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

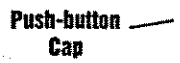
SDI neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall SDI be liable for incidental or consequential damages resulting from the use or handling of this product.

MECHANICAL PIPETTE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE MECHANICAL PIPETTE



To Set Or Adjust Volume

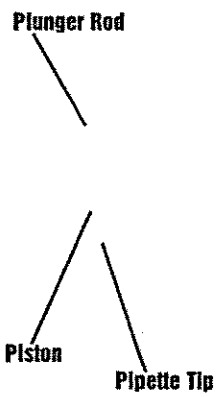
Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "075". Tighten volume lock screw and replace push-button cap.

To Assemble Pipette Tip

Slide larger mounting end of pipette tip onto end of pipette. Holding tip in place, press push-button until plunger rod enters pipette tip. Ensure no gap exists between piston and plunger rod (see illustration).

To Withdraw Sample

With tip mounted in position on pipette, press push-button to first stop and hold it. Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.



To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipette, please refer to your pipette manual.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS SDI EnSys® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of EnSys RIS® immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. **Method blank** - analyze methanol from the extraction jar.

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. 1-800-544-8881.

Data for PAH EnSys® Soil Test

Operator: _____ Date: _____ Location: _____

Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	N O T E S
	Standards	_____ ppm		_____ ppm		

STRATEGIC DIAGNOSTICS INC.

PCB EnSys® 12T SOIL TEST SYSTEM

70203

RAPID IMMUNOASSAY SCREEN

User's Guide

IMPORTANT NOTICE

This method correctly identifies 95% of samples that are PCB-free and those containing 1 ppm or greater of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of polychlorinated biphenyls. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLESHOOTING GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. Solution: Make sure to wash four times vigorously, washing the whole set of 12 tubes at once.

PIPET CALIBRATION

An out-of-calibration pipet may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution*Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipet is out of calibration is if the gold barrel is loose and will turn. (When set on 30 µl there should be about a 1/4 of an inch between the white plunger and the end of the clear pipet tip.)

AIR BUBBLES IN THE PIPET

The presence of air bubbles in the pipet tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution*Quickly examine the pipet tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if necessary.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution*Observe the times in the instructions and mix with sufficient force to ensure that the liquid is homogenous.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

WIPING THE TUBES

Wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PAH kit).

STORAGE AND OPERATING TEMPERATURES

Temperature requirements are very important and should be strictly adhered to. This test kit should be stored at less than 80°F/27°C and operated between 40°F/4°C and 90°F/32°C.

SHELF-LIFE

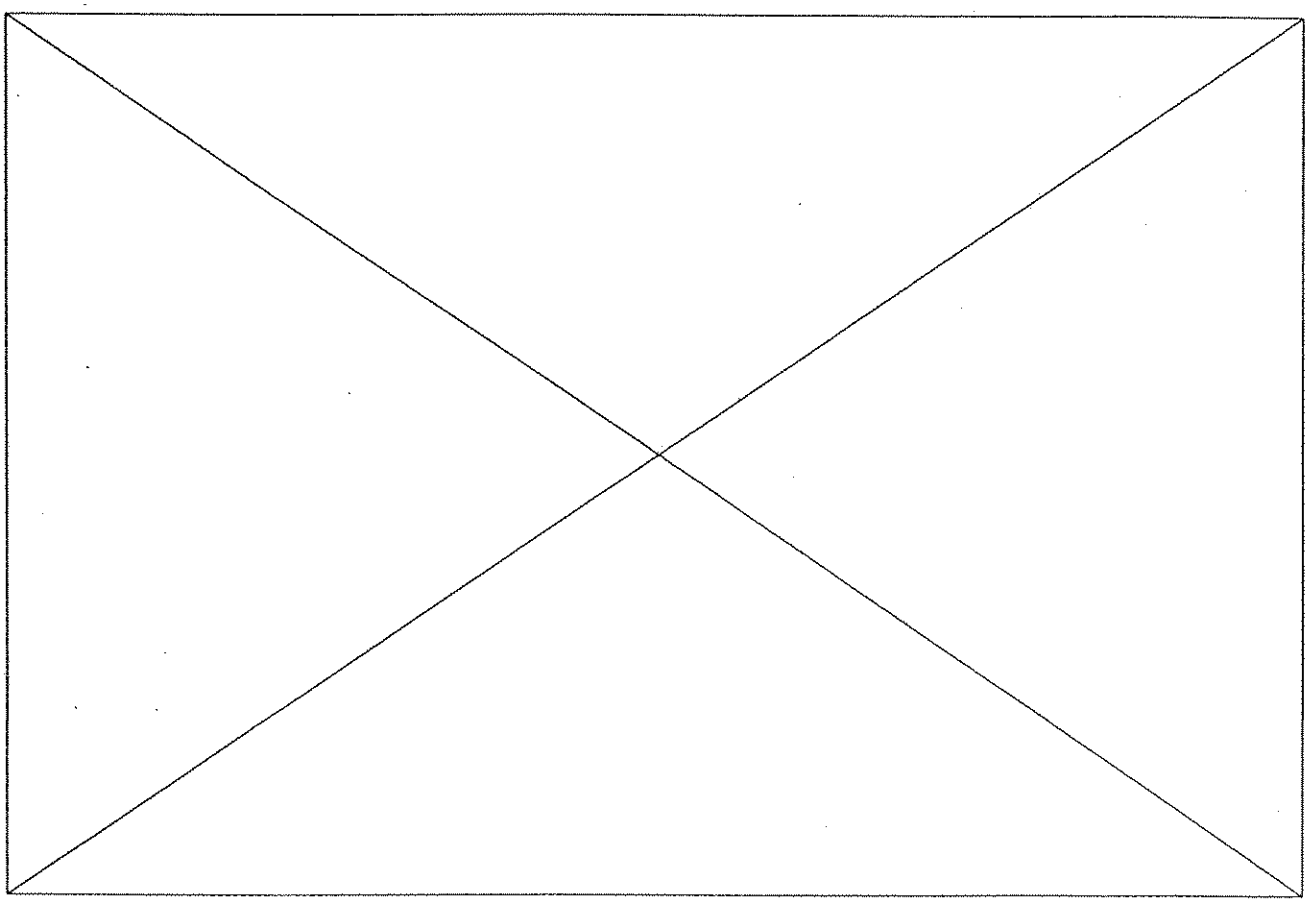
Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- Mechanical pipet tips
- Filter barrels & plungers
- Ampule cracker
- Glass PCB buffer tubes
- Substrate A
- Eppendorf pipet tips
- Bulb pipets
- PCB standard
- Antibody coated tubes
- Substrate B
- Extraction jars
- 1 & 10 ppm dilution ampules
- Stop Solution



Workstation shows components for 3 samples tested at 2 levels

TEST PREPARATION

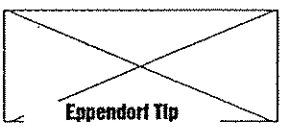
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Do not attempt to run more than 12 tubes, two of which must be standards.
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PCBs at 1 and 10 ppm. See table on page 10 for sensitivity to various Aroclors.

TEST PREPARATION

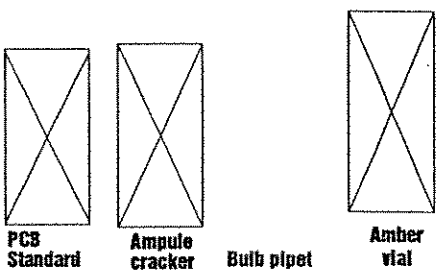
- Label all Eppendorf repeater tips. Tips can be reused for future analyses. Label the first 5mL tip "A", the second 5mL tip "B" and the third 5mL tip "Stop".



- Label the 12.5 mL tip "Buffer".

STANDARD PREPARATION

- Open PCB Standard ampule by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer solution to empty vial with Bulb Pipets.



- Label vial with current date. Standard is usable for 2 weeks. Always cap tightly when finished using standard.

PHASE 1 EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

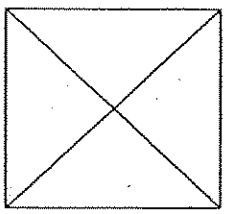
WEIGH SAMPLE

1a. Place unused weigh boat on pan balance.

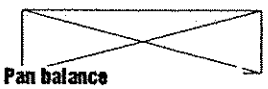
1b. Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c. Weigh out 10 ⁄ 0.1 grams of soil.

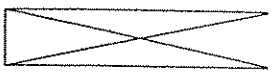
1d. If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Weigh Boat



Pan balance



Wooden spatula

EXTRACT PCBS

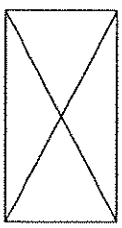
2a. Uncap extraction jar and place on a flat surface. Without contacting solvent puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b. Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

2c. Recap extraction jar tightly and shake **vigorously** for one minute.

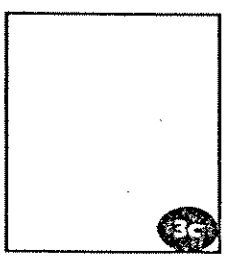
2d. Allow to settle for one minute.

Repeat steps 1a - 2c for each sample to be tested.



Extraction Jar

FILTER SAMPLE

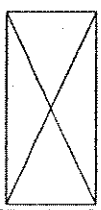


3a. Disassemble filtration plunger from filtration barrel.

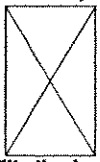
3b. Insert bulb pipet into top (liquid) layer in extraction jar and draw up sample. Transfer **at least ½** bulb capacity into filtration barrel. **Do not use more than one full bulb.**

3c. Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps **3a - 3c** for each sample to be tested.



Filtration plunger



Filtration barrel

Bulb pipet

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.

2. Your kit may include extra dilution ampules to reach high detection levels.

3. **EVERY AMPULE PROVIDED MUST BE USED!**

   If there are any questions concerning the dilution procedure please call SDI Technical Services before running the samples to help avoid costly mistakes. (1-800-544-8881)

EXAMPLE:

NOTE: Your Kit may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

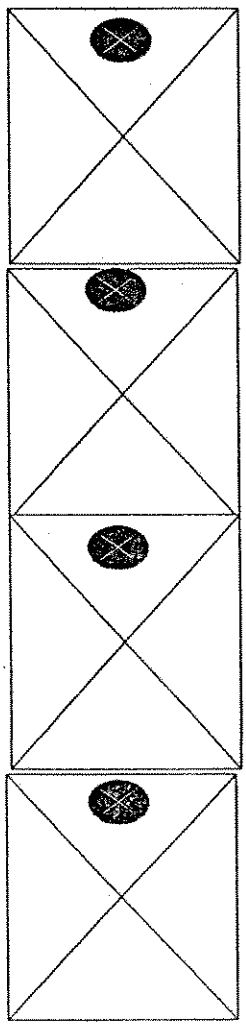
PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Label the plastic antibody coated tubes with a permament marking pen.
- When using the mechanical pipet always withdraw and dispense below the liquid level.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE SAMPLES AND STANDARDS



4a. Set the Eppendorf Repeater on 4, assemble the "Buffer" tip and fill with Buffer.

4b. Dispense 1 mL of Buffer into each glass buffer tube.

4c. Open 1 and 10 ppm dilution ampules by slipping ampule cracker over top, and then breaking top at scored neck.

4d. Withdraw 60 µL of filtered sample using mechanical pipet and dispense below the liquid level in "1 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

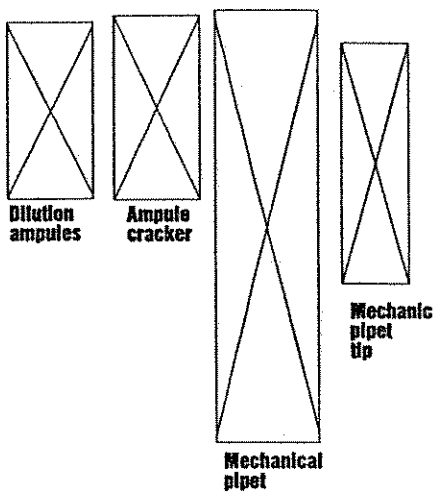
4e. Withdraw 60 µL from the "1 ppm" dilution ampule using mechanical pipet and dispense below the liquid level in "10 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

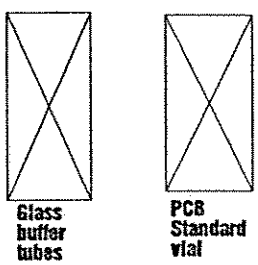
4f. Transfer 60 µL from each dilution ampule into glass buffer tubes. Always wipe tip after dispensing into buffer tube.

4g. Change pipet tip and repeat 4d - 4f for each sample.

4h. Assemble new pipet tip on mechanical pipet and transfer 60 µL from Standard vial into two glass buffer tubes. Immediately replace cap on PCB Standard vial.

4i. Shake all glass buffer tubes for 5 seconds.

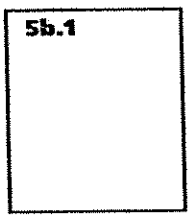


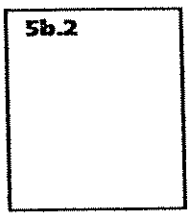


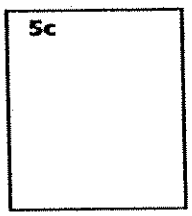
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM DILUTION TUBE TO ANTIBODY COATED TUBE







5a. Set timer for 10 minutes

5b. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding glass buffer tubes.

2. Start timer and immediately invert all connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

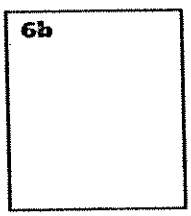
5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

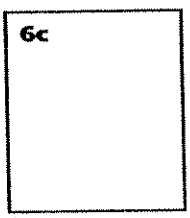
5d. Disconnect and discard the smaller (dilution) tubes. It is not important to worry about drops of liquid adhering to lips of tubes.

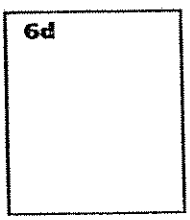
5e. Place conjugate tubes behind antibody tubes in workstation. Remove grey caps and discard.

TRANSFER OF CONJUGATE TO ANTIBODY COATED TUBES

AFTER 10 MINUTES, IMMEDIATELY:







6a. Set timer for 5 minutes.

6b. Working left to right in the workstation:

Start timer and immediately:

Dissolve the conjugate pellets by horizontally connecting the antibody coated tubes and conjugate tubes and **tilt the liquid up to pour it onto the conjugate.**

6c. Return the connected tubes to the appropriate workstation row making sure **the larger (antibody coated) tube is on the bottom. It is important that this step is completed within one minute for all tubes.**

6d. In order to adequately mix solution, **invert** all connected tube pairs **several more times** making sure that the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

6e. Disconnect and discard the conjugate tubes. It is not important to worry about the loss of liquid adhering to lip of tubes.

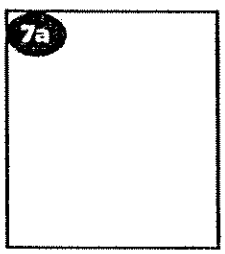
PHASE 3 THE IMMUNOASSAY

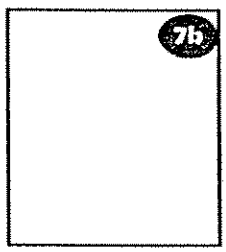
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING
WASH PROCEDURE

- An accurate test requires a vigorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a harmless, dilute solution of detergent.

WASH



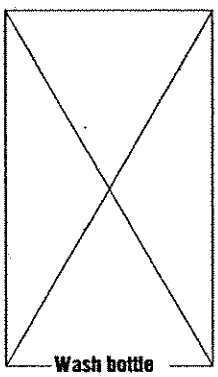


7a After the 5 minute incubation, empty antibody coated tubes into liquid waste container.

7b Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

7c Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.



PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

COLOR DEVELOPMENT

8a. Set the Eppendorf Repeater on 2, assemble the "A" tip and fill with Substrate A (TMB, yellow label).

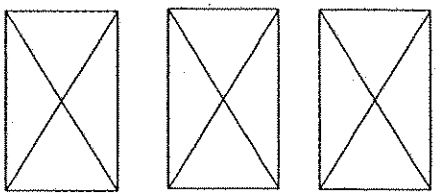
8b. Dispense once (200 µL) into each antibody coated tube.

8c. Set timer for exactly 2 1/2 minutes.

8d. Assemble "B" tip, fill with Substrate B, start timer, and dispense once (200 µL H_2O_2, green label) into each antibody coated tube.

8e. Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.

8f. Assemble "Stop" tip, fill with Stop Solution (red label), and stop reaction at end of 2 1/2 minutes by dispensing once (200 µL) into each antibody coated tube.



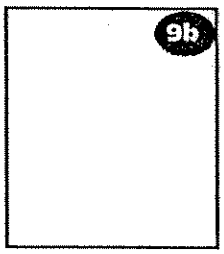
AROCLOR SENSITIVITY

Aroclor	Lowest Detection Level
1248	1.0 ppm
1254	0.5 ppm
1260	0.5 ppm
1242	2.0 ppm
1232	4.0 ppm
1016	4.0 ppm

PHASE 4 ANALYSIS OF RESULTS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



9a. Wipe outside of all antibody coated tubes.

9b. Place both Standard tubes in photometer.

9c. Switch tubes until the photometer reading is negative or zero. Record reading.

If reading is greater than - 0.3 in magnitude (reading is less than or lower than - 0.3), results are outside QC limits. Retest the sample(s). (See QC Example)

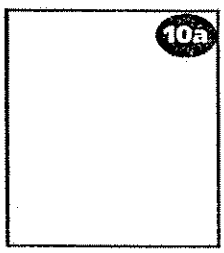
9d. Remove and discard tube in right well. The tube in the left well is the conservative standard.

QC Check Example:

If the photometer reading (with both Standard tubes) is **-0.34 or 0.34**, results are outside the QC limits, and the samples should be retested.

If the photometer reading (with both Standard tubes) is **-0.27 or 0.27**, results are within the QClimits, and testing may proceed.

MEASURE SAMPLE



10a. Place 1 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 1 ppm.

10b. Place 10 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each SDI PCB Ensys® Soil 12 Test Case contains enough material to perform 12 test samples, each at two detection levels.

The SDI PCB EnSys Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-544-8881.

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 1 ppm or greater of PCBs were tested with the SDI EnSys PCB analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

SDI does not guarantee that the results with the PCB EnSys Soil 12 Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown **Sample** is determined by comparing its color intensity with that of a **Standard**.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are Standards) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always follow the procedure in this user's guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.

REPEATER PIPET & MECHANICAL PIPET

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE REPEATER PIPET

To Set Or Adjust Volume

To determine the pipetting volume, the dial setting (1-5) is multiplied by the minimum pipetting volume of the tip.

To Assemble Pipet Tip

Slide filling lever down until it stops. Then raise the locking clamp and insert the tip until it clicks into position. Be sure the tip plunger is fully inserted into the barrel before lowering the locking clamp to affix the tip in place.

To Fill Tip

With tip mounted in position on pipet, immerse end of tip into solution. Slide filling lever upward slowly.

To Dispense Sample

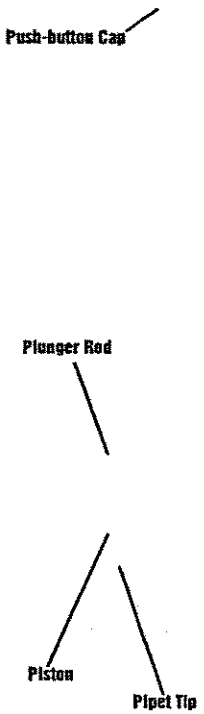
Check the volume selection dial to ensure pipetting volume. Place tip inside test tube so that tip touches the inner wall of tube. Completely depress the pipetting lever.

To Eject Tip

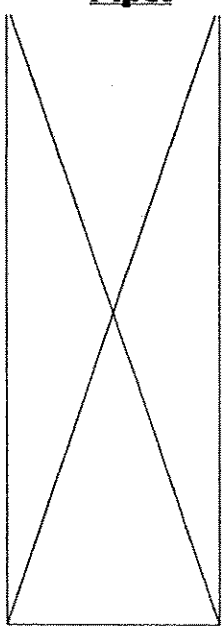
Empty tip of any remaining solution into appropriate container. Raise locking clamp upward, and remove the tip.

For additional information regarding operation and use of repeater, please refer to your Repeater pipet manual.

Mechanical Pipet



Repeater Pipet



HOW TO OPERATE THE MECHANICAL PIPET

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "060". Tighten volume lock screw and replace push-button cap.

To Assemble Pipet Tip

Slide larger mounting end of pipet tip onto end of pipet. Holding tip in place, press push-button until plunger rod enters pipet tip. **Ensure no gap exists between piston and plunger rod.**

To Withdraw Sample

With tip mounted in position on pipet, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipet, please refer to your pipet manual.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS SDI EnSys® 12 TEST SYSTEM

Please read the following before proceeding with field testing.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of fieldanalysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of SDI's EnSys immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. **Method blank** - analyze methanol from the extraction jar.

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. (1-800-544-8881)

Data for SDI PCB EnSys® 12T Soil Test

Operator: _____ Date: _____ Location: _____

Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	Comments
	Standards	_____ ppm		_____ ppm		

Appendix C: Groundwater Flow Modeling Report

Groundwater Model Report
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 153021

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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List of Abbreviations

MGP	Manufactured Gas Plant
ISS	In-Situ Solidification
ft	feet
msl	mean sea level
bgs	below ground surface
MODFLOW	Modular Three-dimensional Finite Difference Groundwater Flow Model
DEM	Digital Elevation Model
MRLC	Multi-Resolution Land Characterization Consortium
NJDEP	New Jersey Department of Environmental Protection
NJGS	New Jersey Geologic Survey
In/yr	inch per year
cm/sec	centimeter per second
GPM	gallons per minute
USGS	United States Geological Survey

Section 1

Introduction

A groundwater flow modeling study was conducted as part of the remedial design efforts for the Patchogue Former Manufactured Gas Plant (MGP) Site. The former MGP Site is located in the Village of Patchogue, Suffolk County, New York, on West Main Street (also known as Montauk Highway and County Road 85) south of Great Patchogue Lake and north of Patchogue Bay. The purpose of the groundwater modeling study was to:

- Simulate the groundwater flow beneath the Site
- Assess the degree to which implementation of in situ solidification (ISS) of the subsurface material, and the corresponding decrease in hydraulic conductivity of this material, effects groundwater flow and groundwater elevations; and
- Assess the rate and duration of dewatering that may be required during for excavations for soil removal in the off-Site area directly east of the Site.

This report documents the groundwater modeling study. Section 1 is the introduction to the report. Section 2 provides a description of the conceptual hydrogeologic model for the Site, which was the basis of the model construction. Section 3 describes the details of the construction and calibration of the model, and the sensitivity analysis that was conducted on the calibrated model. Also included in Section 3 is a description of the simulations that were conducted to assess the components of the remedy. Section 4 provides the conclusions from the study. Section 5 the limitations of the model.

Section 2

Conceptual Hydrogeologic Model

2.1 Regional Setting

The Site is located in southern central Long Island along the west shore of the Patchogue River, which flows from Great Patchogue Lake north of the Site to the Patchogue Bay section of the Great South Bay of Long Island. The outflow of Great Patchogue Lake flows through a system of culverts and engineered channels beneath Holbrook Road and West Main Street before entering its stream channel, approximately 300 ft. east of the northeastern corner of the Site. The Patchogue River enters a tidal inlet of Patchogue Bay approximately one quarter mile south-southeast of the Site.

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 below ground surface (bgs), which was the depth of the deepest borings drilled during the Site investigation activities. Based on regional information, a unit referred to as the Gardiners Clay underlies the outwash deposits. It is estimated that this unit is approximately 100 to 200 feet below grade on the vicinity of the Site (Weiss, 1954).

2.2 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 ft. bgs. Groundwater flow is toward the south-southeast direction and discharges to the Patchogue River. The calculated vertical hydraulic gradients between the fill and outwash are very low, indicating that there is no apparent hydraulic separation between these two deposits. Thus, this supports the conclusion that the fill and outwash are considered as components of the same hydrostratigraphic unit, i.e., they are part of the same water-bearing zone.

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.

Section 3

Groundwater Flow Model

This section of the report documents the development of the groundwater flow model and its use for the assessment of components of the selected remedy. Discussed below are the following topics:

- Model construction;
- Calibration of the model to current Site conditions;
- A sensitivity analysis to assess uncertainty in the model results; and
- Model simulations to assess components of the remedy, specifically implementation of ISS of subsurface materials, and possible dewatering requirements for soil excavation.

3.1 Model Construction

The Modular Three-dimensional Finite Difference Groundwater Flow Model (MODFLOW) was selected for the groundwater flow simulation. This modeling code was developed by the United States Geological Survey (McDonald and Harbaugh, 1988) in the early 1980's based on theoretical flow behavior defined by Darcy's Law. The MODFLOW code is well proven and is 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. The specific version of MODFLOW used was MODFLOW 2000, and the graphical user interface used to input the model components into the model was Groundwater Vistas 6 from Environmental Simulations, Inc.

Site data, including in situ hydraulic conductivity test (slug test) results, characteristics of subsurface deposits described in borings, and water elevation data collected from the monitoring wells, were used to construct and calibrate the model. These data and information are available in the following documents:

- Section 2 of this Remedial Design Report;
- "Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York (Brown and Caldwell, February 2012);
- "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);
- "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York", (TetraTech EC, Inc., December 2009); and
- "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).

Also incorporated into the development of the model were publicly available regional data, where available, such as the USGS Digital Elevation Model (DEM) data to provide regional surface topography and characteristics of the adjacent Patchogue River and nearby Great Patchogue Lake. Also utilized were the National Hydrography Dataset (maintained by USGS) and the National Land Cover Database (maintained by the Multi-Resolution Land Characterization [MRLC] consortium).

3.1.1 Model Domain

The model domain (Figure 3-1) consists of a grid of 129 columns and 218 rows that includes the active model area that is approximately 1.94 square miles in extent. The Site is located near the center of the grid. The columns and rows vary in dimensions with the smaller sizes (as small as 12.5 feet by 12.5 feet) coincident with the area of the Site to provide a higher model resolution within the area of interest (Figure 3-2). The eastern edge of the model is bounded by the presumed hydrogeologic divide associated with the topographic divide between the Patchogue River and its associated tidal inlet and Swan Lake and its associated tidal inlet to the east. The western edge of the model domain is bounded by West Lake, along with the outlet of West Lake to Patchogue Bay and the upgradient streams that flow to it. The southern edge of the model is formed by Patchogue Bay itself. The Northern model boundary is comprised of a combination of tributary ponds and streams that feed into Great Patchogue Lake as well as arbitrary connections to the adjacent boundaries to the east and west.

The surface elevations of the model outside of the Site were derived from the USGS Digital Elevation Model while Site survey data was utilized to determine the surface elevations on the Site itself. These values were interpolated using the kriging method to create a continuous surface that was imported to the top of the uppermost model layer using utilities in the modeling software. The model was constructed with six layers (Figure 3-3). These layers were incorporated into the model to represent significant depths for the selected remedial measures that were to be evaluated with the model. Two hydrostratigraphic layers were simulated within the model: Fill materials were represented with Layer 1 and the glacial outwash deposits were represented using the underlying 5 layers (Layers 2 through 6). The alluvial deposits that locally occur between the Fill and the outwash deposits, as described in Section 2.2, were not represented in a separate model layer because they are thin and discontinuous and often have properties similar to the overlying and underlying deposits. Further, as discussed in Section 2.3, there is no apparent hydraulic separation between overlying Fill and the underlying outwash deposits. So, although the Fill and outwash have somewhat different hydraulic conductivities, they are considered as components of the same water-bearing zone, and the intervening alluvial deposits, where present, do not provide hydraulic separation between the Fill and the outwash. The thicknesses of the model layers were set to constant values so that all simulated remedial measures would be represented at consistent depths below grade. The bottom of the model was assigned a depth of 150 ft. below surface grade based on an estimate to the top of the Gardiners Clay unit which underlies the glacial outwash deposits (i.e., the “Upper Glacial Aquifer”) in the vicinity of the Site (see Section 2.2).

3.1.2 Boundary Conditions

Boundary conditions are simulations of natural and artificial features, such as lakes, streams, drains, extractions wells, surficial recharge, etc., that control water entering and leaving the model domain. The boundary conditions for this particular model are described below.

Inflow of Water. The flow of water into the model was simulated by applying a surface recharge boundary to the topmost layer of the model. Rather than apply a singular recharge value to the model, surface recharge was varied based on land use. Four different recharge values were used; the spatial configuration of the recharge zones was determined by overlaying the National Land Cover Database maps for the area over the model domain.

The table below presents recharge values that were assigned to the land use types occurring within the model domain. During construction of the model, initial estimates of recharge were based on professional judgment through the assessment of land use and land surface characteristics, consistent with the approach in “A Method for Evaluating Ground-Water-Recharge Areas in New Jersey” (NJDEP/NJGS, 1993). Adjustments were then made to these values (as presented below) during model calibration to improve the match with Site-specific conditions measured at the Site.

Table 3-1. Modeled Recharge Values	
Land Use	Recharge (inches/year)
Surface Water Bodies	0.00
Commercial and Services	6.00
Residential	7.20
Forested Land	12.00

The distribution of recharge over the model domain is presented on Figure 3-4. The total annual incident precipitation in the area of the model is approximately 46 inches. It was assumed that all surface water bodies, including streams, rivers, lakes and wetlands are primarily locations of groundwater discharge and, as a result, no recharge was assigned to these areas. Commercial and service industry properties were assigned a recharge value of 6.0 in/yr, consistent with a high percentage of impervious surface areas such as asphalt pavement and building structures with storm-water management systems. Residential areas were assigned a recharge value of 7.2 in/yr, consistent with a generally higher proportion of relatively permeable land surface areas such as grassy areas compared to commercial properties. The model domain also includes a small area of forested land which was assigned a recharge rate of 12 in/yr consistent with a fully vegetated area.

Outflow of Water. Two types of boundary conditions were applied to the model to account for the outflow of water from the model: river boundaries and constant head boundaries. River boundaries were included to represent the Patchogue River adjacent to the Site as well as numerous small streams found within and along the edges of the model boundary. Constant head boundaries were used to represent larger still bodies of water such as Great Patchogue Lake and Patchogue Bay as well as several smaller ponds located along the edges of the model domain (Figure 3-5).

The constant head boundaries representing Great Patchogue Lake, Patchogue Bay and the smaller ponds within the model boundary were set to constant elevations estimated from topographic maps and the USGS digital elevation model. Great Patchogue Lake was set to a constant elevation of 9 ft. above mean sea level. Patchogue Bay was set to mean sea level to represent an average bay elevation over the tidal cycle.

The river boundaries that were used to model the Patchogue River were assigned elevations by a combination of data from stream gauges and estimates from topographic data. Adjacent to the Site the river elevations were determined using the measured elevations at the stream gauges SG-1 and SG-2 in July 2012. Downstream from the Site a linear gradient was used to gradually reduce the stream stage to mean sea level as it enters the inlet of Patchogue Bay. Numerous other small streams were simulated along the western and northern edges of the model domain were simulated using river boundary cells with stage elevations estimated by using a linear gradient between the elevations of the constant head boundaries at either end of the stream, or from topographic elevation data when no constant head boundary was located upstream of the stream.

3.1.3 Hydrogeologic Properties

Horizontal hydraulic conductivity values used in the for the Fill and outwash were based on results from the slug testing of wells or piezometers screened discretely in either the Fill or in the outwash (see Table 2-3 in Section 2 of the Remedial Design report). A horizontal hydraulic conductivity of 0.00714 cm/sec was used to represent the Fill materials modeled in Layer 1; this value is the geometric mean of the estimates from the slug tests conducted on the piezometers screened in the Fill. A horizontal hydraulic conductivity of 0.0377 cm/sec was used to represent the outwash deposits in Layers 2 through 6; this value is the geometric mean of the estimates from the slug tests conducted on wells and piezometers screened in the outwash. The vertical hydraulic conductivity was estimated by

multiplying the horizontal hydraulic conductivity in each unit by a factor of 0.3; this anisotropy in hydraulic conductivity is primarily due to the layering of the deposits. Thus, the vertical hydraulic conductivity values used in the model for the Fill and the outwash deposits were 0.00238 and 0.0126 cm/sec, respectively.

3.2 Model Calibration

The groundwater flow model was calibrated under steady state conditions by comparing model-calculated groundwater levels to monitoring well and stream gauge levels measured in July 2012 from the Site. To obtain the best-fit correlation between model-calculated water levels and measured water levels, the hydraulic conductivity of the units, the recharge values and the bed conductance of the river cells representing the Patchogue River were subjected to adjustments; these adjustments were made within the range of values expected for the type of deposit or land cover.

A plot comparing the measured (observed) groundwater head elevations to model-calculated groundwater heads, as well as statistics to evaluate the degree to which the model values match the observed values are provided in Figure 3-6. These statistics indicate that model-calculated groundwater elevations in the final calibrated model match well to actual groundwater and stream gauge elevation measurements obtained in July 2012. This comparison yields a high correlation coefficient of 0.962, a mean absolute error of 0.23 feet, and a normalized root mean square error (RMS) of 6.9%, all considered indicators of a reasonable match between modeled and observed values.

The calibrated groundwater head equipotential contours for Layer 2 (4 to 9 ft. below ground surface) are displayed in Figure 3-7. Figure 3-8 provides a head equipotential cross-section along the eastern edge of the Site from Great Patchogue Lake to Patchogue River where the river meanders toward the southwest directly south of the Site.

3.3 Model Sensitivity

To determine the degree of uncertainty associated with the calibrated model, a sensitivity analysis was performed by varying the hydraulic conductivity values (both horizontal and vertical) in the model by factors of 0.1 through 10. The recharge zone values were also varied by factors of 0.2, 0.5, 2, and 5 to gauge the model's sensitivity to variations in recharge. Full order of magnitude variations in recharge were not evaluated since values of recharge typically vary over a smaller range than the ranges of hydraulic conductivities. Recharge values for forested land were not included due to their small footprint and the distance of the forested land from the Site (see Figure 3-4). For each variation of the model, the resulting normalized root mean squared error is presented in the table below. The calibrated model has a normalized root mean squared error of 6.9% and is represented by the center "1" multiplier column. A value higher than 6.9% would represent a condition with overall higher error between the observed and modeled groundwater elevations than in the calibrated model, while a value smaller than 6.9% would represent a condition with less overall error than the calibrated model.

Table 3-2. Sensitivity Analysis – Normalized Root Mean Squared Error (%)							
	Multiplier						
Variable	0.1	0.2	0.5	1	2	5	10
Horizontal Hydraulic Conductivity - Fill	6.6%	6.7%	6.8%	6.9%	7.2%	7.9%	8.9%
Vertical Hydraulic Conductivity – Fill	16.5%	10.8%	6.9%	6.9%	7.7%	8.5%	8.8%
Horizontal Hydraulic Conductivity – Glacial Outwash	21.8%	18.0%	10.8%	6.9%	9.4%	16.8%	22.4%
Vertical Hydraulic Conductivity – Glacial Outwash	7.8%	7.8%	7.4%	6.9%	6.9%	7.7%	8.6%
Residential Area Recharge	--	6.9%	6.9%	6.9%	7.0%	7.1%	--
Commercial Area Recharge	--	6.9%	6.9%	6.9%	7.0%	7.5%	--

These statistics indicate that the groundwater model is most sensitive to horizontal hydraulic conductivity variations within the glacial outwash deposits, and to variations in the vertical hydraulic conductivity of the fill deposits. The sensitivity to horizontal hydraulic conductivity in the glacial outwash deposits is expected given the predominately horizontal flow direction observed at the Site through this unit. The analysis indicated that the model is not highly sensitive to variations in recharge. This is likely due to the proximity of Great Patchogue Lake and the Patchogue River to the Site; the gradient between these two features is the principal controlling mechanism for groundwater flow across the Site. Increases in recharge raise the overall groundwater heads across the Site resulting in moderate sensitivity to increases in these values, but the overriding gradient between the two nearby surface water bodies places an effective "floor" on how low head values on the Site can fall with reductions in recharge, thus limiting sensitivity of the model to decreases in recharge values. While some variations produced statistically slightly better results than the calibrated model, such as decreases in the horizontal hydraulic conductivity of the Fill, these variations were judged to be outside the reasonable range of values for these deposits given the hydraulic conductivity testing that has been performed at the Site.

3.4 Assessment of Remedy Components

3.4.1 Simulation of ISS Implementation

Provided below is a discussion of the modifications that were made to the calibrated model to simulate implementation of in-situ solidification (ISS) treatment in the subsurface, followed by the results of the simulation.

Model Modifications. To simulate the effects of the ISS treatment on groundwater heads (i.e., elevations) and groundwater flow, the volume (area and depths) of the subsurface to be treated using ISS was simulated into the model. The ISS depth intervals depicted in Figure 2-1 of the Remedial Design Work Plan (Brown and Caldwell, February 2012) were consolidated into two depth zones. The areas where ISS is planned to be conducted to total depths of 7, 8 and 13 ft. were combined to be a single area where ISS would be simulated to a total depth of 13 ft. below grade. The areas where ISS is planned to be conducted to 21 and 23 ft. were combined into a single area where ISS would be conducted to 23 ft. below ground surface. The hydraulic conductivities within the two areas and their

respective depth intervals were modified to a value of 1 x 10^{-6} cm/sec. The hydraulic conductivities in the cells in Layer 1, which extends from 0-4 ft. below ground surface, were not modified from those in the calibrated model. In this 0-4 ft. depth interval, the material treated using ISS will be removed and replaced with clean fill which is anticipated to have a hydraulic conductivity similar to the existing fill. Following these model modifications, the updated model was run under steady-state conditions using the output of the calibrated base model as the starting head conditions in order to simulate groundwater flow conditions following implementation of ISS. The results of this simulation are provided below.

Simulation Results. The model simulations indicate that implementation of ISS as described results in only minor changes in head (i.e., water table elevations) at the Site relative to existing conditions. The relatively high hydraulic conductivity of the material above, below and surrounding the ISS treated materials minimize the resulting changes in groundwater heads. Particle tracking conducted using the MODPATH software package indicates that despite a lack of significant head changes, groundwater flow directions are altered significantly by the presence of the ISS treated material. Particles deflect around the ISS treated area, with most flowing laterally around the treated area. Several particles tracked also flowed above or below the treated area. Representative groundwater equipotential contours (for Layer 2, positioned 4 to 9 ft. bgs), and example particle traces for the simulations that include the ISS treated volume are included in Figure 3-9.

3.4.2 Transient Dewatering Simulations

For the off-Site area directly east of the Site where excavation of impacted soils is planned, consideration is being given to the use of a slide-rail shoring system. To initiate installation of this system, the upper five feet below ground surface must be unsaturated, i.e., the water table must be at or deeper than five feet bgs. The typical water table is estimated to be at a depth of approximately 2.5 feet bgs in the area planned for excavation. Thus, the water table in the area would need to be lowered by approximately 2.5 feet via dewatering in order to initiate the installation of the slide-rail shoring system. However, it is possible that at times the water table may be closer to the ground surface. In this case, the water table may need to be lowered by up to 5 feet to initiate installation of the slide-rail shoring system. For the evaluation, it was assumed that the overall area would be excavated in 25 ft. by 25 ft. area increments. Provided below is a discussion of the modifications that were made to the calibrated model to simulate dewatering to allow installation of the slide-rail shoring system to be initiated, followed by the results of the dewatering simulations.

Model Modifications. To evaluate the amount of dewatering required to achieve the specified water level drawdown in each 25 ft. by 25 ft. area increment of the excavation, the calibrated groundwater model was modified to run as a short term transient simulation. The modified model utilized the head values that were calculated from the calibrated model as an initial condition. Four constant flux boundaries were then included in the model in Layer 4, which is positioned from 13-23 ft. bgs to simulate the function of dewatering wells. The actual specifics on the configuration and number of dewatering wells (e.g., multiple small diameter well points, several larger diameter wells, etc.) were not required for this analysis. This depth interval was chosen to provide a sufficient saturated thickness such that the constant flux model cells would not be dewatered during the simulation.

Simulation Results. For the scenario to achieve five feet of drawdown in each 25 ft. by 25 ft. excavation increment, each of the four constant flux boundaries was set to remove ~80.5 gallons per minute (GPM) from the model for a combined rate of ~322 GPM. This rate was maintained for a period of 24 hours with the required 5 ft. of drawdown in the center of the 25 by 25 ft. area being achieved at ~24 hours after pumping begins. Once the 5 ft. of drawdown is achieved the pumping rate at each of the constant flux boundaries must be maintained at ~75.3 GPM (total pumping rate of ~301.3 GPM) to prevent heads from rising within the designated area. It is important to note that this is a non-unique solution and similar results may be achieved by extracting groundwater at a higher rate for a shorter initial drawdown

period, or at a lower rate for a longer initial drawdown period. In the case described above the simulated dewatering removed approximately 463,680 gallons in the initial 24-hour period and an additional ~433,872 gallons for each full day thereafter. Cessation of pumping results in rapid water level recovery with ~90% recovery expected in the first 24 hours. A plot of the expected groundwater elevations in a simulated well in the center of the dewatered area is included in Figure 3-10.

Simulations indicate that establishing 2.5 feet of drawdown in each 25 ft. by 25 ft. excavation increment requires a total combined pumping rate of 172.5 GPM for the initial 24 hours. Following the initial 24 hours a combined pumping rate of 157.9 GPM is required to maintain 2.5 ft. of drawdown. In this case the simulated dewatering wells remove approximately 248,353 gallons in the initial 24-hour period and an additional ~227,408 Gallons each full day thereafter. A plot of the expected groundwater elevations in a simulated well in the center of the dewatered area in the 2.5 ft. drawdown scenario is included in Figure 3-11.

Section 4

Conclusions

The following conclusions were made based on the groundwater flow modeling study:

- Implementation of ISS treatment of subsurface materials as planned should result in only very minor changes in head (i.e., water table elevations) at the Site relative to existing conditions. The relatively high hydraulic conductivity of the material above, below and surrounding the ISS treated materials minimizes the resulting changes in groundwater heads.
- Despite a lack of significant head changes, groundwater flow directions are altered substantially by the presence of the ISS treated material relative to existing conditions. Groundwater flow paths are expected to deflect around the ISS treated volume, with most flowing laterally around the treated area, and some flowing above or below the treated area.
- Assuming that the excavation to remove soil in the off-Site area adjacent to the Site would be conducted in 25ft by 25ft area increments, the estimated rate and duration of dewatering to provide for the necessary 5 feet of unsaturated soil to allow for the initiation of the installation of the slide-rail shoring system being considered are as follows:
  - If the water table is positioned at approximately 2.5 ft. below grade, an initial pumping rate of approximately 173 GPM is required for the first 24 hours to achieve the 2.5 feet of water level drawdown, and once established, a pumping rate of 158 GPM is required to maintain this level of drawdown.

    If the water table is positioned at approximately the ground surface (i.e.,0 ft. below grade), an initial pumping rate of approximately 322 GPM is required for the first 24 hours to achieve the 5 feet of water level drawdown, and once established, a pumping rate of 301GPM is required to maintain this level of drawdown.

  It is important to note that this is a non-unique solution and similar results may be achieved by extracting groundwater at a higher rate for a shorter initial drawdown period, or at a lower rate for a longer initial drawdown period

Section 5

Limitations

This groundwater model, like all others, cannot simulate groundwater behavior with absolute certainty, but rather provides an estimate of flow behavior based on the current understanding of subsurface conditions at the Site. Missing information, or data gaps, is addressed to the extent possible using assumptions that are based on general geologic principles, regional geologic data where available and ascertainable, or information generated from studies performed in like settings that are documented in the scientific literature. The use of these non-direct sources of data creates a level of uncertainty, as conditions may be different from those assumed. Sensitivity analyses have been performed in an attempt to quantify uncertainties. However, despite all efforts to reduce or quantify uncertainty, subsurface conditions may nonetheless exist that are not predictable and which could result in groundwater behave that is significantly different than that simulated by the groundwater model.

Section 6

References

Weiss, Lawrence 1954. Foraminifera and Origin of the Gardiners Clay (Pleistocene), Eastern Long Island, New York. U.S. Geological Survey Professional Paper 254-G.

Brown and Caldwell. February 2012 "Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York.

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

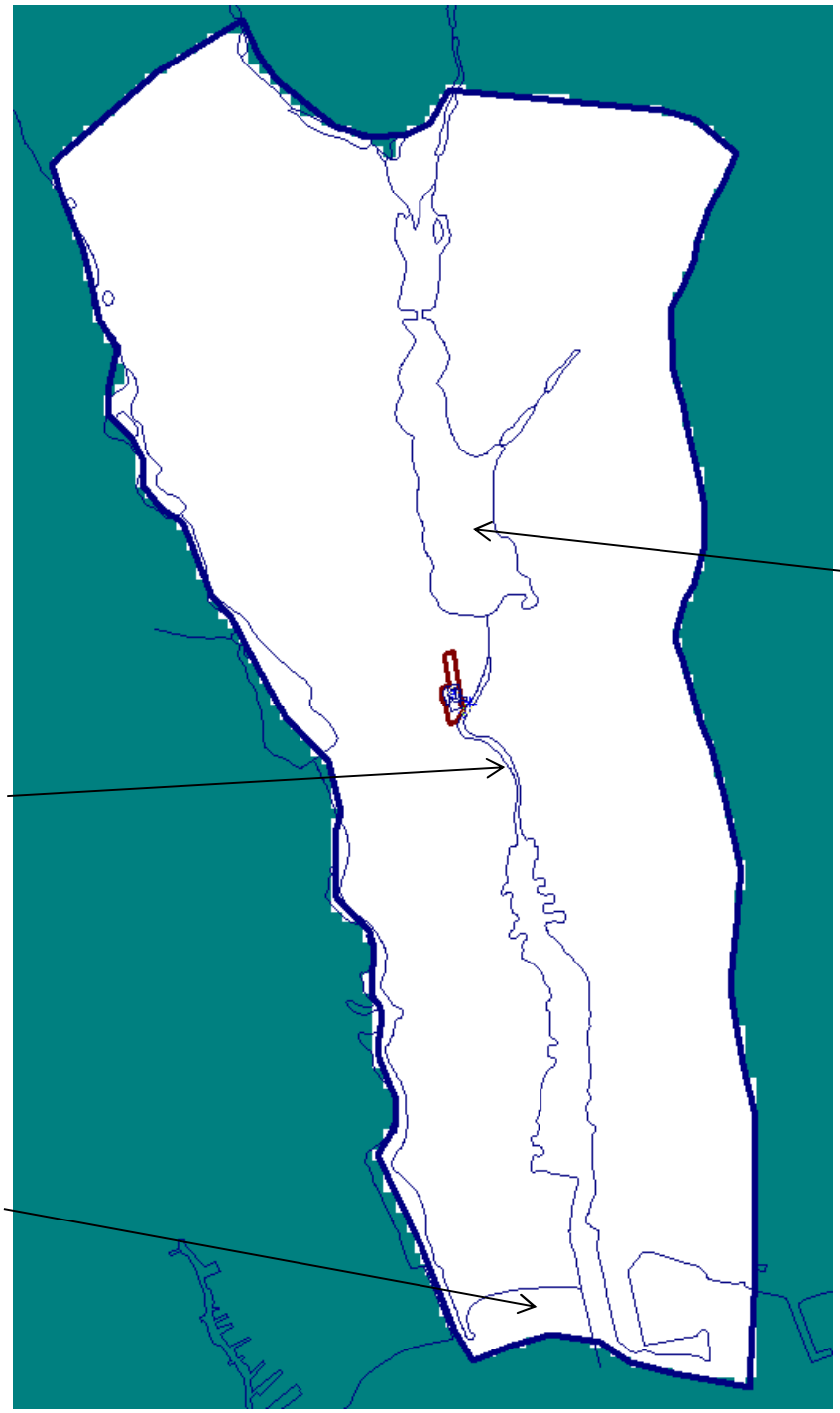
McDonald and Harbaugh, 1988 "A Modular, Three-Dimensional Finite-Difference Groundwater Flow Model," Techniques of Water-Resources Investigations, Book 6, U.S. Geological Survey.

New Jersey Department of Environmental Protection and Energy and the New Jersey Geological Survey, 1993. "A Method for Evaluating Ground-Water-Recharge Areas in New Jersey," New Jersey Geological Survey Geological Report GSR 32, 1993.

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

Vanasse, Hangen, Brustlin (VHB) March 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".

Figures



Inactive Cell

Property Outline

Model Domain Boundary

Surface Water Feature

Approximate Scale 0 1000 2000 FT

Figure 3-1

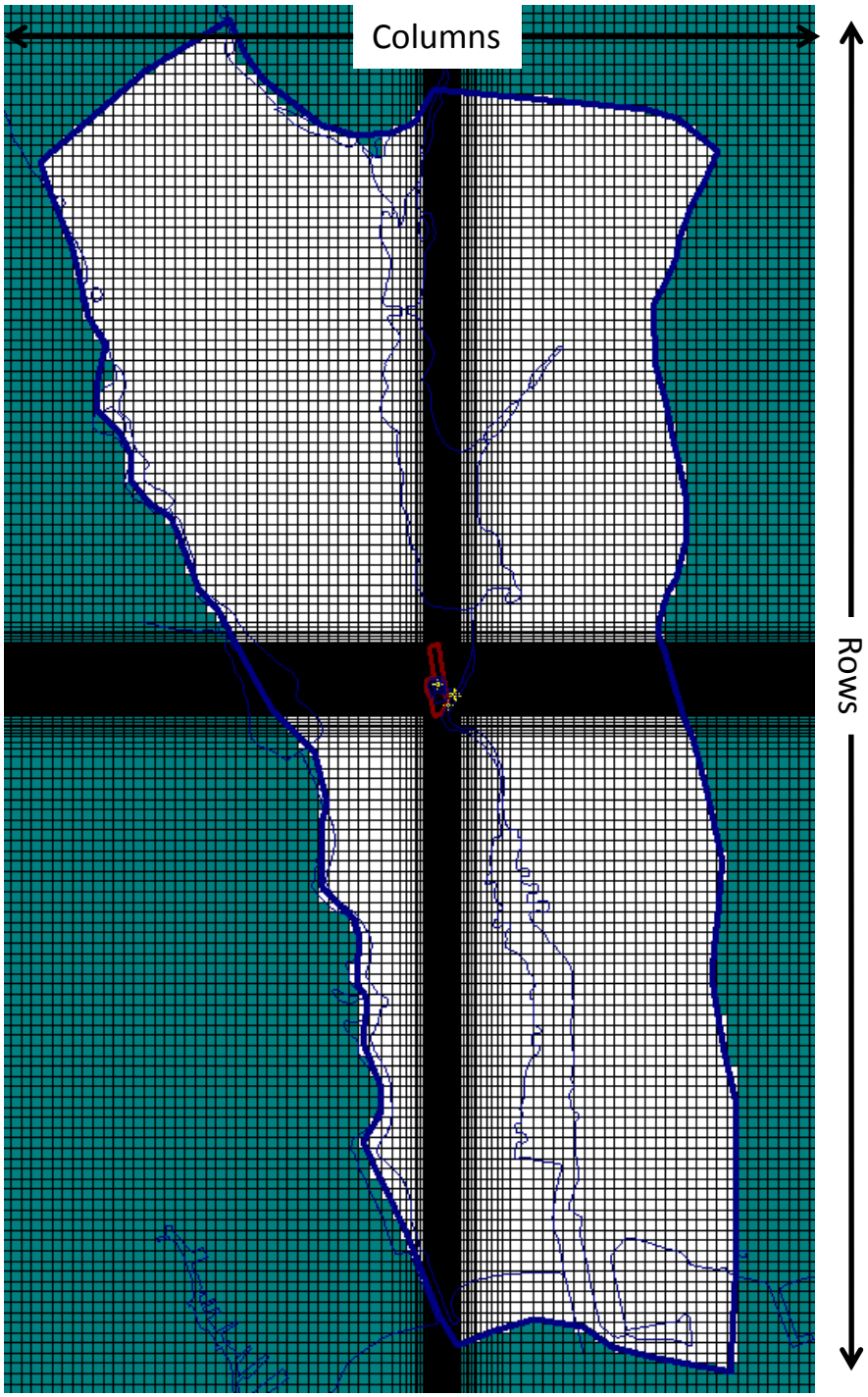
MODEL DOMAIN

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey



Inactive Cell

Model Gridlines

Property Outline

Model Domain Boundary

Surface Water Feature

Approximate Scale 0 1000 2000 FT

Figure 3-2

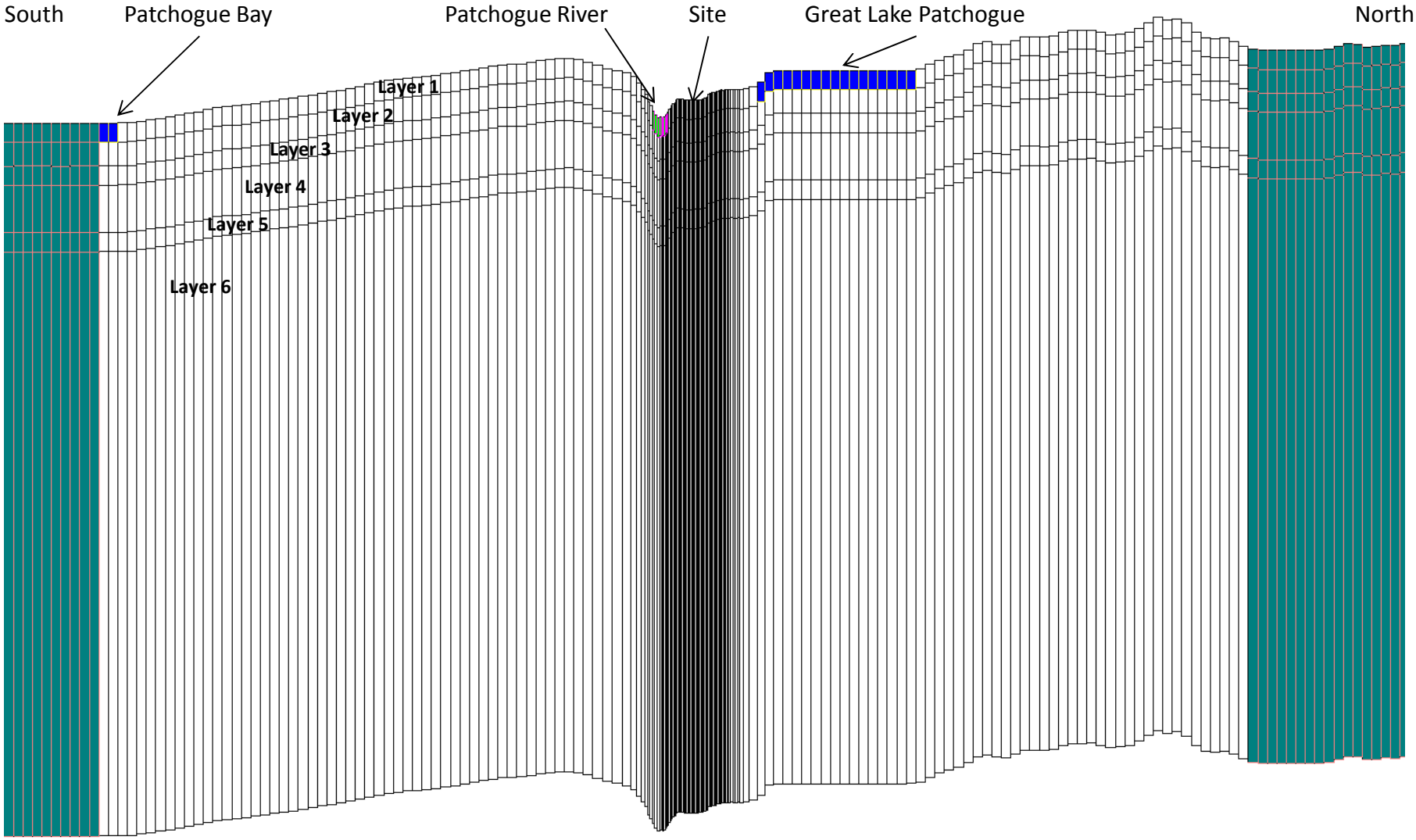
MODEL GRID

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey



Inactive Cell

Constant Head Boundary

Model Gridlines

River Boundary

Note: Cross-Section taken from Column 66 of the Groundwater Model
50 x Vertical Exaggeration

Figure 3-3

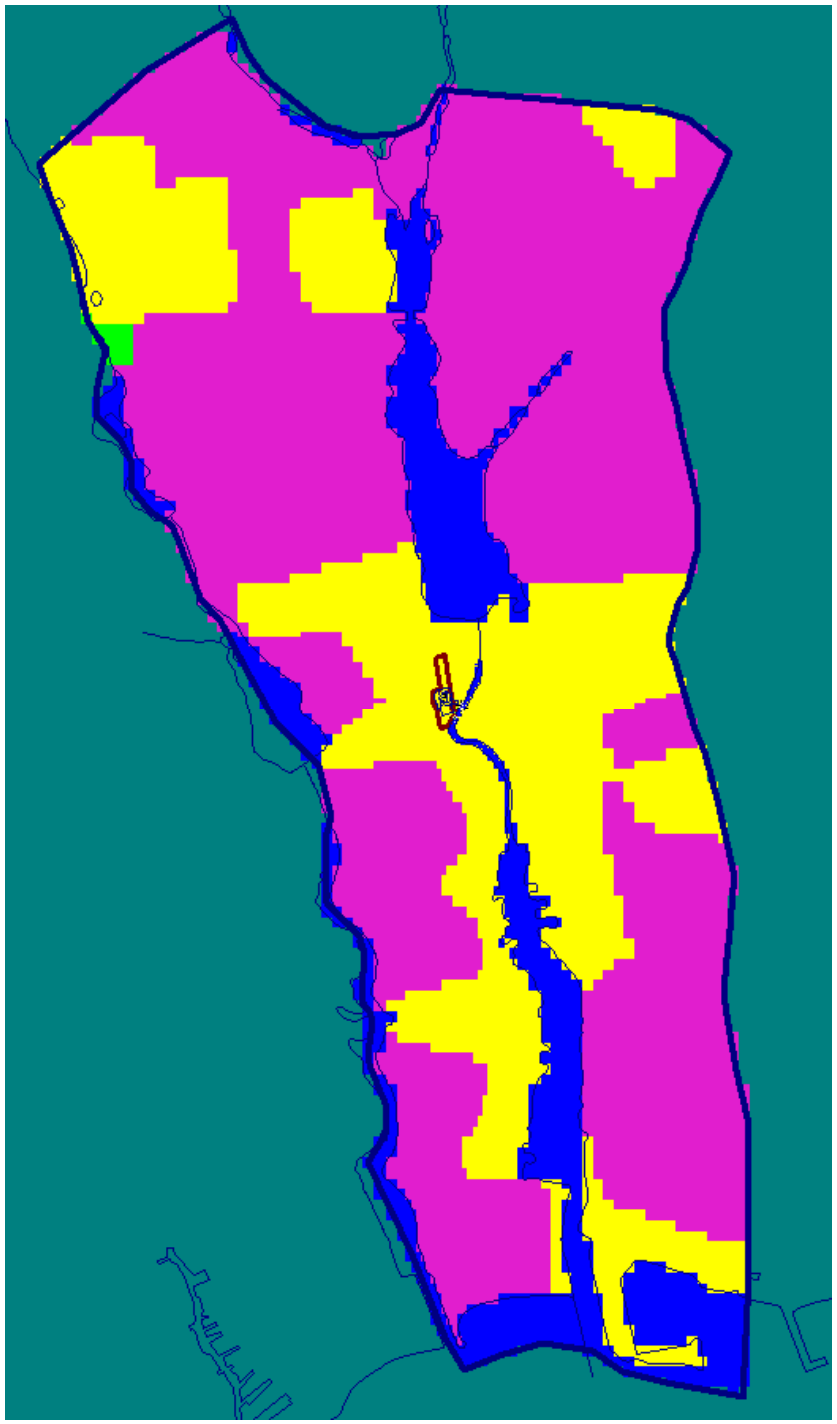
MODEL DOMAIN IN CROSS-SECTION

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey



Inactive Cell

Model Domain Boundary

Surface Water Body
0.00 in/yr

Commercial and Services
6.00 in/yr

Residential
7.20 in/yr

Forested Land
12.00 in/yr

Approximate Scale 0 1000 2000 FT

Figure 3-4

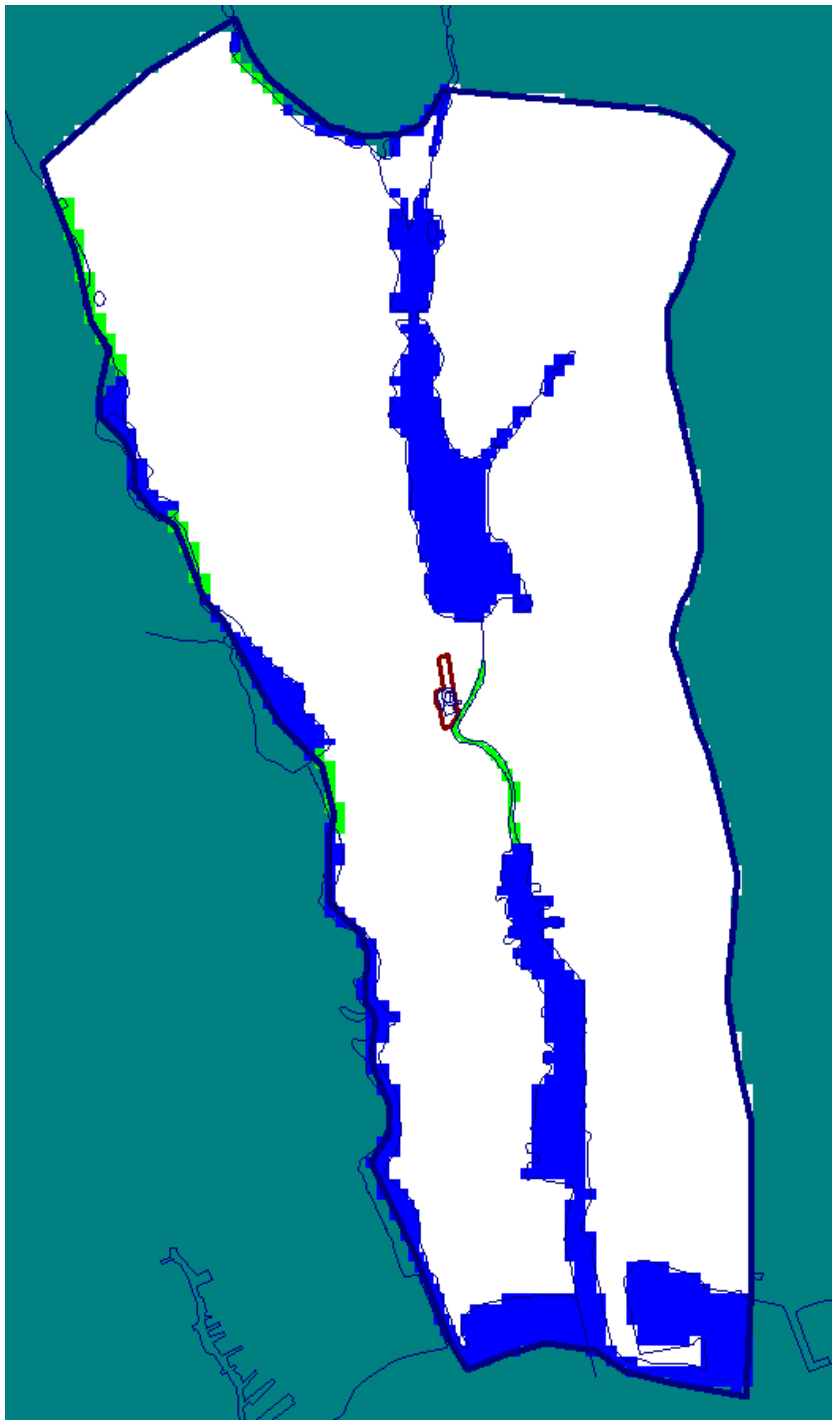
MODEL RECHARGE VALUES

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date
11/21/2012

Project Number
142128

Brown AND Caldwell
Allendale, New Jersey



Inactive Cell

Constant Head Boundary

River Boundary

Property Outline

Model Domain Boundary

Note: Constant Head and River Boundaries are only positioned in model layer 1. Inactive cells are in the same positions in all 6 model layers

Approximate Scale 0 1000 2000 FT

Figure 3-5

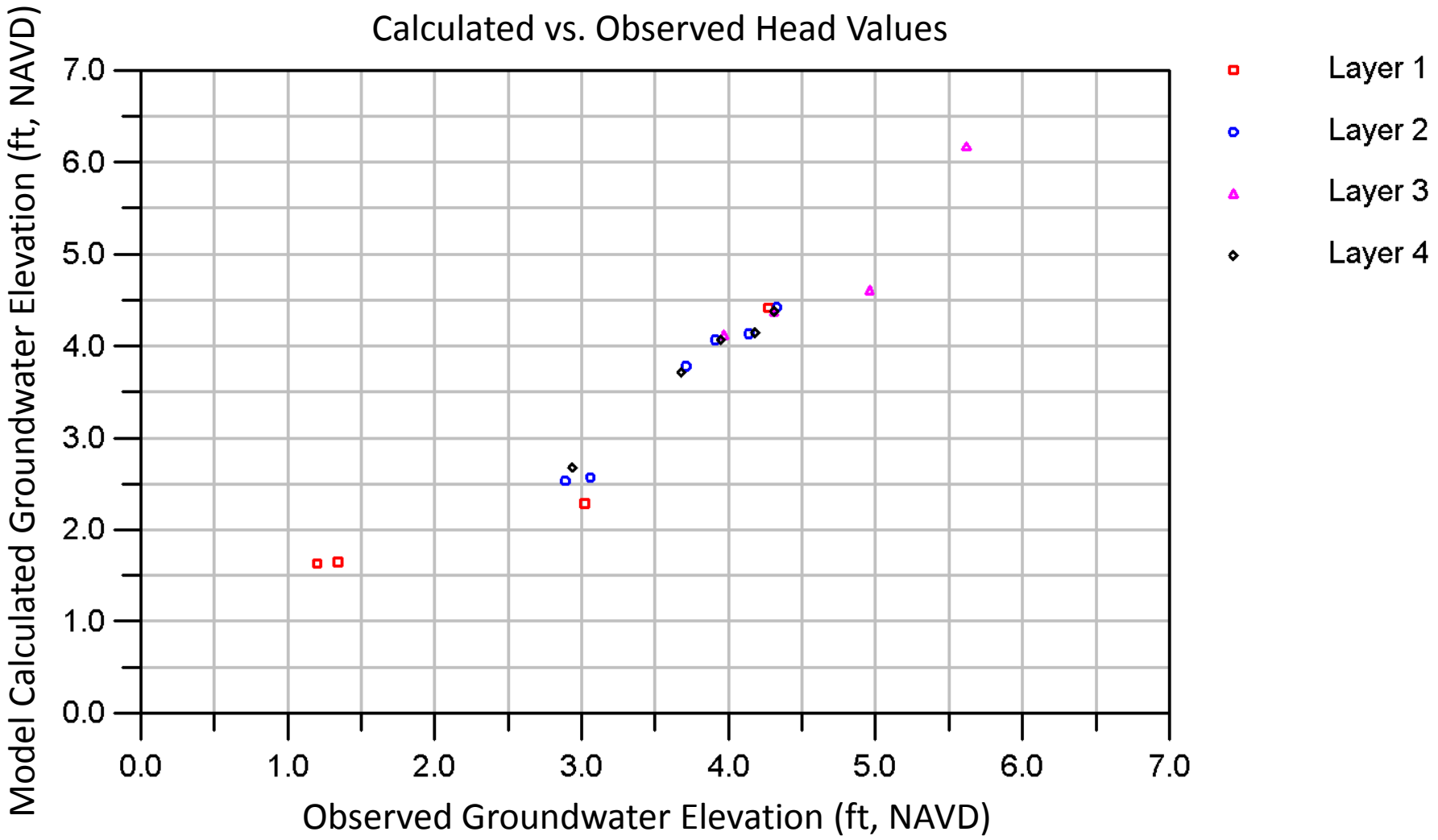
LAYER 1 BOUNDARY CONDITIONS

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142148

Brown AND Caldwell
Allendale, New Jersey



Absolute Residual Mean	0.23 ft
Residual Sum of Squares	1.78 ft^2
Maximum Absolute Residual	0.73 ft
Normalized Root Mean Squared Error	6.9 %
Correlation Coefficient	0.962

Note: Observed groundwater elevations measured in July 2012

Figure 3-6

CALIBRATION PLOT AND STATISTICS

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey

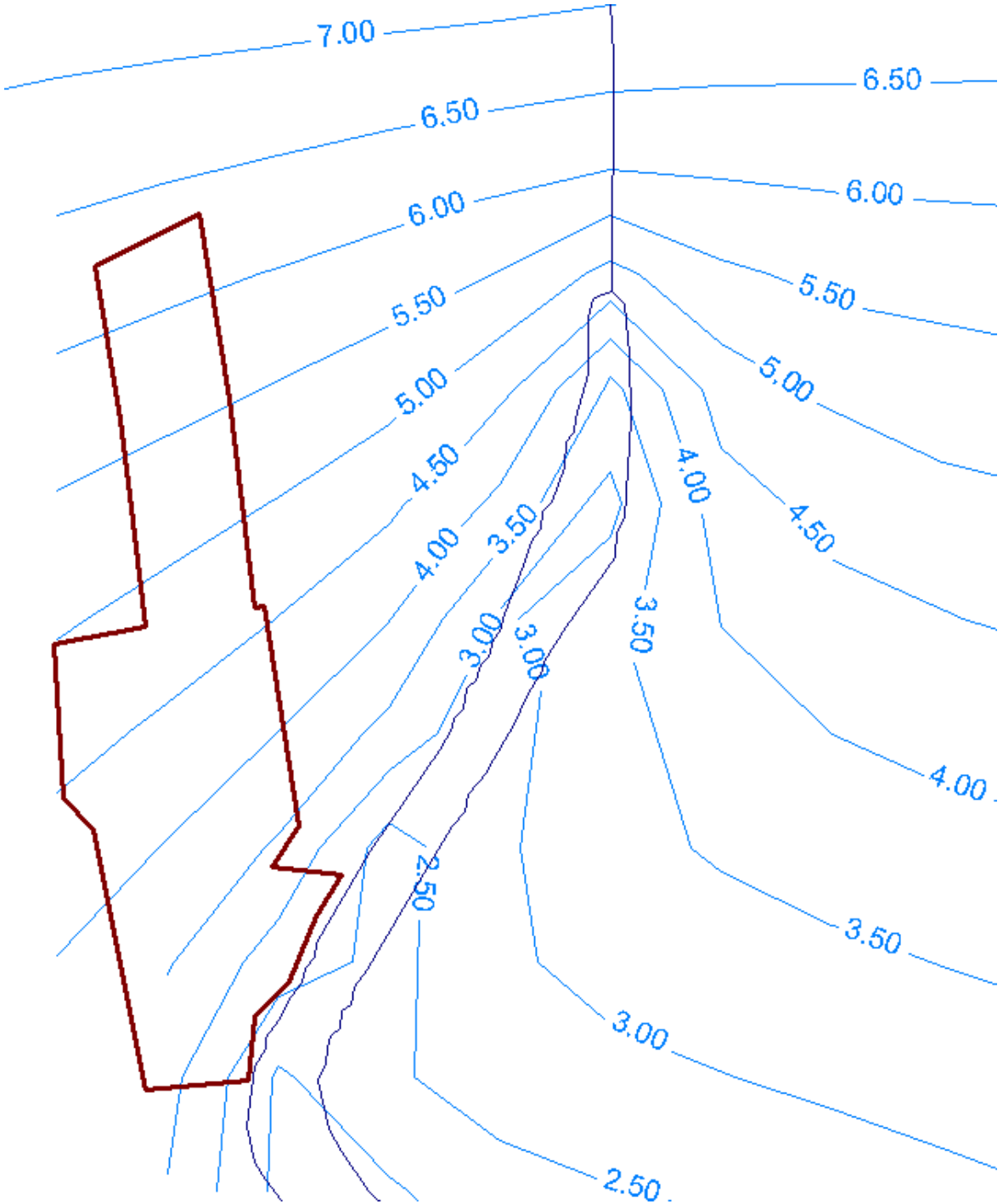


Figure 3-7

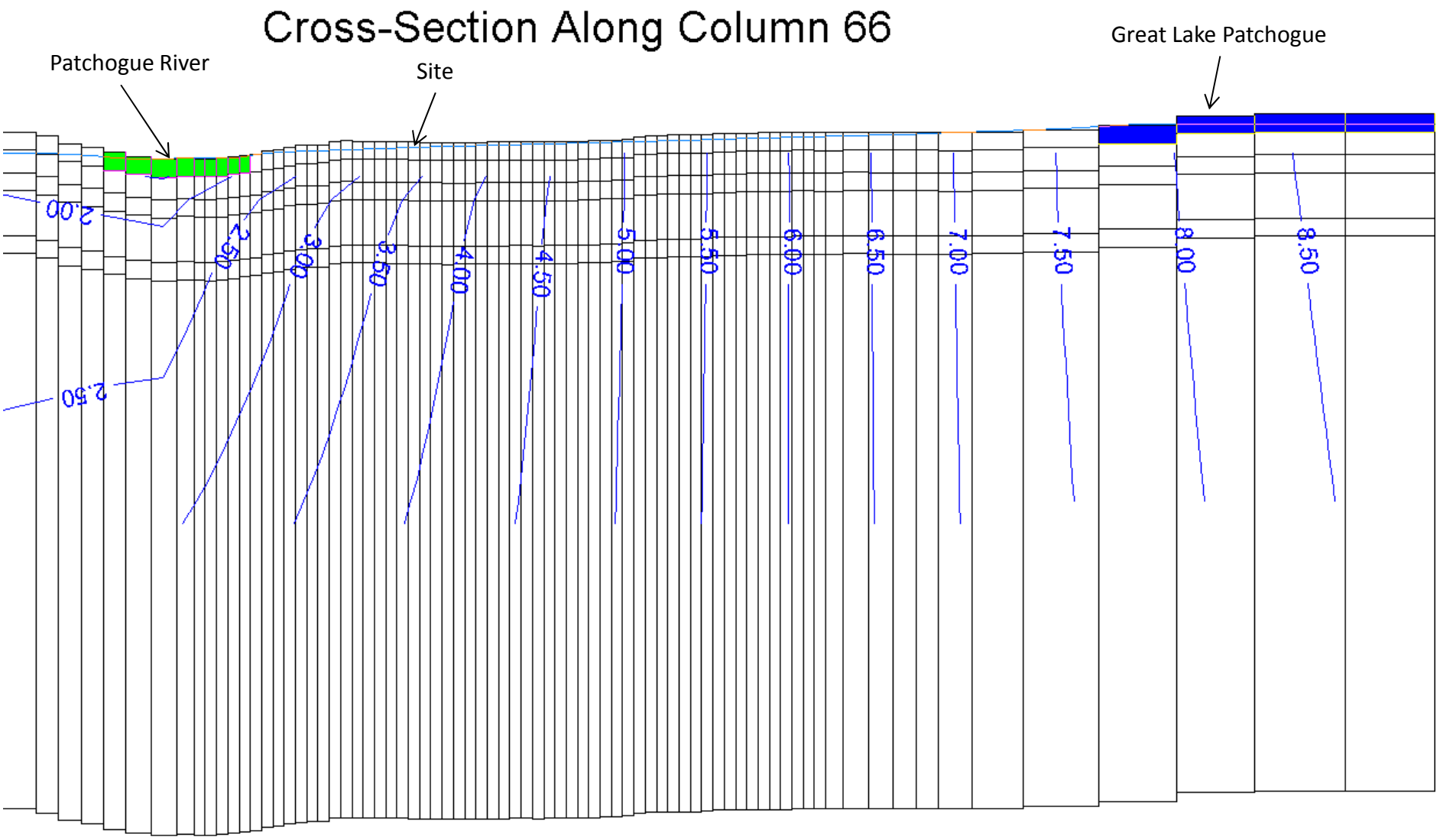
CALIBRATED MODEL (EXISTING CONDITIONS) GROUNDWATER ELEVATION CONTOURS, LAYER 2

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey



2.0 Groundwater Elevation Contour (ft. NAVD)

River Boundary

Constant Head Boundary

Note: Cross-Section taken from Column 66 of the Groundwater Model
5 x Vertical Exaggeration

Figure 3-8
CALIBRATED MODEL (EXISTING CONDITIONS)
MODEL CROSS-SECTION WITH
EQUIPOTENTIAL CONTOURS

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey

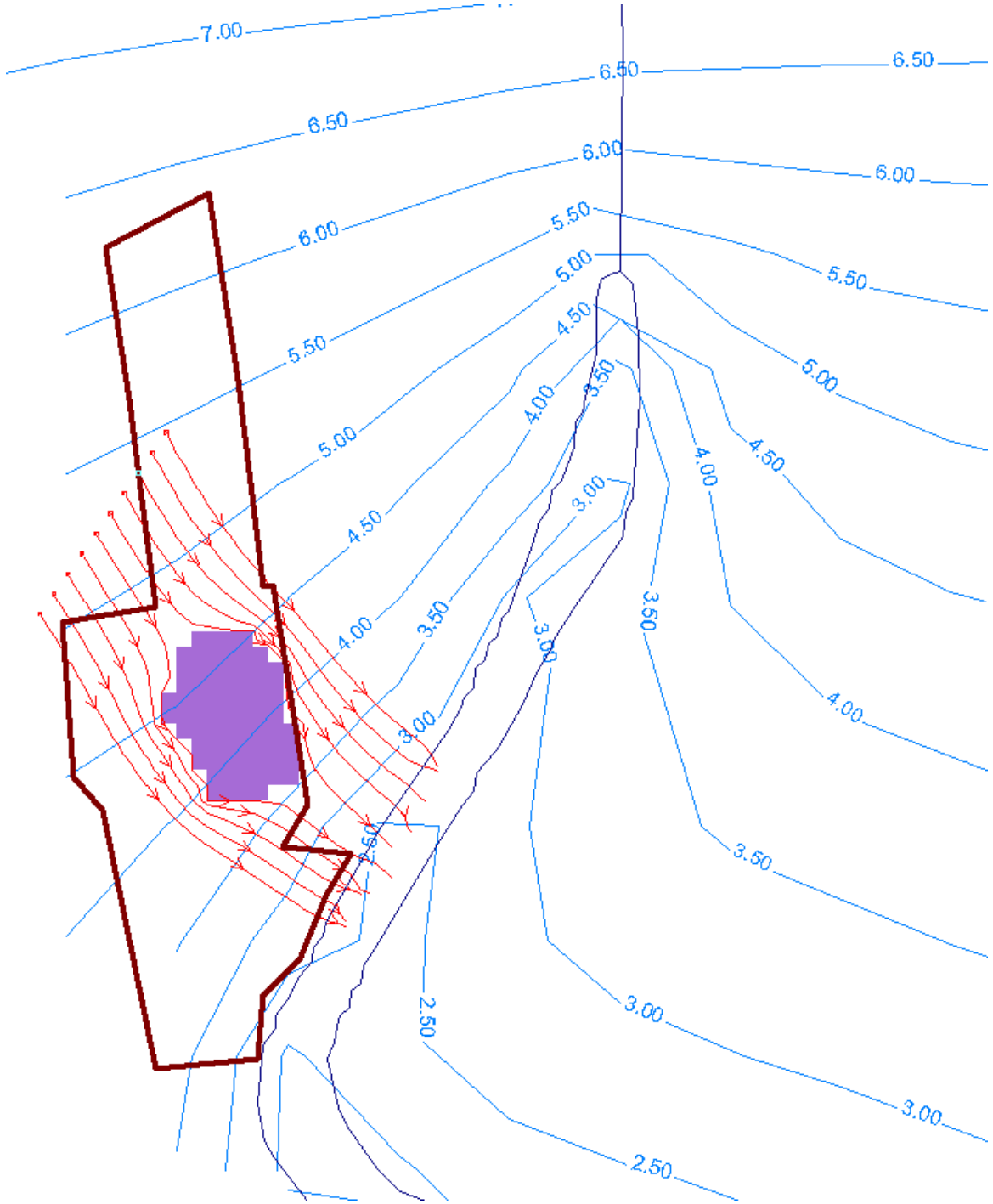


Figure 3-9

MODEL WITH ISS SIMULATION; GROUNDWATER ELEVATION CONTOURS AND FLOW PATHS, LAYER 2

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey

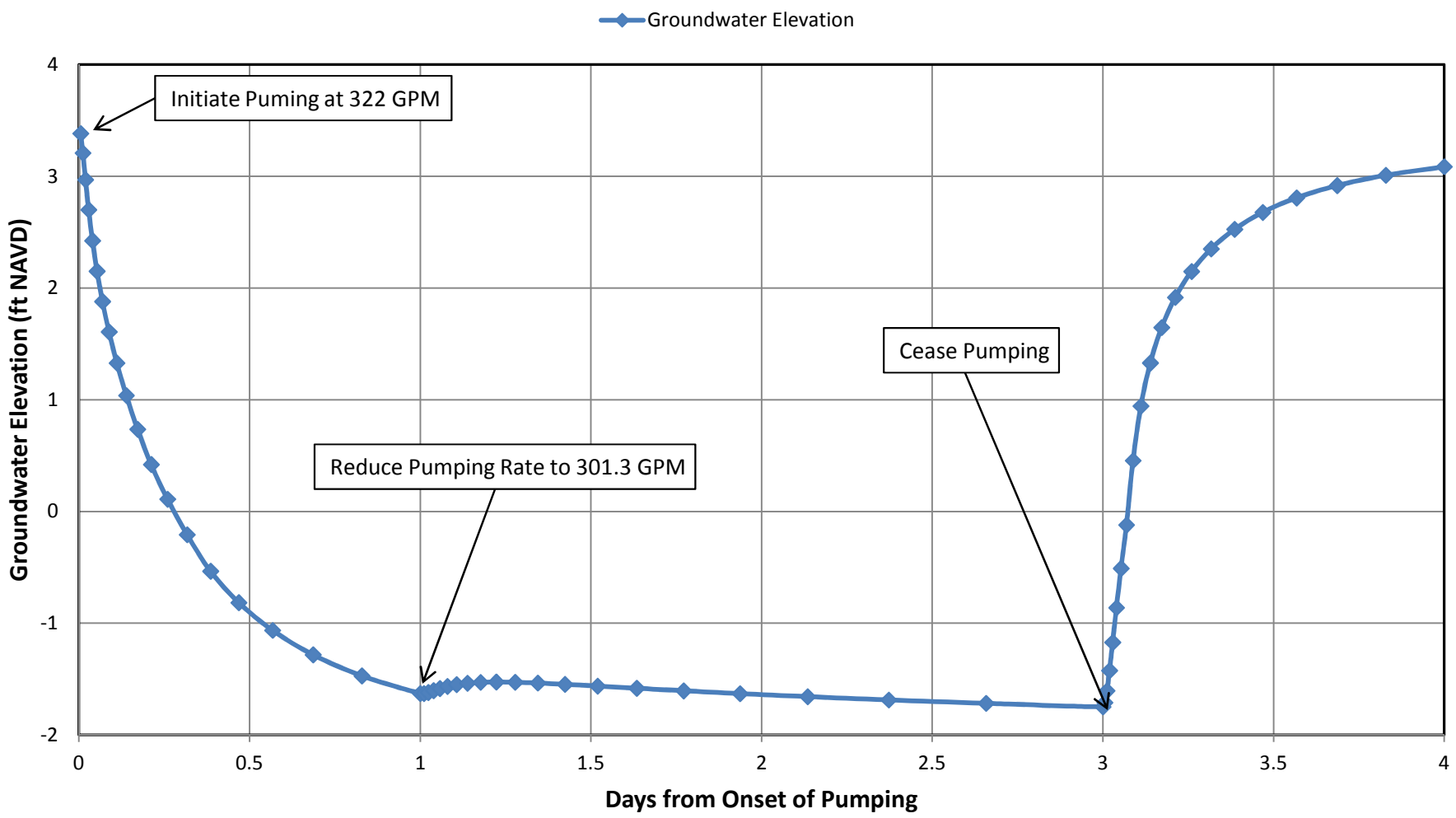


Figure 3-10

SIMULATED DEWATERING FOR INSTALLATION OF SLIDE RAIL SYSTEM – 5 FOOT DRAWDOWN

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey

Groundwater Elevation in Dewatering Area

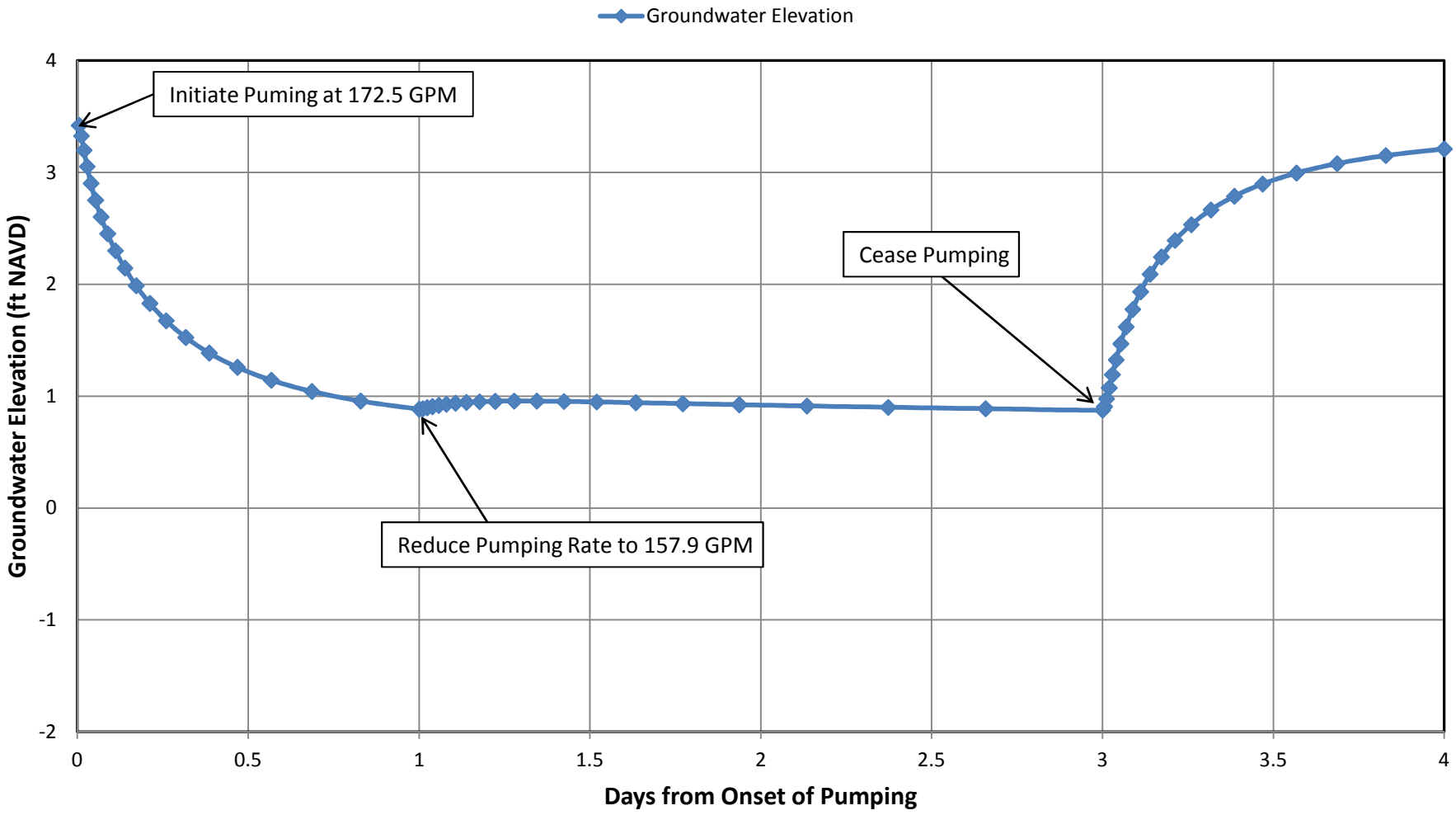


Figure 3-11

SIMULATED DEWATERING FOR INSTALLATION OF SLIDE RAIL SYSTEM – 2.5 FOOT DRAWDOWN

NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Date: 11/21/2012

Project Number: 142128

Brown AND Caldwell
Allendale, New Jersey

Appendix D: Piezometer Construction Logs

WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-1A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	8.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/21/12 - 3/21/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255177.4 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219314.6 ft.
			Ground Surface Elev: 6.3 ft.	TOC Elev: 8.1 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well (Stick Up)	ppm Readings (ppm)	Remarks
		SM	**FILL**	2-5-15-12			75.0	
	5	SC	Brown mf SAND, some Organics, little Silt. Pulverized concrete.					0.9-2' BGS: Moderate to strong odor.
		SW	Black mf SAND and mf GRAVEL (cinders & slag). Saturated w/ water @ 2.7'.	8-9-7-4			0.4	*0-1.5' BGS: Cement-bentonite grout*
		SM	Black mf SAND, trace Silt.					*1.5-2' BGS: Bentonite Plug*
		SM MH	Black mf SAND, some Silt.	6-5-6-6				*2-7.5' BGS: Filter pack (#1 Filpro Sand)*
5			No Recovery.					*2.5-7.5' BGS: PVC Screen (0.020" Slot)*
	0	SP	Dark brown mfc SAND, trace Gravel (rounded granite and granite flakes).	7-9-11-15			0.0	

P:\National_Grid\Patchogue\Addl_Inv\patchogue_logs_5_2010

WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-1B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/21/12 - 3/21/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255178.7 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219305.9 ft.
			Ground Surface Elev: 5.9 ft.	TOC Elev: 8.9 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well (Stick Up)	ppm Readings (ppm)	Remarks
	5	SW	**FILL**	19-10-10-5			0.0	
		SP	Brown-black mfc SAND, some Organics (roots, grass).					
		SM	Pulverized red-brown concrete.	2-4-3-7			0.0	
		SP	Reddish-black mf SAND, trace (-) Gravel. Pieces of red brick present. Mosit @ 1.7'.					
		GP	Black mf SAND, little Silt, trace Organics.	14-8-3-4				
5		SP	Saturated w/ water @ 3'.					
	0		Black c SAND and f Gravel (cinders and brick present).					*0-10' BGS: Cement-bentonite grout*
		SW		1-1-5-7			0.0	
		GP	Black mf SAND trace Gravel, trace (-) Silt. No recovery.					
		SW	**OUTWASH DEPOSITS**	17-12-8-11			0.0	
		GW	Brown mfc SAND, little (-) mf Gravel. Tan mfc SAND, little (+) Gravel (rounded qtz).					
10		SW		10-5-3-3			0.0	
	-5	GW	Brown mfc SAND, some Gravel (rounded qtz).					*10-12' BGS: Bentonite Plug*
		SP	Tan-orange mf SAND, trace (-) Gravel.	1-2-4-4			0.0	
		SP	Tan-grey mf SAND, trace (-) Gravel.					
				2-2-2-3			0.0	
15								*12-19' BGS: Filter pack (#1 Filpro Sand)*
	-10							
		SP	Tan-grey-beige mf SAND, trace Gravel. @ 17.1' BGS shell present w/ iron staining.	3-4-6-7			0.0	*14-19' BGS: PVC Screen (0.020" Slot)*
		SP	Tan-grey-beige mf SAND, little Gravel.	3-2-4-5			0.0	
		GP						
20								

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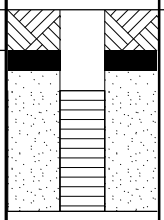
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-2A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
3/22/12 - 3/22/12	ADT	**Hammer Type:** 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:		
Shawn Miller	HSA	CME 1500	**Horiz Datum/Proj:** NYS Plane NAD83 **Vert Datum:** NAVD88 **Ground Surface Elev:** 5.8 ft.	**Easting:** 1255197.8 ft. **Northing:** 219330.2 ft. **TOC Elev:** 8.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well	ppm Readings (ppm)	Remarks
5	5		Refer to PZ-2B boring log for description of soil.								*0-1' BGS: Cement-bentonite grout.* *1-1.5' BGS: Bentonite seal.* *1.5-5' BGS: Filter pack.* *2-5' BGS: PVC Screen (0.020" Slot)*

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-2B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	18.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255209.7 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219332.1 ft.
			Ground Surface Elev: 5.3 ft.	TOC Elev: 8.3 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well	ppm Readings (ppm)	Remarks
		SP	**FILL** Brown mf SAND, little Organics (roots, grass), trace (-) Gravel. Specs of red brick present.	16-16-9-10			0.0	
		SP GP						
		SW	Pulverized concrete.	4-6-4-5			0.1	*0-6' BGS: Cement bentonite grout.*
		SM	Black mf SAND, some Gravel (cinders). Moist.					2.9-3.4' BGS: Slight tar-like odor.
		SP		2-3-2-1			72.1	4-4.3' BGS: Slight tar-like odor.
5	0	OH	Grey-beige mfc SAND, trace (-) Gravel (rounded qtz). Saturated w/ water @ 2.0'.					4.6-6' BGS: Black staining on some grains. Tar-like odor. Oily sheen on water.
		SW	**ALLUVIAL DEPOSITS**	1-1-3-3			7.0	*6-8' BGS: Bentonite seal.*
		SP	Grey-beige mfc SAND, little Silt, trace Organics, trace (-) Gravel (rounded qtz).					7' BGS: NAPL on surface of wood.
		SM	Color change to beige-tan @ 3.4'.	1-5-4-6			67.0	8-8.5' BGS: Black staining. Oily sheen on water.
		SP	Brown-biege mf SAND, trace Gravel.					8.5-10' BGS: Black staining. Moderate odor. NAPL coating on large grains.
		SW GP	Brown ORGANICS, little mf SAND.					*8-15' BGS: Filter pack.*
10	-5		Brown-beige mfc SAND.	3-3-3-5			7.0	*10-15' BGS: PVC Screen (0.020" Slot)*
		SP	Brown-beige mf SAND, trace (-) Organics (1" thick pcs of wood).					12-12.9' BGS: Oily sheen on grains and water. Tar-like odor.
			OUTWASH DEPOSITS	8-7-5-5			27.1	14-16' BGS: Slight odor. Slight staining.
			Black mf SAND, little Silt.					16-18' BGS: Black NAPL flecs w/ tacky, tar-like texture. Leaves residue on gloves. No odor.
		SW	Brown-beige mf SAND.					
		GP	Brown mfc SAND, some (-) Gravel.	7-3-3-4			13.0	
		SP	Brown-beige mf SAND. Mica flecs present.					
15	-10	GW	Brown-tan mfc SAND, some (-) Gravel.					
		SW	Brown-tan mc SAND and mfc GRAVEL (rounded qtz).	5-9-6-7			1.1	
			Tan-orange mfc SAND.					

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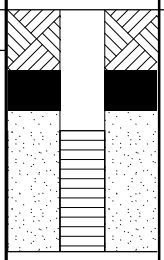
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-3A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
3/23/12 - 3/23/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:		
Shawn Miller	HSA	CME 1500	**Horiz Datum/Proj:** NYS Plane NAD83 **Vert Datum:** NAVD88 **Ground Surface Elev:** 5.0 ft.	**Easting:** 1255240.1 ft. **Northing:** 219241.1 ft. **TOC Elev:** 8.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well	ppm Readings (ppm)	Remarks
5	0		Refer to PZ-3B boring log for description of soil.								*0-1.5' BGS: Cement bentonite grout.* *1.5-2.5' BGS: Bentonite seal.* *2.5-6' BGS: Filter pack.* *3-6' BGS: PVC Screen (0.020" Slot)*

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-3B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255252.2 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219240.4 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 8.9 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well	ppm Readings (ppm)	Remarks
		SP GP SP	**FILL** Dark brown mf SAND, little Gravel, little Organics, little (-) Silt.	16-8-5-7			0.0	
		GP	Crushed/pulverized concrete.	7-5-5-4			0.0	*0-9' BGS: Cement bentonite grout.*
		SP GP	Black fm SAND, some Gravel (red brick), little (-) Silt. Moist.					
		SP	Grey-beige mc SAND, some m Gravel (angular).	2-2-2-2			0.0	4-6' BGS: Slight tar-like odor.
5	0	GP SP	Black fmc SAND, little (+) m Gravel. Wet.					
		GP SW	Wood. Grey-black mc SAND, little m Gravel (cinders). Wet to saturated. Saturated w/ water @ 4.0'.	1-2-4-8			35.0	6-6.8' BGS: Black staining on grains. Sheen on spoon. Black/reddish-brown NAPL blebs (sand sized).
		SP		3-5-5-4			19.5	6.8' BGS: 1/2" NAPL lens across core.
		SW	**OUTWASH DEPOSITS** Brown-beige mfc SAND.					8-8.6' BGS: Strong odor. Heavy, oily sheen on water in spoon.
10	-5	GW SW	Grey-beige mf SAND, trace (-) mf Gravel (rounded qtz).	3-6-4-3			2.6	8.6-10' BGS: Heavy NAPL staining on largest grains. Strong odor.
		GP SW	Grey-beige mfc SAND and mfc GRAVEL.					*9-11' BGS: Bentonite seal.*
		GP	Grey-brown mfc SAND, some f Gravel. Tan-brown mfc SAND, some f Gravel (rounded qtz)	5-5-5-4			4.5	10-10.1' BGS: Sheen on grains.
				13-5-6-4			3.0	10.1' BGS: 1/2" Tacky/thick NAPL lens across core.
15	-10	SW	Tan-orange mfc SAND.					10.7-12' BGS: Strong tar-like odor.
		SW	Tan-orange mfc SAND, trace (-) Gravel (rounded).	10-5-7-6			4.7	*11-18' BGS: Filter pack.*
		SW	Tan-orange mfc SAND.	4-5-6-4			9.1	14.8' BGS: Thin NAPL lens across core.
20	-15							*13-18' BGS: PVC Screen (0.020" Slot)* 18-20' BGS: Slight tar-like odor.

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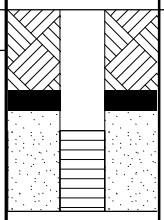
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-4A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
5/23/12 - 5/23/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255365.3 ft.
Chris Miglione	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219236.5 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 4.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well (Traffic Rated Vault Box)	ppm Readings (ppm)	Remarks
5	0		Refer to PASB-45 / MW-4D boring log soil description.								*0-2' BGS: Concrete well vault (flush mount).* *2-2.5' BGS: Bentonite seal.* *2.5-5' BGS: Filter pack.* *3-5' BGS: PVC Screen (0.020" Slot)*

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Appendix E: Slug Test Plots and Kh Calculations

Appendix F: ISS Treatability Study Laboratory Report (CD-ROM)

Appendix G: Pre-Design and Off-Site Investigation Soil Boring Logs

BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Boring No.** GI-1A **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	NA	N/A"	24.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/27/12 - 3/27/12	ADT	Hammer Type: 140lb Auto	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255203.2 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219321.8 ft.
			Ground Surface Elev: --	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		SW	**FILL** Brown mfc SAND trace (-) Organics.	12-31-18-9						0.0	*Boring was re-drilled due to running sand on initial boring. A column of water was added to hollow stem augers to stabilize borehole.*
		GP	Black mfc SAND and GRAVEL (composed of angular cinders).								
		SW	Crushed/pulverized Blue-grey concrete.	3-5-1-2						2.5	
			Crushed/pulverized red brick.								2.0' BGS: NAPL odor. Sheen on large grains.
		SW	Black mfc SAND, little (-) Gravel (angular).	2-3-2-2						117	4-4.6' BGS: Heavy NAPL coating on organics (branches/wood). Strong odor.
5		SW	Saturated with water.								
			ALLUVIAL DEPOSITS								
		SW	Black mfc SAND, some Gravel, trace Organics.	2-2-8-8						73.1	4.6-6' BGS: Saturated w/ reddish-brown NAPL. Strong odor.
			Brown-black mfc SAND.								6-8' BGS: Strong odor. Heavy staining (reddish-black). Sheen on water.
		SW	Piece of wood in spoon @ 5.3'	3-8-13-10						11.5	
		SP	**OUTWASH DEPOSITS**								8-10' BGS: Black staining. Strong odor. Sheen on water and grains.
		GP	Brown mfc SAND, little Gravel.								
10		SW	Brown-black mfc SAND.	3-6-10-7						39.7	10-14' BGS: Saturated w/ NAPL. Strong odor. Rainbow sheen across spoon.
			Brown-black mc SAND and f GRAVEL.								
		SW	Brown mfc SAND, trace (+) Gravel (rounded quartz).	5-5-6-7						12.5	14.3' BGS: 1/4" thick NAPL lens across spoon.
			Reddish- brown mfc SAND, some (-) Gravel (rounded quartz).								
		SW	Tan mfc SAND.	3-4-6-4						2.7	
15		SW	Orange-tan mfc SAND. @17.1' BGS: Band of Iron staining (1" thick).								16-18' BGS: Slight odor.
				1-3-5-5						1.5	
				2-3-3-4						3.9	
20			No recovery.	3-1-2-2							
		SW	Orange-brown-tan mfc SAND.	3-3-4-5						12.9	

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Boring No.** GI-2 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	NA	N/A"	24.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/23/12 - 3/23/12	ADT	Hammer Type: 140lb Auto	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255218.8 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219268.3 ft.
			Ground Surface Elev: --	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SW	**FILL** Brown-grey fmc SAND, little Gravel, little (-) Silt, trace Organics.	9-10-10-7			0.0	
		SW	Pulverized concrete.	4-5-5-2			53.5	2-2.6' BGS: Black staining. Strong odor. 2.6-4' BGS: Saturated with tacky NAPL.
		SW PT	Dark grey mfc SAND. Includes pieces of red brick. Slightly moist. @1.2' BGS: Piece of red brick in shoe of sampler.	5-4-1-1				
5			Brown fmc SAND, little Gravel.					
		SW	**ALLUVIAL DEPOSITS** Organics. Saturated w/ water @ 2.6'.	4-6-3-1			55.0	6-7' BGS: Heavy NAPL staining. Strong odor. 6.7' BGS: Thin NAPL lens across core.
		SW	No recovery.	6-6-5-7			30	7-8' BGS: Slight NAPL staining.
			OUTWASH DEPOSITS					
		SW	Brown mfc SAND, trace (+) Gravel.					
		GW	Tan-brown mfc SAND, trace (+) Gravel.					
10		SW GW	Tan-grey mfc SAND and mfc GRAVEL (rounded). Tan-orange mfc SAND and GRAVEL.	4-7-6-6			4.0	
			No Recovery. Cobble in shoe of sampler.	5-5-7-6				
		SP	Tan-orange mf SAND.	6-5-2-3			1.0	
15				4-6-10-11			1.0	16-17.2' BGS: Slight NAPL sheen on larger grains. 17.2' BGS: 1/4" thick NAPL lens across core. Tacky, viscous consistency.
				12-5-5-4			0.0	
20				1-1-3-3			1.5	
				5-3-5-6			0	
			@22.8' BGS: Piece of rounded quartz cobble in spoon.					

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Boring No.** GI-3 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/23/12 - 3/23/12	ADT	Hammer Type: 140lb Auto	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255108.9 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219367.5 ft.
			Ground Surface Elev: --	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		ML	**FILL** Brown SILT, little Sand, trace Organics. Moist.	2-3-6-5						0.0	
		ML									
		SW									
		SW	Pulverized concrete.	5-3-4-18						0.0	
		SW	Grey SILT, little SAND, trace Organics. Includes misc. fill (glass). Moist.								
		SW	Brown mfc SAND, saturated w/ water.	16-50/3						0.0	
5			Brown mfc SAND.								
			Wood, concrete in spoon.								
			Brown mfc SAND.	12-9-4-3						0.0	
		SW	Crushed concrete.								
			OUTWASH DEPOSITS Tan-beige mfc SAND.	9-1-2-3						0.0	
10				15-3-3-2						0.0	
				9-2-3-3						0.0	
		SW	Beige mfc SAND, trace (-) Gravel (rounded quartz).	10-3-2-5						0.0	
15				12-5-4-4						0.0	
				5-5-5-5						0.0	
20				17-3-3-3						0.0	
		GW	Beige mfc GRAVEL, little Beige mfc Sand.	1-2-2-2						0.0	22-24' BGS: Sand may have been removed from sample when borehole flushed w/ water to remove collapsing cuttings.
		SW	Beige mfc SAND, some mf Gravel.	7-3-5-9						0.0	
25		SW	Beige mfc SAND, trace Gravel. @26.8' BGS: Color change to tan-beige.	9-14-14-15						0.0	
		SW	Tan-beige mfc SAND, trace (-) Gravel.	5-7-9-12						0.0	
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Boring No.** GI-4 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
5/24/12 - 5/24/12	ADT	Hammer Type: 140lb Auto	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255295.6 ft.
Chris Miglione	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219292.5 ft.
			Ground Surface Elev: --	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
			FILL Crushed pavement/concrete.	4-7-8-5						0.0	
		SW	Grey-black mfc SAND	4-3-2-2						0.0	
		SM	Black stained mfc SAND, little Silt, trace Gravel (fill). Moist.								
		SM		1-1-1-1						0.0	
5		SM	Brown-black mf SAND, some Silt, little (+) Gravel.								
		SP	Wood in spoon.	3-5-9-12						0.0	
		OH	Grey-black mf SAND, trace (+) Gravel.								
		SW	Brown decomposing organics.								
		SW	Beige-grey mfc SAND, little Gravel.	12-7-8-11						0.0	
		GW	Tan-orange mfc SAND and GRAVEL								
		SW	(rounded qtz)								
10			Black-grey mfc SAND, trace f Gravel (composed of pieces of crushed red brick).	3-7-7-6							
			No recovery.								
		SW	**OUTWASH DEPOSITS**	5-5-5-8						0.0	
		SP	Tan-orange mfc SAND.								
		SW	Tan-orange c SAND.								
		SP	Tan-orange mfc SAND, trace Gravel (rounded quartz).	1-2-6-9						0.0	
15			Orange mf SAND.								
		SW	Tan-grey mfc SAND, little (-) f Gravel.	5-4-7-10						0.0	
		SW	Orange mfc SAND.	2-4-3-4						0.0	
20		SW	Orange mfc SAND, trace (+) Gravel (rounded quartz).	5-9-12-11						0.0	
			No recovery.	4-4-5-7							
				5-6-4-7							
25		SP	Orange-tan mf SAND. @ 27' BGS: 1/4" band of iron staining.	20-11-14-14						0.0	
			No recovery.	4-5-12-18							
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Boring No.** GI-5 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
5/24/12 - 5/24/12	ADT	Hammer Type: 140lb Auto	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255326.5 ft.
Chris Miglione	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219273.8 ft.
			Ground Surface Elev: --	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SM	**FILL** Brown-black mfc SAND, little (+) Silt, little Gravel (composed of rounded quartz, crushed concrete, and misc. fill- glass, cinders). @0.3' BGS: Piece of wood in spoon. @2.3' BGS Moist.	6-6-7-4			0.0	
		SM		3-7-14-11			0.0	
		SM	Same as above. Color change to black-red-grey @3.4' BGS: Wet.	2-1-1-1			9.3	
5		SW	Black mfc SAND, little (+) Silt, little (-) mfc Gravel (composed of quartz & crushed fill). @4.7' BGS: Saturated with water.	3-7-10-11			8.2	5.2-6.5' BGS: Black oily sheen on water. Black staining on grains. Slight to moderate tar-like odor.
		GP	Black stained mfc SAND, little Gravel					6.5-7' BGS: Slight NAPL staining on glass when soil placed in jar.
		SW	(composed of crushed red brick), little (-)					
		GW	Silt.	5-7-6-4			0.0	
			Tan-grey mfc SAND.					
10		SW	Grey-tan mfc SAND and GRAVEL (quartz).	4-6-13-18			0.0	8-10' BGS: Slight sheen on water.
		GP	Grey-tan mfc SAND, some Gravel (composed of rounded quartz & few cinders).					
			No recovery.	3-7-17-35				
		SW	**OUTWASH DEPOSITS** Beige-grey mfc SAND, trace Gravel (rounded quartz).	2-5-6-6			0.0	
15				2-5-15-21			0.0	
				16-35-19-14			0.0	
20				6-12-75/2			0.0	
		SW	Tan-orange mfc SAND, little (-) Gravel.	15-14-14-27			0.0	
				22-25-43-50/3			0.0	24-26' BGS: Slight sheen on water.
25				14-18-34-50/3			0.0	
			No recovery.	2-2-3-6				
30								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Boring No.** GI-6 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
5/25/12 - 5/25/12	ADT	Hammer Type: 140lb Auto	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255296.9 ft.
Chris Miglione	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219254.8 ft.
			Ground Surface Elev: --	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SW	**FILL** Crushed asphalt.	7-5-3-2			0.0	
			Black mfc SAND little (+) Gravel (crushed concrete) little Silt. Moist. @1.3' BGS: 1" thick wood in spoon.	2-3-3-7			9.8	
		SM	Green black mfc SAND some Silt, trace Gravel (misc. fill- Glass). @3.3' BGS: Saturated with water.	2-3-3-1			34.4	2.8-4.7' BGS: Slight to moderate tar-like odor. Slight sheen on water.
5		SW	Tan-grey mfc SAND.	1-1-1-1			1.1	4.7-4.9' BGS: Reddish brown NAPL coating on grains. Moderate odor. 6-8' BGS: Sheen on water and slight odor.
		SW	Tan-beige mfc SAND. @8.7' BGS: 2" band of color change to dark grey.	9-10-11-12			0.2	
		GW SP SW	Tan-beige mc SAND and GRAVEL (rounded qtz) **OUTWASH DEPOSITS**	6-6-6-8			0.0	
10			Orange mfc SAND trace (-) Gravel (rounded qtz). @11' BGS: 1" Granite cobble in shoe.	6-3-5-4			0.0	
			No recovery.					
		SW	Beige-grey mfc SAND, trace Gravel (rounded quartz).	6-5-5-6			0.0	
15		SW	Orange mfc SAND.	2-2-3-1			0.0	
			No recovery. Piece of rubber in spoon.	3-6-7-11				
20		SW	Orange mfc SAND.	3-2-3-4			0.0	
				4-6-9-7			0.0	
				2-2-4-7			0.0	
25		SW	Orange mfc Sand trace (-) Gravel (rounded qtz).	9-6-6-7			0.0	
			No recovery.	7-7-10-4				
30								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-137 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T. Chaturgan/Allendale, NJ	RLO	3"	NA	N/A"	10.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
1/10/12 - 1/10/12	ADT	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.3 ft.	Easting: 1255121.2 ft. Northing: 219367.6 ft. TOC Elev: N/A ft.
A. Larkin	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		SW	**FILL** Concrete	NA	1					0.0	*Borehole backfilled with bentonite chips.* 1.4-3.4' BGS: Slight tar-like odor.
		GW	Grey fmc SAND and mfc GRAVEL.								
		SW	Grey-brown-tan fmc SAND, trace (+) f Gravel. Saturated @ 3.0'								
		SW	**OUTWASH DEPOSITS** Beige-tan fmc SAND, little (-) fm Gravel. Saturated.								
5	0			NA	2					0.0	4.7' BGS: Specks of black hard tar, tacky. 5-5.4' BGS: Gravel-sized pieces of brittle tar, moderate tar-like odor.
		SW	Beige-tan fmc SAND, trace (+) f Gravel. Saturated.								
10											**Note:** *Soil Sample from 0-3' bgs collected with a post hole digger or hand auger during utility clearance.*

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-138 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T. Chaturgan/Allendale, NJ	RLO	3"	NA	N/A"	10.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
1/10/12 - 1/10/12	ADT	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255118.0 ft.
A. Larkin	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 219360.8 ft.
			Ground Surface Elev: 5.4 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5	SW	**FILL** Concrete.		1		0.0	*Borehole backfilled with bentonite chips.*
		GW	Grey mfc SAND and mfc GRAVEL, trace Silt.					1.25 - 2.85' bgs: Black stained soils, faint tar-like odor.
		SW	Black stained mf SAND, trace (+) Silt.					
		SW	Black-yellow-beige mf SAND, little (+) fm Gravel, trace Silt. Saturated @ 3'.		2		0.0	2.85 - 3.7' bgs: Faint tar-like odor.
		SW						
5	0	SW	Beige-tan-grey fmc SAND, trace (+) fm Gravel. Saturated.					4.8' bgs: Stringy/tacky tar observed within soils.
		SW	Pulverized concrete.					
			OUTWASH DEPOSITS Tan cmf SAND, some (-) fm Gravel, trace Silt.		3		0.0	
			Beige-tan iron-stained fm SAND, trace (+) f Gravel. Saturated @ 8'.					
10								**Note:** *Soil Sample from 0-3' bgs collected with a post hole digger or hand auger during utility clearance.*

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-139 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T. Chaturgan/Allendale, NJ	RLO	3"	NA	N/A"	23.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
1/10/12 - 1/10/12	ADT	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255164.9 ft.
A. Larkin	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 219314.0 ft.
			Ground Surface Elev: 5.5 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5	SW	**FILL** Black-brown fmc SAND, some mf Gravel, trace (+) Organics. Wet @ 1.4'.	NA	1		0.0	*Borehole backfilled with bentonite chips.* 1.6 - 3.5' bgs: Black stained soils, slight tar-like odor.
		SW	Black stained mfc SAND, some (-) mf Gravel, trace (+) Silt w/ pieces of wood and red brick. Saturated @ 3'.					
		SW	Black-stained mfc SAND, little (+) fm Gravel, trace (+) Silt w/ wood and pieces of glass. Saturated.	NA	2		0.0	3.5 - 4.45' bgs: Black stained soils, slight to moderate tar-like odor.
5	0	SW	Iron-stained mfc SAND, trace (+) f Gravel.					
			OUTWASH DEPOSITS Tan-beige mf SAND, trace (+) Gravel. Saturated.					
		SW	Brown-tan/grey fmc SAND, trace (+) f Gravel. Saturated.	NA	3		0.0	
10	-5	SW	Tan-beige iron-stained cmf SAND, trace (-) f Gravel.					**Note:** *Soil Sample from 0-3' bgs collected with a post hole digger or hand auger during utility clearance.*
		SW	Tan-beige mf SAND, trace (+) f Gravel.					
				NA	4			
15	-10							
		SW	Saturated, tan-beige fmc SAND, trace (+) f Gravel.	NA	5		0.0	
20	-15							

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-140 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T. Chaturgan/Allendale, NJ	RLO	3"	NA	N/A"	23.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
1/10/12 - 1/10/12	ADT	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255173.6 ft.
A. Larkin	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 219281.6 ft.
			Ground Surface Elev: 5.3 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SW	**FILL** Black-grey fmc SAND, some (-) mf Gravel, trace (+) Organics, trace Silt w/ pieces of red brick and glass/wood. Black staining @ 0.9'.	NA	1		0.0	*Borehole backfilled with bentonite chips.* 0.9' bgs: Black stained soils. 2-3.7' bgs: Black stained soils, faint tar-like odor. 3.7-4.8' bgs: Black stained soils, moderate tar-like odor.
		SW	Black stained cmf SAND, little (-) fm Gravel, trace (+) Silt. @3' Saturated.	NA	2		0.7	
		SW	Pulverized red brick.					
5	0	SW	Black stained cmf SAND, little (+) fm Gravel, trace (+) Silt.					
			OUTWASH DEPOSITS Grey-tan fmc SAND, little (+) mf Gravel (rounded), trace (+) Silt.					
		SW	Tan-beige fmc SAND, little (+) mf Gravel. Saturated.	NA	3		0.1	
10	-5							**Note:** *Soil Sample from 0-3' bgs collected with a post hole digger or hand auger during utility clearance.*
		SW	Tan-beige fmc SAND, trace (+) f Gravel. Saturated.	NA	4		0.0	
15	-10							
				NA	5		0.0	
20	-15	SW	Tan-beige iron-stained cmf SAND, little (-) mf Gravel.					

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-141 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T. Chaturgan/Allendale, NJ	RLO	3"	NA	N/A"	13.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
1/10/12 - 1/10/12	ADT	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255135.7 ft.
A. Larkin	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 219364.2 ft.
			Ground Surface Elev: 5.5 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5		**FILL**	NA	1		50.2	*Borehole backfilled with bentonite chips.*
		SW	Concrete					1 - 2.6' bgs: Black stained soils, moderate tar-like odor.
		GW	Grey fmc SAND and mfc GRAVEL.					
		SW	Black-stained fm SAND, little (-) fm Gravel, trace Silt.					
		SW	Black-stained fm SAND.	NA	2		47.8	2.6 - 3.0' bgs: Black NAPL coating soil grains, thin bands of NAPL, strong tar-like odor, abundant sheen.
		SW	Grey-black fm SAND, little (-) Silt. Saturated.					3 - 3.9' bgs Soils heavily coated with NAPL, strong tar-like odor, abundant sheen.
5	0	GW	Grey-white fm SAND and fm GRAVEL (possible pulverized concrete).					4.8' bgs: Black stained soils, moderate tar-like odors.
		SW	**OUTWASH DEPOSITS**					4.9 - 5.1' bgs: Moderate tar-like odor.
		SW	Beige-tan fm SAND, trace (+) f Gravel. Saturated.	NA	3		0.7	5.1 - 6.7' bgs: Slight tar-like odor.
			Beige-tan fmc SAND, trace f Gravel. Saturated.					8 - 10.6' bgs: Very slight tar-like odor.
10	-5		Beige-tan fm SAND, trace (-) Silt. Saturated.					

Note: *Soil Sample from 0-3' bgs collected with a post hole digger or hand auger during utility clearance.*

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Appendix H: Geotechnical Laboratory Report

Appendix I: Community Air Monitoring Plan (CAMP)

Community Air Monitoring Plan
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 149322.570

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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Section 1

Introduction and Purpose

This Community Air Monitoring Plan (CAMP) has been prepared on behalf of National Grid for use at the Patchogue (West Main Street) Former Manufactured Gas Plan (MGP) Site located at 234 West Main Street and the adjacent property located at 210 West Main Street (Off-Site Property) in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (the "Site") during implementation of remedial activities. The Site location and Site plan are shown on Figure 1-1 and 1-2, respectively. The Site is the location of a former MGP facility (owned by a predecessor of National Grid) where manufactured gas was produced. The adjacent property (off-Site) is included as part of the Site, and remediation activities will be conducted on that parcel. The adjacent property is currently vacated and leased by National Grid for the duration of the remedial activities. A remedy has been selected for the Site by the New York State Department of Environmental Conservation (NYSDEC) to address contaminated media resulting from these operations. The contaminated media is generally the result of byproducts and wastes associated with the former MGP operations such as coal tar and spent purifier wastes. Contaminated media are present primarily within certain subsurface portions of the Site and in some adjacent off-Site area.

Efforts were initiated in 1999 by KeySpan (a predecessor to National Grid) to assess the presence and extent of MGP-contaminated media to achieve conditions that are protective of human health and the environment.). 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 preliminary site assessment (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 "Preliminary Site Assessment Report, Order on Consent D1-001-99-05, NYSDEC Site 1-52-182, Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York" dated March 2002, prepared by Vanasse, Hangen, Brustlin, Inc., (PSA Report). In 2008 and 2009, remedial investigation activities were performed and the results were documented and submitted to the NYSDEC in the "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York" dated December 2009, prepared by TetraTech EC., Inc.

1.1 Community Air Monitoring Plan (CAMP) Purpose

The Community Air Monitoring Program will generate data to document that the quality of the air leaving the Site during the implementation of the remedy does not exceed applicable criteria as a result of the release of MGP-related contaminants. Further, the data will be used to confirm that the air quality in adjacent neighborhoods is not being adversely impacted by the Site activities. This CAMP conforms with the requirements of the New York State Department of Health (NYSDOH) "Generic Community Air Monitoring Plan, Revision 1, June 2000" guidelines as presented in Appendix 1A of the NYSDEC, Final DER-10, "Technical Guidance for Site Investigation and Remediation", dated May 2010. This CAMP will also provide a basis for implementation of response actions to mitigate potential air emissions that may result from the implementation of the remedy.

In addition, a Site-specific Health and Safety Plan (HASP), included in the Remedial Design Report, Patchogue Former Manufactured Gas Plant Site, Village of Patchogue, Suffolk County, New York, NYSDEC Site No. 1-52-182" (RDR) dated October 2017, prepared by Brown and Caldwell, has been prepared which addresses potential exposures to on-Site personnel implementing the CAMP. The HASP specifies air monitoring requirements within the work zone.

1.2 Potential Air Emission Sources

As detailed in the RDR, the remedial activities for the Site include:

- Site Preparation;
- Excavation;
- Shoring;
- In-Situ Solidification (ISS);
- Construction of an Environmental Cap;
- Construction of Stormwater Management System; and
- Site Restoration

The primary air quality concern during implementation of the remedy is the generation and migration of particulates (i.e., dust), and volatile organic compounds (VOC). Potential activities which could impact air quality at the Site perimeter include excavation, ISS activities, materials handling, grading and vehicular traffic, amongst other remedial activities.

Section 2

Community Air Monitoring Program

The NYSDOH Generic CAMP protocol requires continuous perimeter air monitoring during all ground intrusive activities. Ground intrusive activities are defined in the NYSDOH Generic CAMP protocol as including, but not limited to, soil/waste excavation and handling, ISS activities, shoring installation, test pitting or trenching, and the installation of soil borings or monitoring wells.

The NYSDOH Generic CAMP protocol also requires periodic monitoring for VOCs during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. Examples of "periodic" monitoring presented in the NYSDOH Generic CAMP include collection of air quality data upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and prior to leaving a sample location. The NYSDOH Generic CAMP protocol further states that in some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities.

This Community Air Monitoring Program will consist of continuous air monitoring during the ground intrusive activities. For the continuous air monitoring, a minimum of five fixed air monitoring stations will be established and monitored for five to seven days before the start of remedial activities to establish background conditions. The continuous monitoring will continue for the duration of the remedial activities.

2.1 Continuous Air Monitoring

Continuous monitoring of particulates and VOCs will be conducted at each of the air monitoring stations. Real-time data will be recorded in 15-minute intervals. Continuous monitoring will be conducted prior to commencement of work to establish baseline conditions, and throughout the duration of the remedial activities. Once the construction activities begin, monitoring will be performed for VOCs dust along the Site perimeter 24 hours a day. Data will be downloaded once every 24 hours by on-Site oversight personnel.

The air monitoring system consists of up to five air monitoring stations, one meteorological station, and one central computer system. The central computer system will be in the Remedial Contractor's field office. The VOC and PM-10 will be stored in dataloggers located within each air monitoring station. Stored analytical data along with system performance data from each station will be sent in real-time (e.g., radio telemetry) to the Site central computer system for monitoring and analysis. The meteorological station will be downloaded at a minimum of once per week.

2.1.1 Station Layout

The proposed location of the air monitoring stations, a minimum of two upwind and a minimum of two downwind and an additional station located where designated by CAMP contractor and National Grid, is based on prevailing wind directions and the direction of potential off-Site receptors. Figure 2-1 presents the proposed station locations. Wind roses[1] for Patchogue, New York appear in Figures 2-2a through 2-2l. When comparing the wind rose for each month of the year, the following observations can be made:

[1] Wind rose obtained from Iowa Environmental Mesonet (EIM), Iowa State University website http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS, Accessed January 24, 2017

- The primary wind direction across Patchogue, NY is from the Northwest and Southwest.
- During the summer months, the wind direction is mostly from the Southwest
- During the winter months, the wind direction is mostly from the Northwest

The layout depicted on Figure 2-1 encompasses the work zones in which the remedial activities will be implemented. The station layout may be modified prior to the initiation of the remedial activities based upon the prevailing wind direction measured during the baseline monitoring period as well as the portion(s) of the Site being subject to remedial activities.

2.1.2 Analytical Instrumentation

Each monitoring station will be equipped with a particulate meter and a photoionization detector (PID) for continuous measurement of air quality parameters in the ambient air. The particulate meters and the PIDs will each be configured to provide 15-minute time-weighted average (TWA) values. Both pieces of instrumentation will be housed in weather tight NEMA 4-type enclosures, or equivalent

2.1.3 Meteorological Instrumentation

Instrumentation will be installed at the Site to measure wind speed, direction, ambient temperature, and relative humidity. Wind direction which will be used to identify which of the monitoring stations is upwind, downwind, or crosswind.

2.2 Action and Alert Levels

Action levels are designated with either a “Green,” “Yellow,” “Orange,” or “Red” status. These color-coded levels correspond to points at which the Construction Manager/Remedial Contractor will be notified that the activities being performed are having an impact on air quality and that immediate mitigation is necessary (e.g., control measures are to be implemented). The mitigation/control measures shall be determined by the Remedial Contractor. The types of mitigation measures which the Remedial Contractor shall include, but are not limited to:

- Application of suppressant foams;
- Wetting of soil and other media or other means to control dust;
- Modification of work activities; and
- Stop work activities.

Due to the industrial nature of the area surrounding the Site, elevated levels of ambient (background) suspended particulates and VOCs may occur. The presence of upwind and downwind monitoring is critical to assess whether action level conditions are the result of remedial activities or are the result of ambient (background) conditions (i.e., migration from upgradient or localized conditions).

Section 3.3 outlines the response procedures for action and alert level conditions.

2.2.1 Volatile Organic Compound Action and Alert Levels

In accordance with the NYSDOH Generic CAMP, if the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

To mitigate the chance that remedial activities will generate VOC air impacts at or in excess of five (5) ppm above background, a tiered approach to alarm levels consisting of a lower (yellow) action level and a mid (orange) alert level will be established. Mitigation/control measures will be implemented based on

the level of the alarm, progressively becoming more urgent until a halt work is required. The alarm will be triggered based on total levels, but work would not be halted or any mitigation measures implemented unless the differential between background and downwind readings exceeds the alert or action level, as shown in Table 2-1 below.

"Actions levels" referred to concentrations of VOC or PM10 that exceed the standard NYSDOH guidance levels. Levels below the standard guidance document values where the Remedial Contractor needs to take action in order to not reach an "action level" will be referred to as an "alert level."

VOC data from continuous monitoring will be used to calculate 15-minute time-weighted average (TWA) values for comparison to the action level.

The following table summarizes the alert and action levels, and the associated responses for VOCs.

Table 2-1. Alert and Action Levels and Responses for VOCs

Alert Level	Response
Below 2.5 ppm above background for the 15-minute average	Continue and/or resume work activities
> 2.5 ppm to <3.7 ppm above background (15-minute average) or if odors are observed	Notify Contractor of need to implement mitigation measures. Employ dust suppression techniques or modify work activities.
>3.7 to <5 ppm above background (15-minute average) or if odors are observed	Notify Contractor of need to implement more aggressive mitigation measures. Work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions and continue monitoring.
Action Level	**Response**
> 5 ppm above background (15-minute average) or if odors are observed	Work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring. Contact NG PM immediately. Notify NYSDEC and NYDOH about exceedance and corrective measures implemented
>5 ppm to <25 ppm above background (15-minute average)	Work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average. Contact NG PM immediately. Notify NYSDEC and NYDOH about exceedance and corrective measures implemented
>25 ppm above background (15-minute average)	Activities must be shutdown. Contact NG PM immediately. Notify NYSDEC and NYDOH about exceedance and corrective measures implemented

The 15-minute readings will be recorded and maintained. Instantaneous readings, if any, used for decision making purposes will also be recorded.

2.2.1.1 Odor Complaints

Community complaints regarding odors and the response taken will be documented. Response actions taken will depend on the number and/or magnitude of the complaints. At a minimum, the response

action will consist of documenting the date and time the complaint is received. In accordance with the Volatile Organic Compound Action Levels presented above, response actions will progressively become more urgent until a halt work is required. NYSDEC and NYDOH will be notified about the complaints and the corrective measures implemented.

2.2.2 Particulate Matter (PM10) Action and Alert Levels

In accordance with the NYSDOH Generic CAMP protocol, the action level for perimeter air monitoring at the Site is 150 micrograms per cubic meter (µg/m^3) of respirable particulate matter above background for the 15-minute average. Particulates that are 10 microns or smaller and are considered respirable are known as PM10. No visible dust can be seen migrating from the work area. Particulate data from continuous monitoring will be used to calculate 15-minute TWA values for comparison to the action level.

For this Site, in order to mitigate the chance that remedial activities will generate visible dust or air impacts at or above 150 µg/m^3 above background, a tiered approach to alarm levels consisting of a lower (yellow) alert level and a mid-alert level (orange) will be established. Mitigation/control measures will be implemented based on the level of the alarm progressively becoming more urgent until a halt work is required. The alarm will be triggered based on total levels, but work would not be halted or any mitigation measures implemented unless the differential between background and downwind readings exceeded the action levels.

"Actions levels" referred to concentrations of VOC or PM10 that exceed the standard NYSDOH guidance levels. Levels below the standard guidance document values where the Remedial Contractor needs to take action in order to not reach an "action level" will be referred to as an "alert level."

The following table summarizes the alert and action levels, and the associated responses for particulates.

Table 2-2. Alert and Action Levels and Responses for Particulates

Alert Level	Response
Below 75 µg/m^3 above background for the 15-minute average	Continue and/or resume work activities
Action Level	**Response**
> 75 to < 100 µg/m^3 above background for the 15-minute average or if airborne dust is observed leaving the work area	Dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.
>100 to <150 µg/m^3 above background for the 15-minute average or if airborne dust is observed leaving the work area	Notify Contractor of need to implement more aggressive mitigation measures. Work may continue with dust suppression techniques provided downwind PM-10 particulate levels do not exceed 150 µg/m^3 above background for the 15-minute average and airborne dust is not observed leaving the work area.
Action Level	**Response**
If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level	Work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration. Contact NG PM immediately. Notify NYSDEC and NYDOH about exceedance and corrective measures implemented

The 15-minute readings will be recorded and be maintained. Instantaneous readings, if any, used for decision making purposes will also be recorded.

Section 3

Procedures

This section outlines the routine and contingency procedures for implementation of the CAMP. The air monitoring activities will be directed by the Air Monitoring Manager.

3.1 Community Air Monitoring Program Schedule

The CAMP is anticipated to consist of one week of baseline monitoring and continuous monitoring for the duration of the remedial activities.

3.1.1 Baseline Monitoring

Prior to commencement of remedial activities, monitoring will be conducted to establish baseline conditions and evaluate the potential range of background concentrations that may be present during implementation of the remedy. To establish baseline conditions, continuous monitoring will be conducted at the monitoring stations for three to five days for a minimum of eight (8) hour periods.

3.1.2 Continuous Monitoring

Continuous air monitoring will be executed for the duration of remedial activities when there is the potential for exposure to MGP-related contaminants. Particulates and VOC data will be monitored via the monitoring stations at the locations proposed in Figure 2-1 for the entire work day.

3.1.3 VOC Analytical Sampling

Verification VOC samples will be collected once per week at two air monitoring stations. The verification samples are collected to demonstrate that the real-time monitoring stations are effective in measuring the concentration of the VOC target compounds. VOC samples will be collected using 6-liter Summa® canisters (or equivalent vacuum canisters) and analyzed using United States Environmental Protection Agency (EPA) Method TO-15 modified to include naphthalene. An accredited laboratory will perform the analytical testing on the canisters and will provide Category B deliverables as required by the New York Analytical Services Protocol. The data will be validated according to EPA and New York State Requirements.

3.2 Routine Procedures

Routine air monitoring procedures will consist of the following:

- Daily inspection of the monitoring stations to confirm that they are secure and operating properly. Check for damage, loss of air flow, dirt or moisture buildup, and replace inlet filters, as necessary, or as prescribed by the manufacturer of the monitoring equipment.
- Daily calibration of PIDs in accordance with manufacturer specifications. Calibration frequency may be modified, as appropriate, based on communication with manufacturer/vendor.
- Daily calibration of particulate meters in accordance with manufacturer specifications. Calibration frequency may be modified, as appropriate, based on communication with manufacturer/vendor.
- Daily inspection of operational set points on PIDs.
- Daily inspection of operational set points on particulate meters.

- Daily inspection of the meteorological station for proper operation.
- Troubleshooting of potential system issues.
- Observe baseline conditions, including particulate levels and meteorological data. Based on wind direction, adjust location of air monitoring stations, as appropriate.
- Monitor each station throughout the workday for action level conditions. Section 3.3 outlines response procedures to action level conditions.
- Generate daily field reports. Document system troubleshooting, station layout adjustments, action level conditions and corresponding response actions, if any.

3.3 Response Procedures

As detailed in Section 2.2, the "red" action level for community air monitoring at the Site is five (5) ppm and above for VOCs and 150 µg/m^3 for PM10. The system will be monitored for potential exceedances of the established yellow/orange/red action and alert level(s). The lower alert levels have been established to implement control measures before reaching the stop work ("Red") action level. No audible or visible alarms will be utilized at the Site.

The presence of upwind and work zone monitoring is critical to assess whether action and alert level conditions are the result of remedial activities or ambient (background) conditions (i.e., migration from upgradient or localized conditions). Work would not be halted or control measures implemented until upwind and work zone readings are compared to the continuous monitoring readings, with the exception of visible dust or odoriferous conditions.

The following steps outline the procedures the Air Monitoring Manager shall follow in response to action level and alert conditions:

1. Identify whether the station is upwind, downwind, or crosswind to the work area.
    a. If station is upwind, then continue work with air monitoring. Note the condition and response in the Daily Field Report.
    b. If station is downwind or crosswind, then proceed to Step 2.
2. Compare the reading to upwind readings.
    a. If the upwind reading is above alert levels, then continue work with air monitoring. Note the condition and response in the Daily Field Report.
    b. If the upwind reading is below action levels, then proceed to Step 3.
3. Determine the difference between the readings obtained at the upwind and downwind stations. Based on visual determination, assess whether the exceedance is due to a localized ambient (background) condition (i.e., dust from upwind sites or roadways) in the vicinity of the station:
    a. If it is suspected that the reading is not the result of a localized ambient (background) condition, then inform the Construction Manager/Remedial Contractor to take corrective action. Note the condition, response and corrective actions implemented by Construction Manager/Remedial Contractor in the Daily Field Report.
    b. If it is suspected that the reading is the result of a localized background condition, then obtain readings from the downwind boundary of the work zone with a handheld instrument and compare to the station reading.
        i. If the work zone reading is less than station reading, then continue work with air monitoring. Note the condition and response in the Daily Field Report.
        ii. If work zone reading is greater than station reading, then inform the Construction Manager/Remedial Contractor to take corrective action. Note the condition, response and

corrective actions implemented by the Construction Manager/Remedial Contractor in the Daily Field Report.

Visible dust emanating from the work area will require immediate implementation of dust control measures without progressing through the steps outlined above.

3.3.1 VOCs

If remedial activities result in a concentration of total VOCs at the downwind perimeter of the work area in excess of five (5) ppm over background, activities will be managed in accordance with the NYSDOH Generic CAMP guidance as follows:

- If the concentration of total VOCs at the downwind perimeter of the work area exceeds five (5) ppm over background, but less than 25 ppm, for a 15-minute average, work activities will be temporarily halted and monitoring continued. If concentrations drop rapidly, work activities can resume with continued monitoring.
- If concentrations between 5 ppm and 25 ppm above background persist, work must be stopped and the source of the vapors identified and mitigated. Mitigation measures may include engineering controls such as application of foam or the use of temporary enclosures and modification of work protocols (e.g., excavation procedures). After work activities resume, the total VOC concentration at the contingency location (defined as 200 feet downwind of the work area or half the distance to the nearest receptor, whichever is less) must remain below five (5) ppm on a 15 minute-averaged basis.
- If the concentrations exceed 25 ppm at the perimeter of the work areas, the remedial activities will be halted. Air sampling in accordance with this CAMP will continue in the event that elevated PID levels are detected, so that this information will be available to assess the potential impacts to off-Site receptors or to develop mitigation measures.

3.3.2 Particulates

The tiered action levels presented in Section 2.2.2 are more conservative than those prescribed in the NYSDOH Generic CAMP protocol. Dust suppression levels for this Site are implemented at the yellow action level (initially 75 µg/m^3 of PM10).

- If the concentration of total PM10 particulates at the downwind perimeter of the work area exceeds 75 µg/m^3 over background for a 15-minute average, dust suppression techniques must be instituted.
- Work may continue after employment of dust suppression as long as the downwind perimeter PM10 levels are below 150 µg/m^3 over background and there is no visible dust emanating from the Site.
- If levels below 150 µg/m^3 cannot be achieved, work must stop and can only resume when additional controls are successful in keeping perimeter dust levels less than 150 µg/m3 above background.

3.4 Communication Plan

Any “Red” stop-work condition, the associated control measures taken by the Construction Manager/Remedial Contractor and the recommencement of remedial activities will each be immediately communicated to the National Grid Project Manager upon occurrence. The National Grid Project Manager will also be notified if response actions are not implemented according to this plan.

Analytical data generated at each fixed-station are sent to the central computer system via radio telemetry or will be manually downloaded daily. The monitoring data will also be downloaded to the project database for data evaluation. The Daily Air Monitoring Reports shall include the following charts and information:

- Instantaneous and averaged VOC concentrations compared to the VOC Action Level

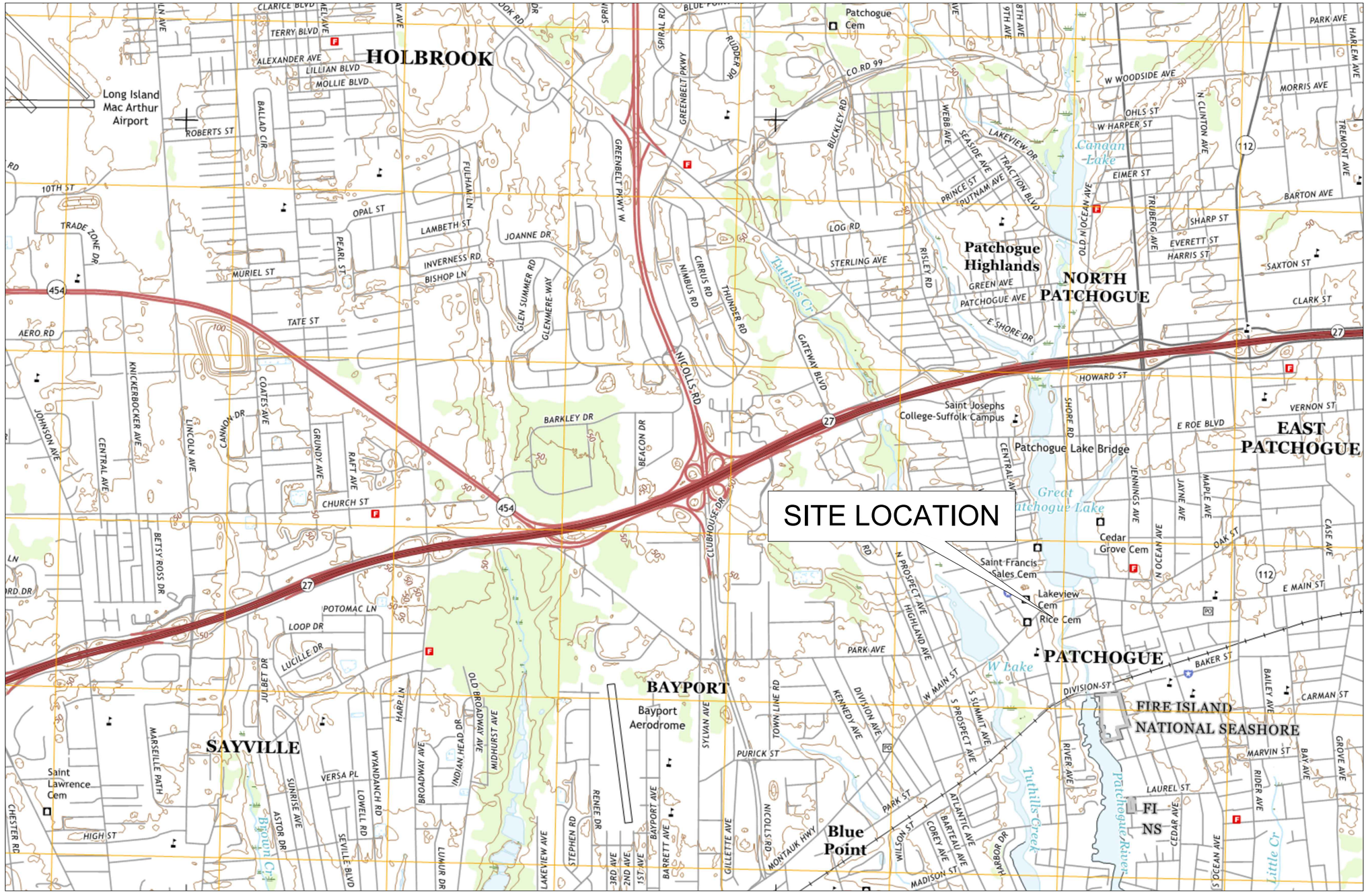
- Instantaneous and averaged PM-10 concentrations compared to the PM-10 Action Level
- Weather summary including wind speed and direction, temperature low and high, and precipitation if any.
- Summary of construction activities.
- Summary of response action and mitigation measures implemented.

A Weekly Air Monitoring Report summarizing the results of the Daily Air Monitoring Field Reports, including any action level conditions and the actions taken to control emissions from the Site as well as the following information:

- Meteorological summary
- Maximum 15-minute average concentrations of VOC and PM-10
- Summary of construction activities

The weekly summary reports will be discussed at the Weekly Progress Meetings. A copy of the weekly summary will be provided to the NYSDEC and NYSDOH via email. At the completion of the remedy implementation, a final CAMP summary report and the weekly Air Monitoring Reports will be included in the Final Engineering Report.

Figures



SOURCE:
USGS 7.5 MINUTE TOPOGRAPHIC MAPS
PATCHOGUE QUADRANGLE
NEW YORK-SUFFOLK CO.
PATCHOGUE, NY 2016

Brown AND Caldwell

SCALE: 1" = 2000'

149322

DATE: August 7, 2017

DESIGN FOR REMEDIAL CONSTRUCTION
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

SITE LOCATION MAP

FIGURE
1-1

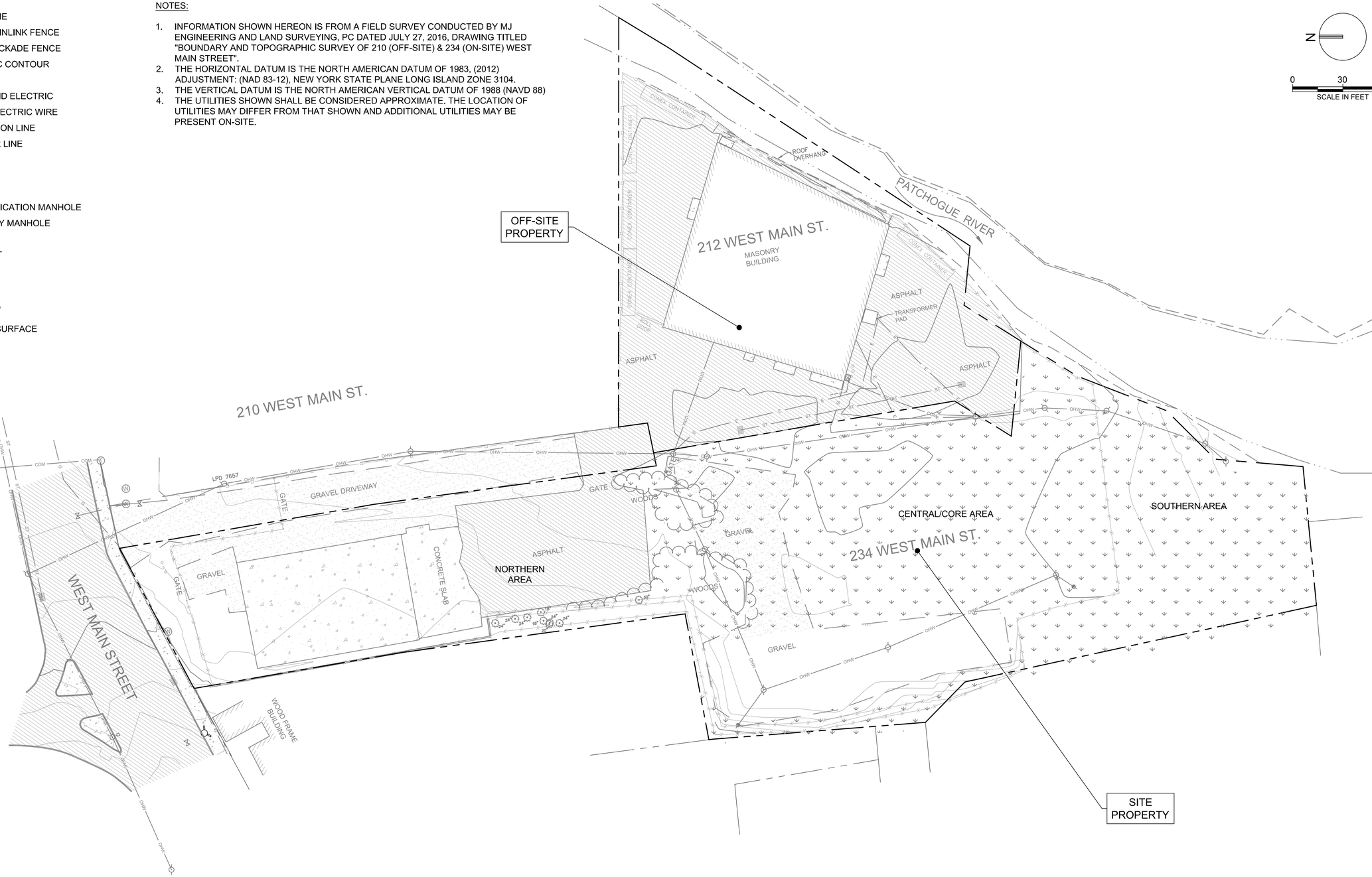
Path: \\bcusrfp01\projects\National_Grid\Patchogue\149322_NG_Patchogue_RDR\90%-95%_Remedial_Design_Report\Appendices\Appl_CAMP\Figures File Name: FIG 1-1 Plot Date: August 7, 2017 9:25 AM Cadd User: Alan Santiago

LEGEND:

- PROPERTY LINE
- EXISTING CHAINLINK FENCE
- EXISTING STOCKADE FENCE
- TOPOGRAPHIC CONTOUR
- TOP OF BANK
- UNDERGROUND ELECTRIC
- OVERHEAD ELECTRIC WIRE
- COMMUNICATION LINE
- STORMWATER LINE
- GAS LINE
- WATER LINE
- UTILITY POLE
- TELECOMMUNICATION MANHOLE
- WATER UTILITY MANHOLE
- WATER VALVE
- FIRE HYDRANT
- CATCH BASIN
- CONCRETE
- GRAVEL ROAD
- VEGETATIVE SURFACE

NOTES:

1. INFORMATION SHOWN HEREON IS FROM A FIELD SURVEY CONDUCTED BY MJ ENGINEERING AND LAND SURVEYING, PC DATED JULY 27, 2016, DRAWING TITLED "BOUNDARY AND TOPOGRAPHIC SURVEY OF 210 (OFF-SITE) & 234 (ON-SITE) WEST MAIN STREET".
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983, (2012) ADJUSTMENT: (NAD 83-12), NEW YORK STATE PLANE LONG ISLAND ZONE 3104.
3. THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
4. THE UTILITIES SHOWN SHALL BE CONSIDERED APPROXIMATE. THE LOCATION OF UTILITIES MAY DIFFER FROM THAT SHOWN AND ADDITIONAL UTILITIES MAY BE PRESENT ON-SITE.



Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\2-SHEETS\C-CIVIL File Name: FIG_1-2 Plot Date: October 9, 2017 5:15 PM Cadd User: Radhika Patel

Brown AND Caldwell

SCALE: 1" = 30'

147663

DATE: October 9, 2017

NATIONAL GRID PATCHOGUE FORMER MGP SITE
234 WESTMAIN STREET, VILLAGE OF PATCHOGUE, NY
SITE PLAN

FIGURE

1-2

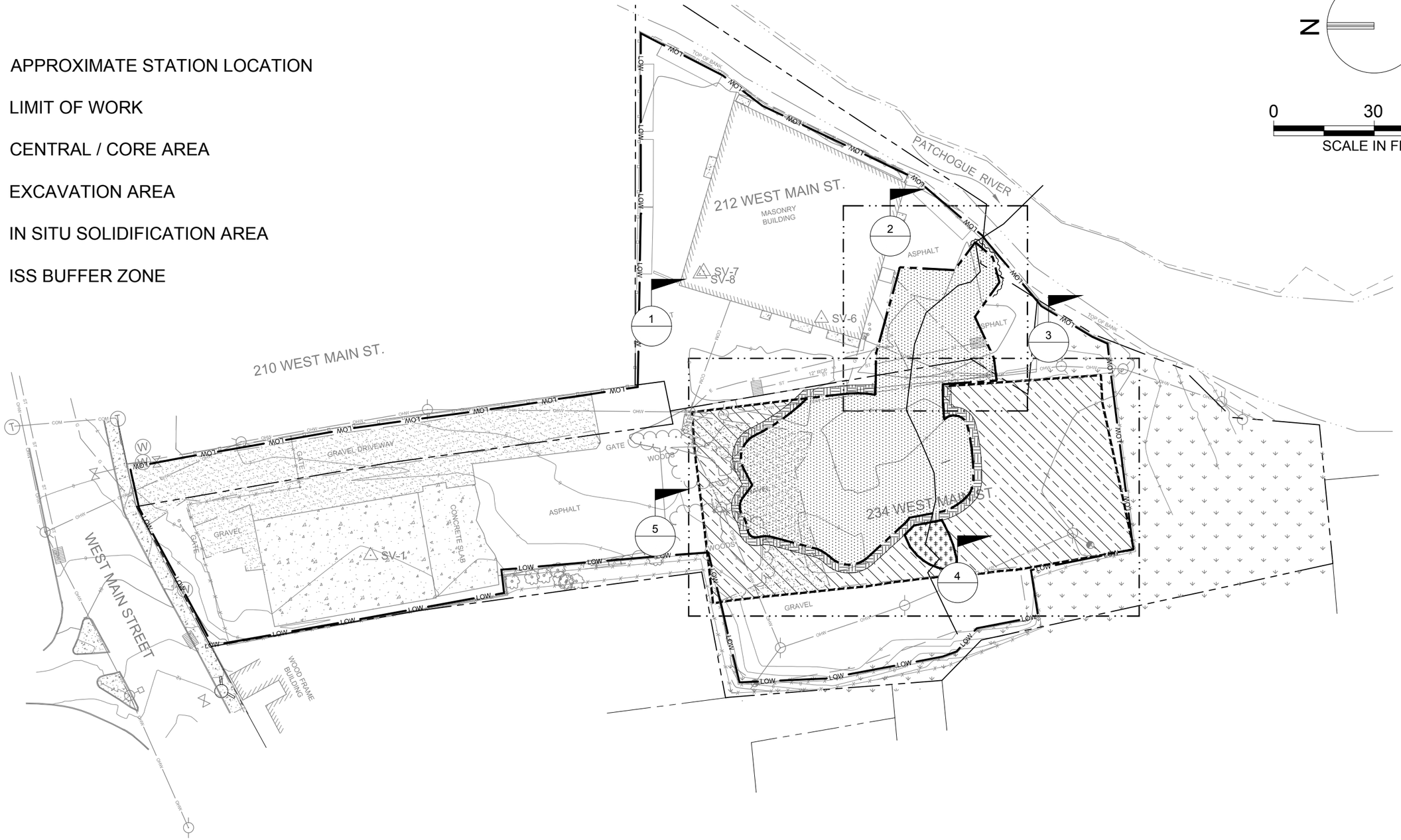
LEGEND:

- APPROXIMATE STATION LOCATION
- LIMIT OF WORK
- CENTRAL / CORE AREA
- EXCAVATION AREA
- IN SITU SOLIDIFICATION AREA
- ISS BUFFER ZONE

N

0 30 60

SCALE IN FEET



Brown AND Caldwell

SCALE: 1" = 60'

149322

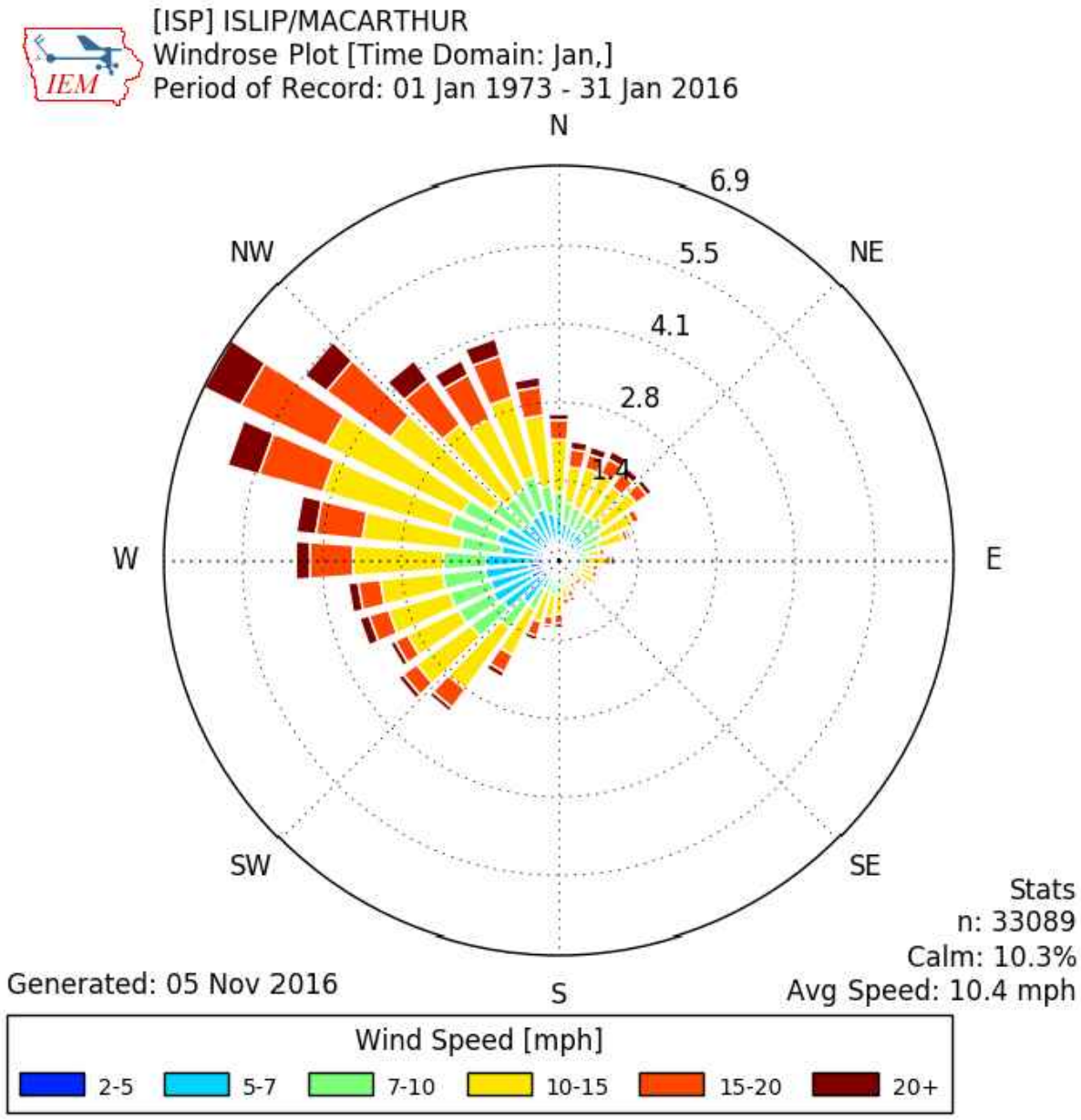
DATE: October 9, 2017

DESIGN FOR REMEDIAL CONSTRUCTION
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

PROPOSED STATION LOCATION

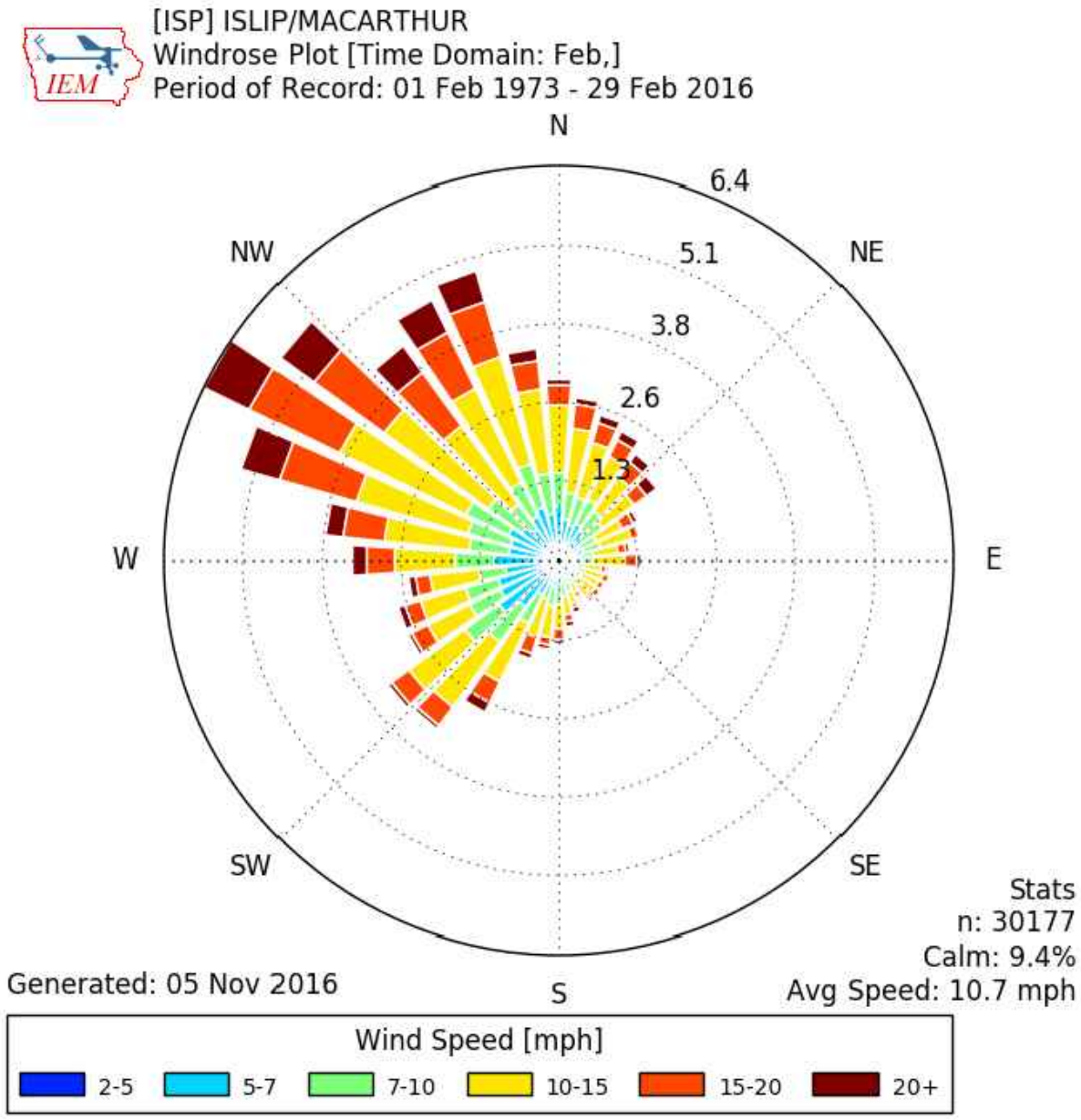
FIGURE
2-1

Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR\90%-95%_Remedial_Design_Report\Appendices\Appl_CAMP\Figures File Name: FIG 2-1 Plot Date: October 9, 2017 2:23 PM
Cadd User: Radhika Patel



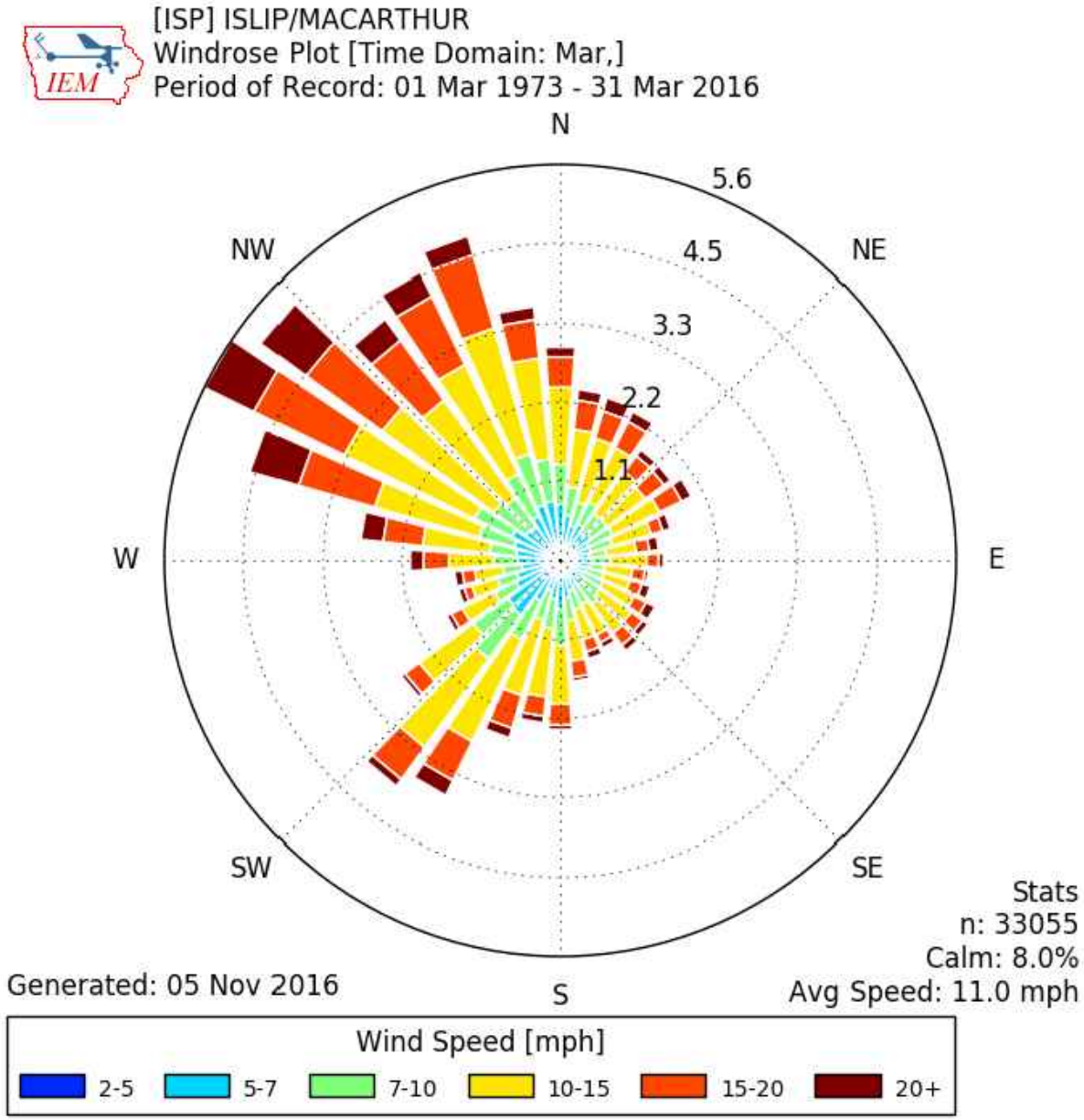
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	NATIONAL GRID - PATCHOGUE PATCHOGUE, NY WIND ROSE (JANUARY)	FIGURE 2-2a



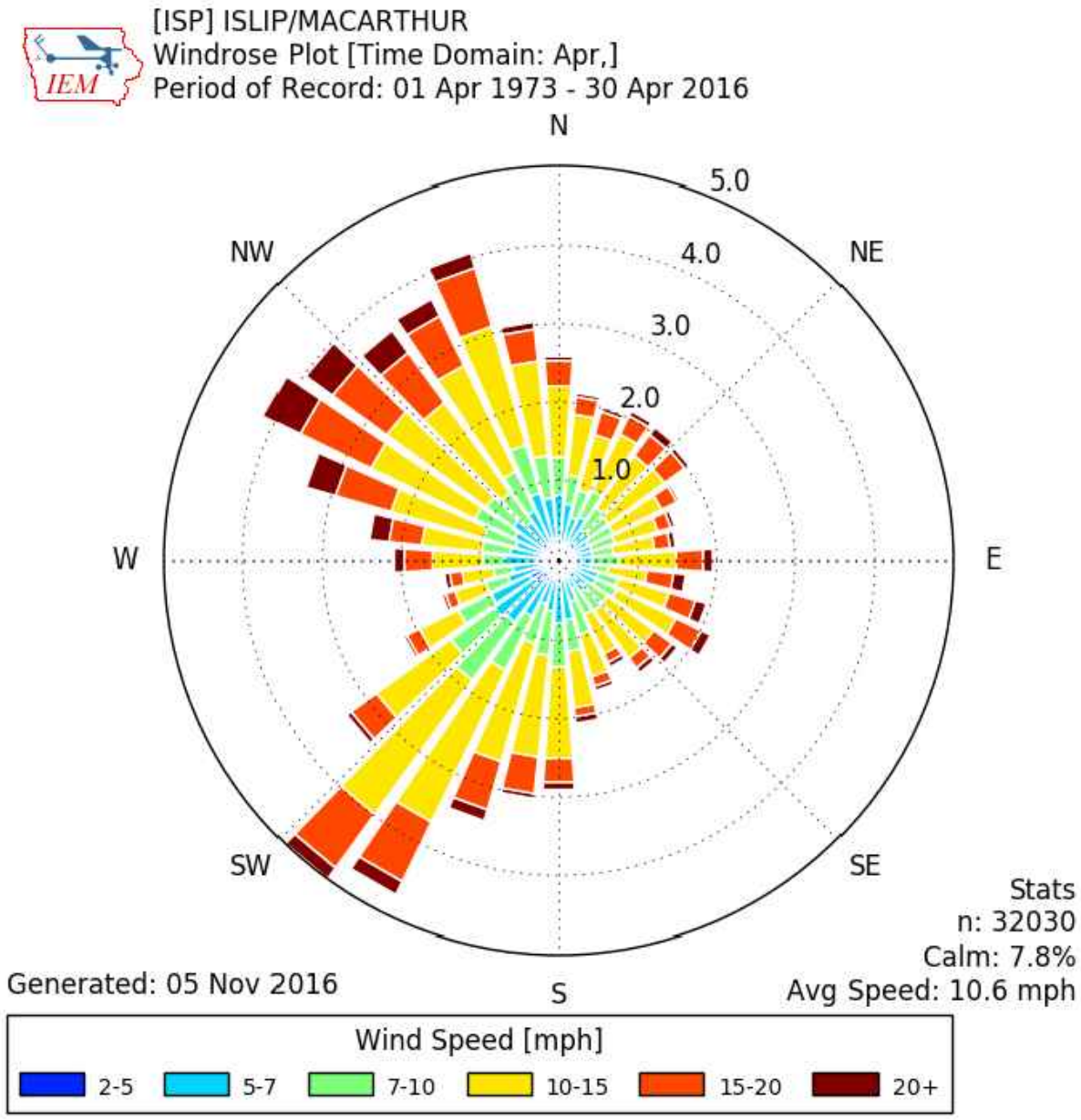
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (FEBRUARY)	FIGURE 2-2b



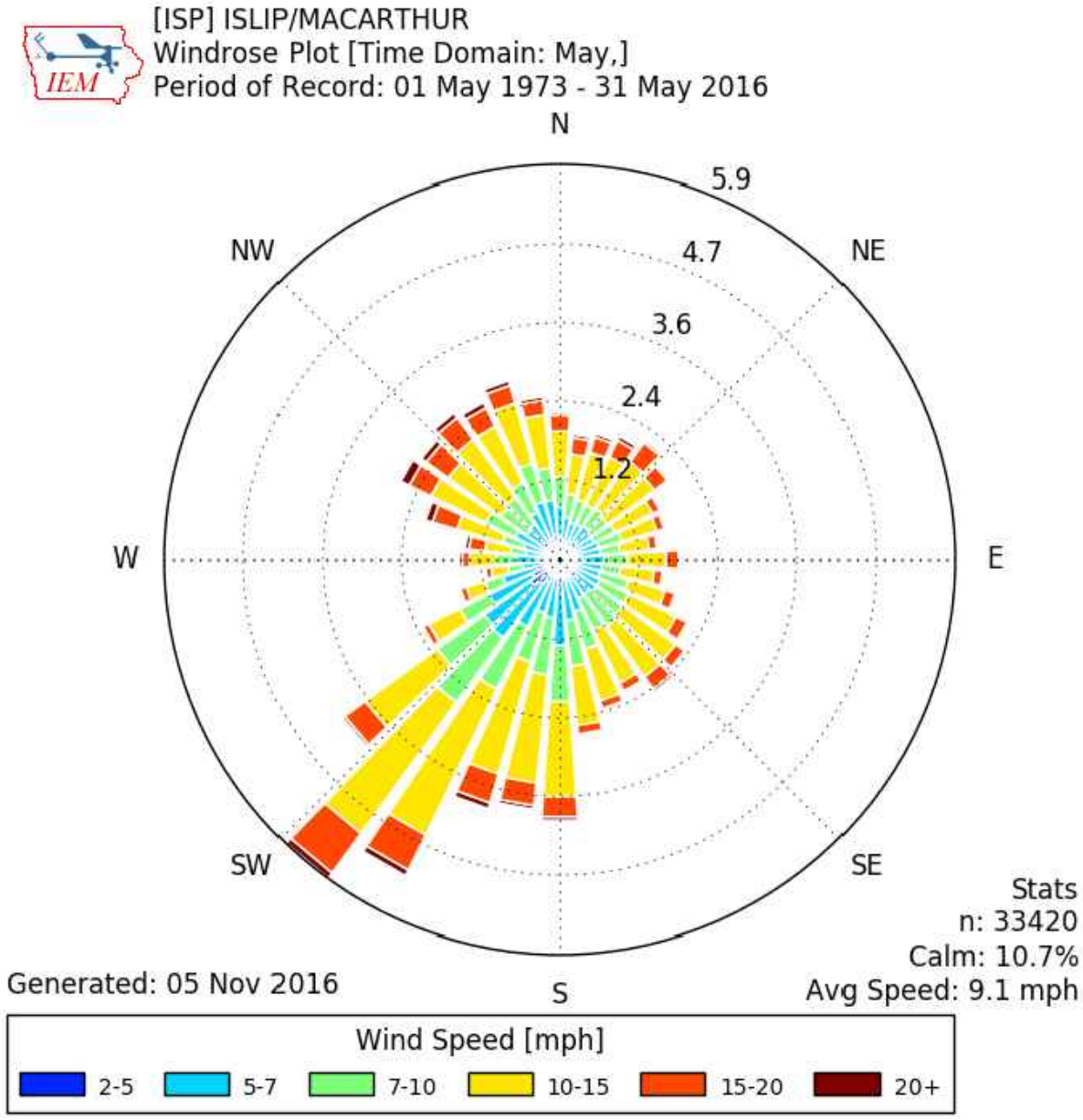
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (MARCH)	FIGURE 2-2c



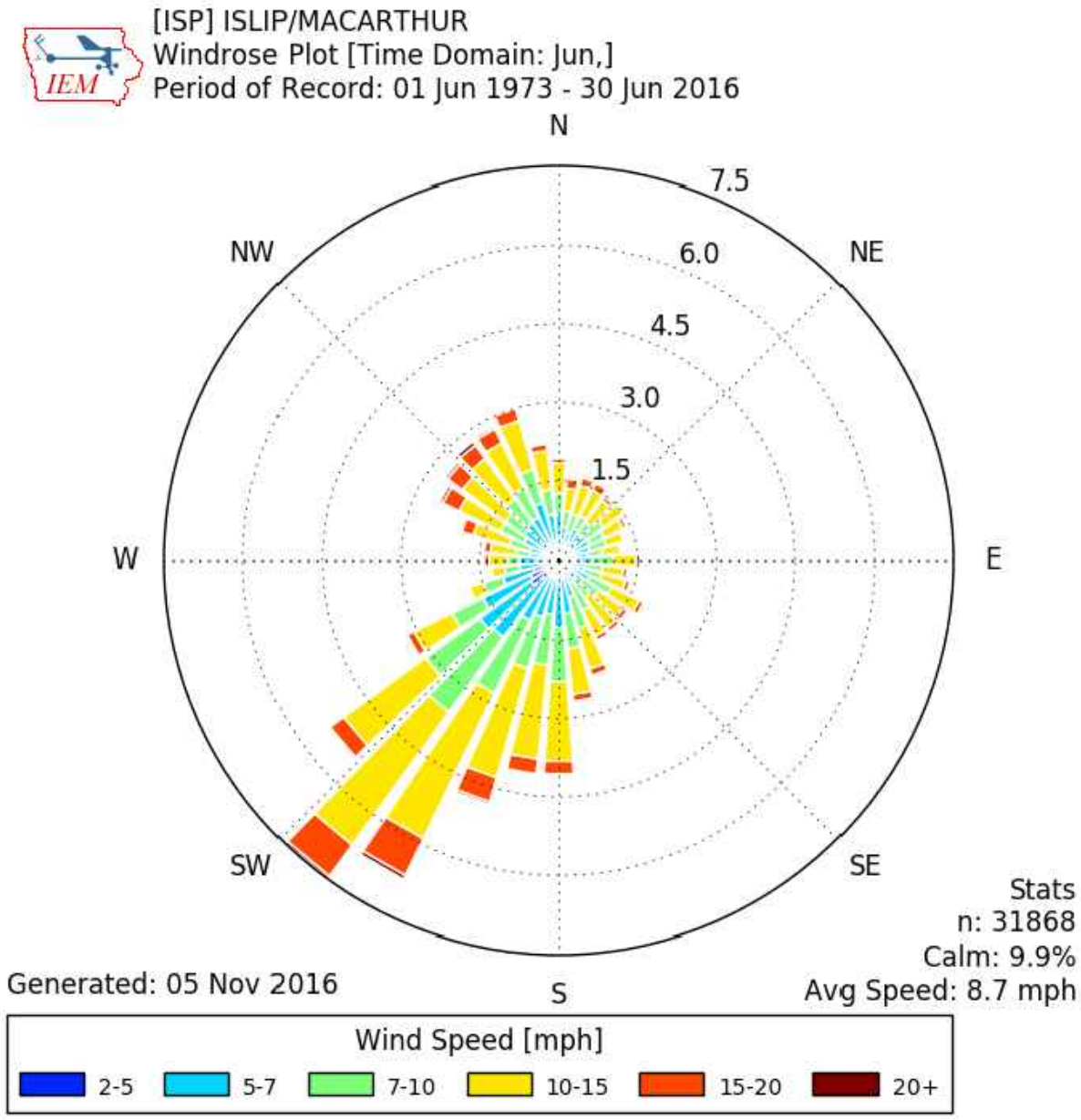
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (APRIL)	FIGURE 2-2d



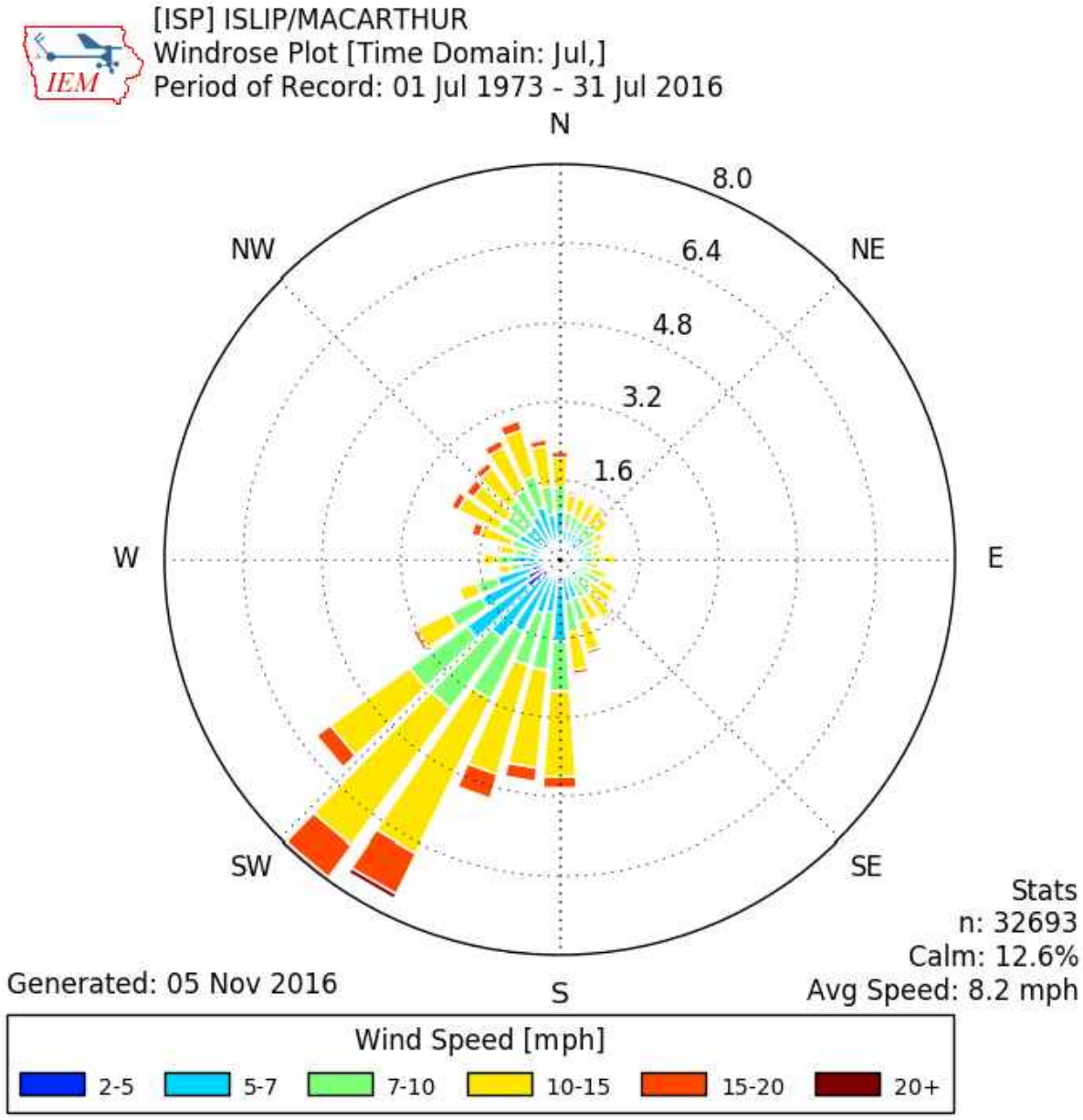
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (MAY)	FIGURE 2-2e



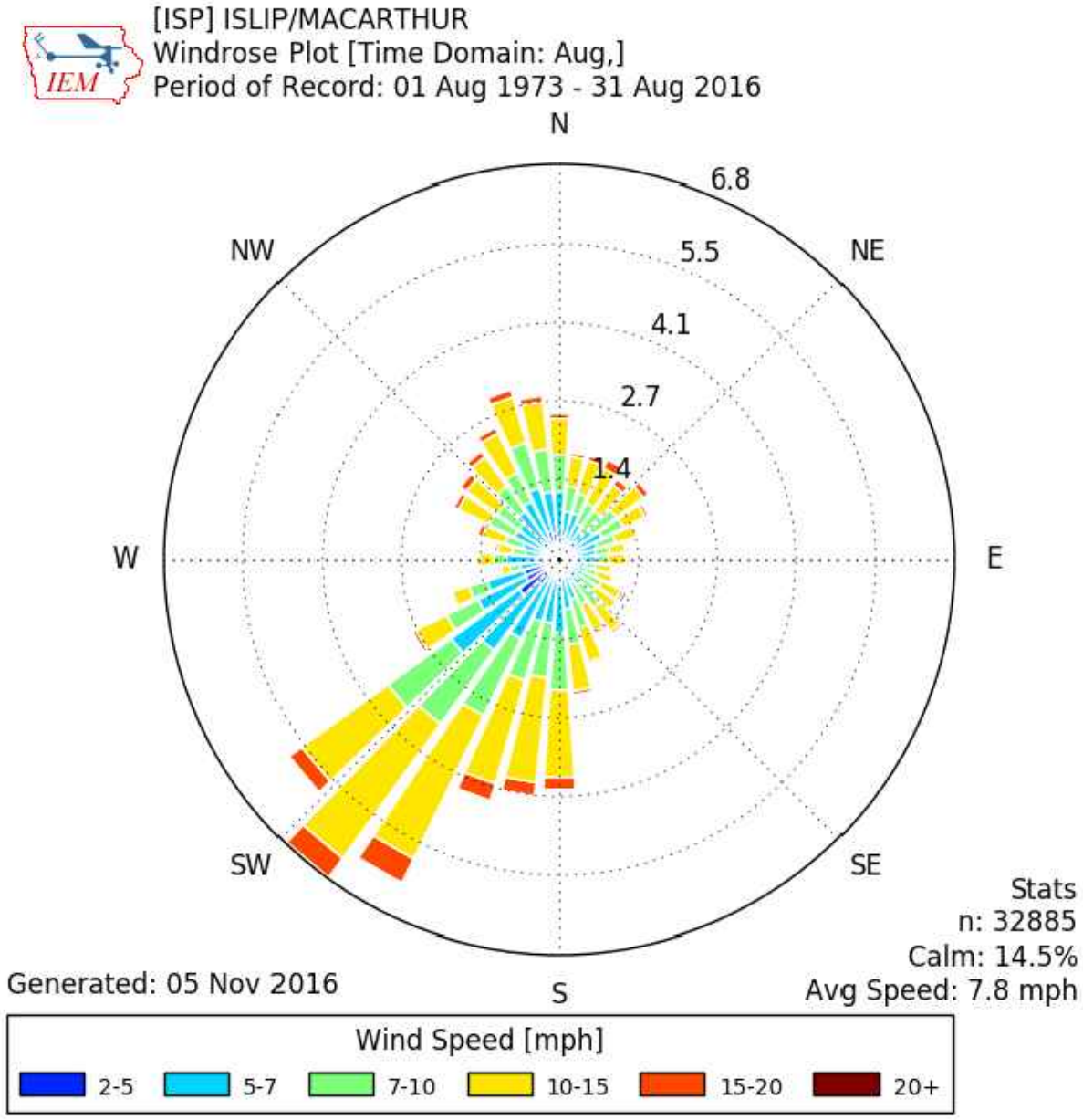
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (JUNE)	FIGURE 2-2f



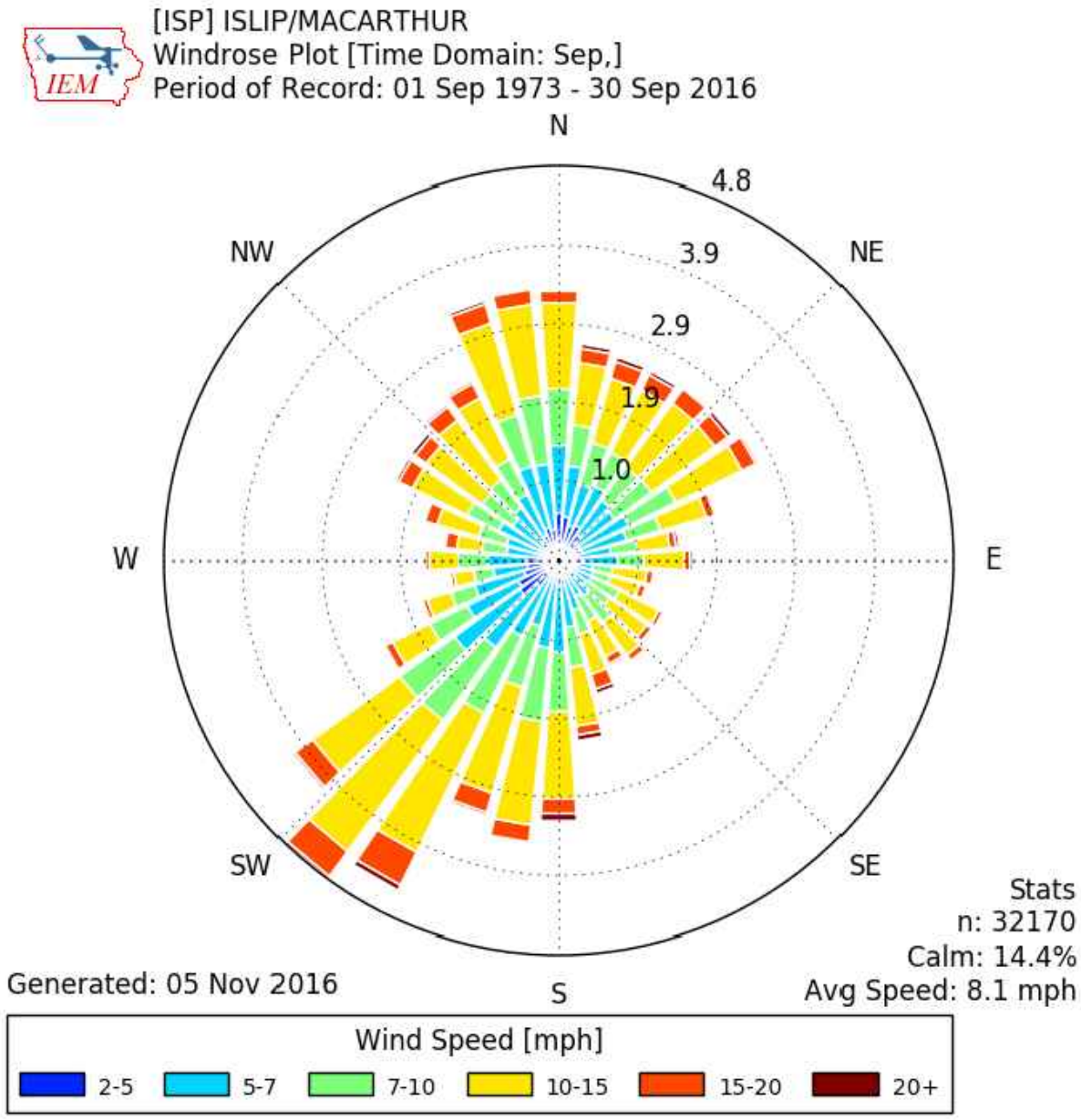
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (JULY)	FIGURE 2-2g



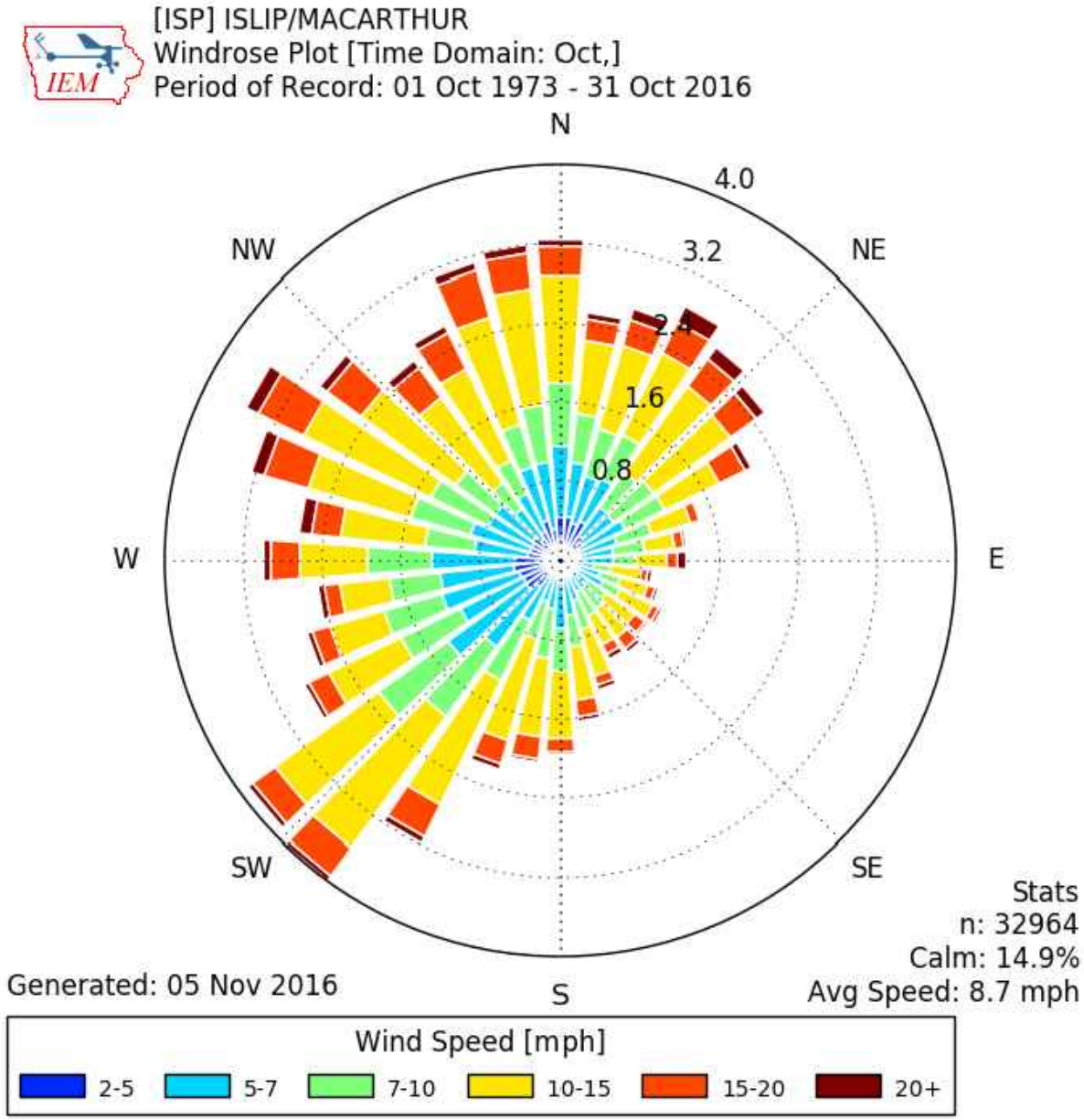
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (AUGUST)	FIGURE 2-2h



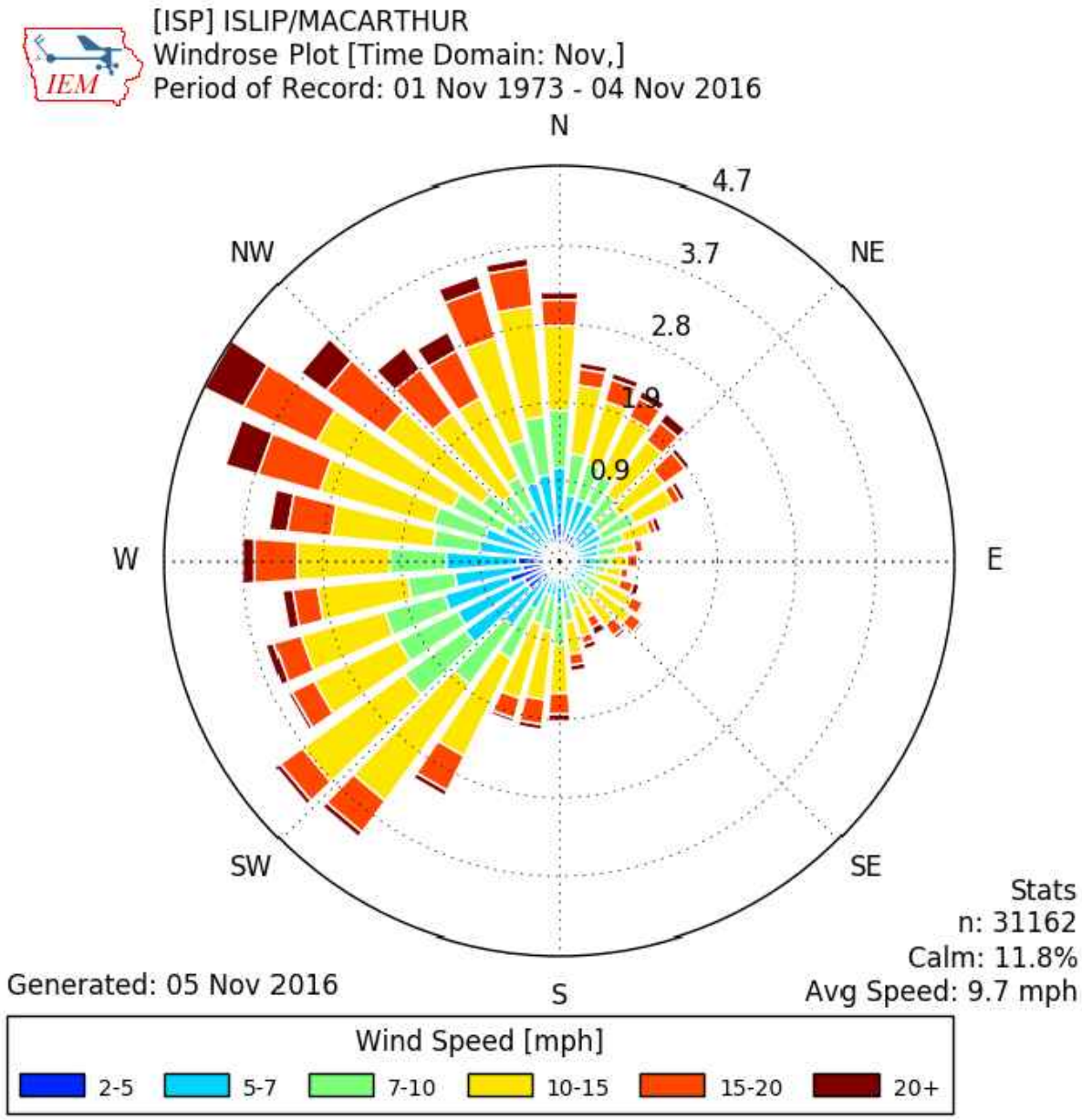
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (SEPTEMBER)	FIGURE 2-2i



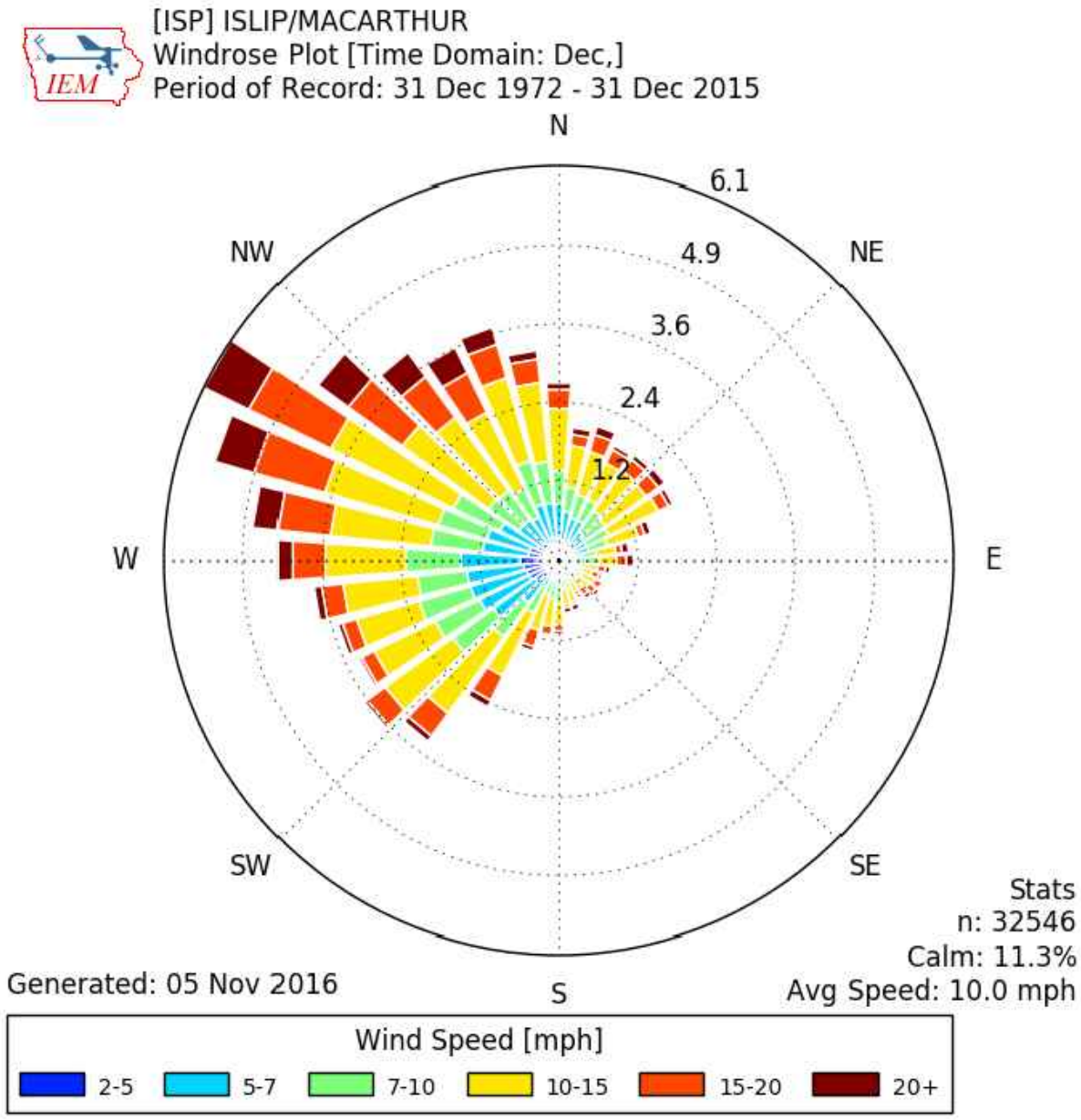
SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (OCTOBER)	FIGURE 2-2j



SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (NOVEMBER)	FIGURE 2-2k



SOURCE: IOWA ENVIRONMENTAL MESONET (IEM), IOWA STATE UNIVERSITY WEBSITE FOR ISLIP/MACARTHER, NEW YORK: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ISP&network=NY_ASOS. (ACCESSED JANUARY 24, 2017)

Brown AND Caldwell	SCALE: NONE JOB NUMBER: 149322 DATE: JUNE 2017	PATCHOGUE FORMER MGP SITE PATCHOGUE, NEW YORK WIND ROSE (DECEMBER)	FIGURE 2-2I

Appendix A: New York State Department of Health

Generic Community Air Monitoring Plan

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

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

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

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

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

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Appendix J: Health and Safety Plan (HASP)

Draft
Health and Safety Plan for Site Remediation

Patchogue Former MGP Site
234 West Main Street
Village of Patchogue, Suffolk County, NY 11772

January 2017Revision 9

BC Project Number: 149322

Prepared for:

NATIONAL GRID
175 East Old Country Road
Hicksville, NY 11801

Prepared by:

2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

DRAFT

Approval Page

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 (149322).**

	Name	Signature	Title	Date
Prepared By:	Thomas Parel		Site Safety Officer	
Reviewed By:	Keith Bogatch		Project Manager	
Reviewed By:	Sarah Everman, ASP		Safety Manager	
Reviewed By:	Susan Rosenberg, CIH		Certified Industrial Hygienist	
Effective Dates:	through			

Limitations: *This is a Project/Site-specific Health and Safety Plan for exclusive use of Brown and Caldwell. This document shall not be copied or used without the express written consent of a Brown and Caldwell Safety Manager. A copy of this document may be provided to subcontractors in an effort to help them identify expected conditions at the Site and general Site hazards; however, the subcontractor shall remain responsible for identifying and evaluating hazards at the Site as they pertain to their activities and for taking appropriate precautions. Subcontractor personnel are expected to comply fully with subcontractor's own Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities that may be identified in this Health and Safety Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.*

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Revision/Modification Log

Revision No.	Revision Date	Reason	Editor/Approver
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	April 2012	Addition to SOW – Utility Corridor Work Plan Implementation	C. Trent/ J. Bucha
5	June 2013	Deletion of Investigation Activities and Utility Corridor Work Plan Implementation/Annual Update	K. Bogatch/ L. Crabtree/ J. Bucha
6	April 2014	Addition of Off-Site Investigation Activities	J. Marolda
7	June 2015	Revised schedule for groundwater monitoring and addition of Off-Site Investigation Activities	T. Chaturgan
8	December 2016	Update for continuing semi-annual groundwater monitoring activities and deletion of Off-Site Investigation Activities	K. Bogatch/ R. Patel/S. Everman
9	January 2017	Update for Site Remedial Activities	R.Patel

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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".

Site Information	
Site Location	234 West Main Street Patchogue, New York 11772
Client/Site Contact: Sarah Aldridge	Office: (516) 545-2568 Cell: (860) 334-0554
BC Project Manager (PM): Keith Bogatch	Office: (201) 574-4765 Cell: (201) 739-2320

Primary Known Compound(s) of Concern:

- Benzene
- Toluene
- Ethylbenzene
- Xylene
- PAHs
- Cyanide
- NAPL/Tar
- Purifier Waste

Personal Protective Equipment (PPE)		
Task/Activity	Required PPE	Required Respiratory Protection
On-Site (minimum)	Level D. Work shirt and long pants, ANSI- or ASTM-approved steel-toed boots or safety shoes, ANSI-approved safety glasses, high visibility vest, and ANSI-approved hardhat.	None (Level D)
Groundwater level measurement, purge/sampling or NAPL gauging	On-site minimum + Nitrile gloves	None (Level D), though potential for upgrade (Level C) possible. Refer to Section 5 for air monitoring requirements along with upgrade and stop work action levels.
Working in overgrown or high-tick potential areas	On-site minimum + Tyvek or other non-chemical resistance suite to minimize exposure to ticks, chiggers and other insects	None

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

SEE SECTION 10 FOR SITE EMERGENCY CONTINGENCY PROCEDURES

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

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EMERGENCY PHONE NUMBERS	
In the event of emergency, contact the Project Manager (PM) and/or Safety Manager (SM).	
Emergency Services (Ambulance, Fire, Police)	911
Poison Control	(800) 876-4766 or (800) 222-1222
Hospital Name	Brookhaven Memorial Hospital and Medical Center
Hospital Address	101 Hospital Road Patchogue, NY 11772
Hospital Phone Number	(631) 654-7100
BC Safety Manager (SM; Sarah Everman, ASP)	Office: (615) 250-1263 Cell: (615) 879-9905
BC Site Safety Officer (SSO; Thomas Parel)	Office: (201) 574-4739 Cell: (516) 301-0535
BC Corporate Risk Management: Property Loss: Yolanda Harden Injury: Angela Hale	Office: (925) 210-2494 Office: (925) 210-2218
BC Electrical Safety Officer (ESO; Eric Campbell)	Office: (206) 749-2223 Cell: (480) 252-2095

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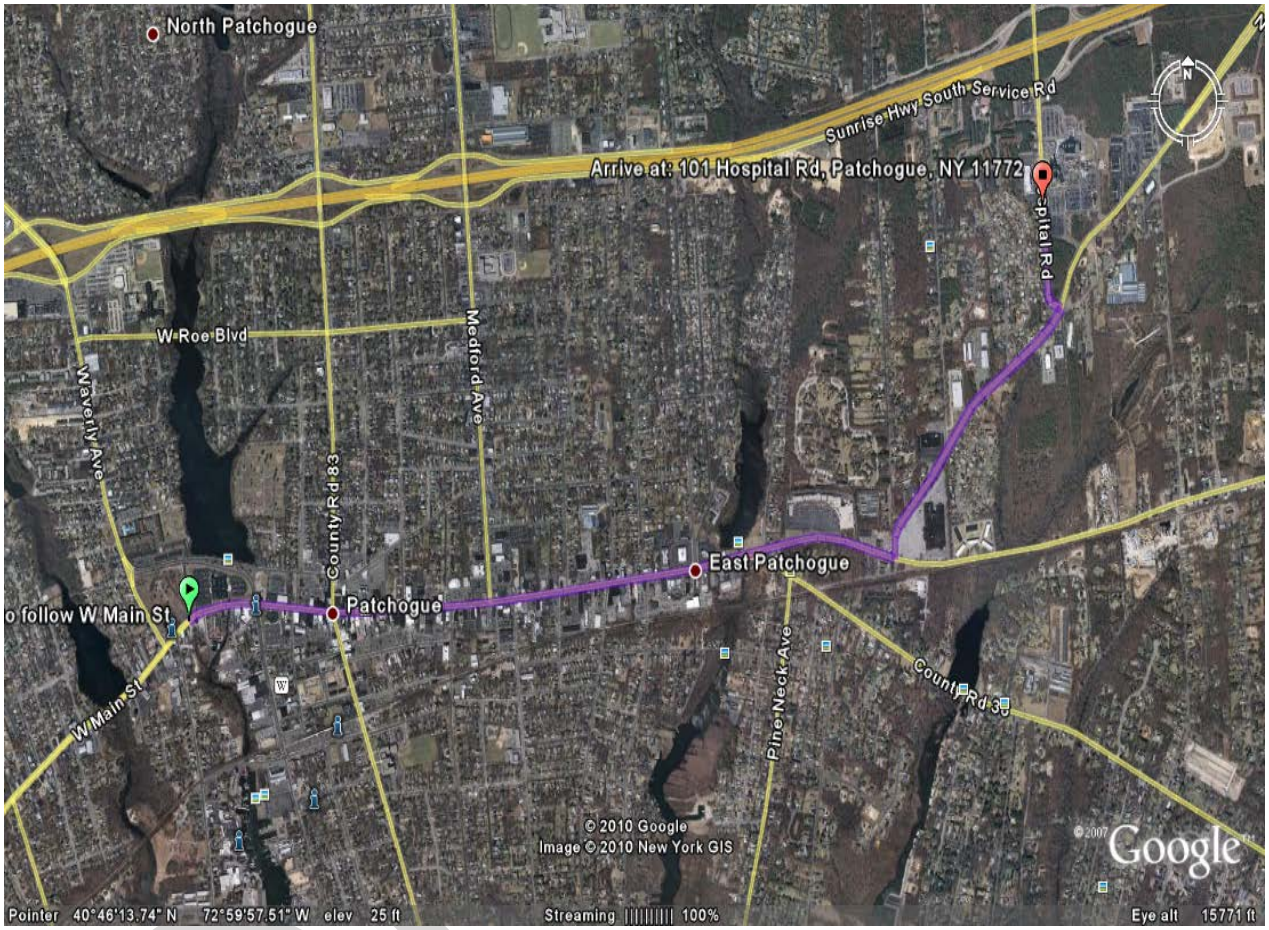
Hospital Map and Directions



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, NY 11772

Phone: (631) 654-7100

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

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Site Emergency Locations Map

Emergency meeting location

Site entrances and exits

Building access points (restrooms available)

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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. FOLLOW PROTOCOLS INCLUDING THAT A STANDBY PERSON IS PRESENT.** IF APPLICABLE, REVIEW SDSs 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 SM once the situation is under control and emergency services have been notified. Complete the appropriate incident investigation reports as soon as possible.

STOP BLEEDING AND CPR GUIDELINES	
To Stop Bleeding	**CPR**
1. Give medical statement indicating that you are trained in First 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 to 60 seconds to help control severe bleeding. 5. Continue primary care and seek medical aid as needed.	1. Give medical statement indicating that you are trained in CPR. 2. Check for responsiveness: Tap shoulders and shout, "Are you OK?" **If unresponsive and not breathing:** 3. Send someone to call **911** and to obtain an AED and first aid kit (or, if you are alone, complete these actions yourself). **It is very important to call for emergency assistance prior to initiating CPR.** 4. Immediately begin CPR, starting with compressions: • **30 COMPRESSIONS:** - at least 2 inches deep - rate of 100 to 120 compressions per minute • **2 RESCUE BREATHS:** - Open airway: tilt head past neutral position and lift chin. - Pinch nose and form seal over mouth. 5. Continue 30/2 cycle until breathing resumes or Emergency Services arrive. 6. When AED is available, use it in accordance with the AED instructions. 7. If breathing resumes, maintain an open airway and monitor for any changes in condition.

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Section 1

Introduction

It is **Brown and Caldwell's (BC's)** goal to manage projects in a manner that controls the risks associated with recognized workplace hazards and prevent injury or illness to BC project personnel, subcontractors, client personnel and the public, as well as preventing damage to property and/or the environment.

The philosophy and objectives to achieve this goal are:

- The health and safety (H&S) of project personnel is first priority.
- Successful project performance can best be achieved if sound H&S practices are an integral part of daily project activities.
- Sound project H&S practices are responsibilities that must be shared equally, without exception, by all personnel working on the project.
- Management and supervisors, including subcontractors, are accountable for the H&S of the personnel for whom they are responsible.
- Each person involved with the project is expected to use common sense and necessary safety precautions to conduct their daily activities in a manner consistent with this policy.

This Health and Safety Plan (HASP) has been developed for use during the Site Remediation **activities** 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 H&S 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 Safety Manager and Project Manager will be informed immediately upon discovery, and appropriate changes will be made to this HASP.

BC's H&S programs and procedures, including medical monitoring, respiratory protection, injury and illness prevention, hazard communication, and personal protective equipment (PPE), are documented in the BC H&S Manual. The BC H&S Manual is readily accessible to BC employees via the BC Pipeline. These H&S 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 H&S 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 hazard associated with tasks and equipment that are particular to the subcontractor's scope of work and Site activities (e.g., operation of a drill rid, excavator, crane, or other equipment).

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Additionally, subcontractors are not to rely on BC's HASP to identify all hazards that may be present at the Site. Due to the scope of their work, the subcontractor's HASP should

1.1 Site 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).

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.

1.2 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. A vacant site formerly occupied by 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 on the eastern side of the Patchogue River.

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1.3 Scope of Work

Brown and Caldwell personnel will be observing and documenting subcontractor activities. Brown and Caldwell will also collect waste characterization samples (soil and water). Site Remediation Field activities will include the tasks described below:

- Soil Remediation
- Verification Sampling
- Air Monitoring
- Monitoring well and Piezometer abandonment
- Asphalt repair, as needed
- Site cover installation
- Observation and documentation of fill placement performed by others
- Observation and documentation of site construction activities

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Section 2

Roles and Responsibilities

Keith Bogatch is the BC Project Manager (PM). **Sarah Everman** is the BC Safety Manager (SM). **Thomas Parel** has been designated as the BC Site Safety Officer (SSO) for this project. Other critical project team members are identified under the Critical Information Section of this HASP with contact information.

2.1 THINK SHARP: Pause, Think, Go

In order to prevent mishaps, BC personnel and subcontractors are expected to analyze the risks associated with his/her role and associated activities at the Site. A logic tool referenced as **THINK SHARP: Pause, Think, Go** should be utilized to aid project personnel through the risk management process. **THINK SHARP: Pause, Think, Go** requires each person to thoroughly and thoughtfully perform the following before starting each task:

- **PAUSE:**
  - What can go wrong?
  - What has experience performing this task taught?
  - Do the personnel performing this task have experience?
  - What Site conditions or periphery activities could affect safety while performing this task?
- **THINK:**
  - What precautions are needed?
  - What PPE is needed?
  - What tools are needed to perform this work safely?
  - Are the correct tools present to perform the activity (i.e., no "rigging" tools)?
- **GO:**
  - Proceed only when it is determined the task can be performed safely.

If a job cannot be done in a safe manner, it should not be undertaken. It is important for personnel involved with this project to understand that each person has the authority to call a halt to work or activities that have the potential to cause harm to persons, property, or the environment. If an unsafe condition is encountered, each person has the right, responsibility, and obligation to report it without fear of reprisal.

2.2 General Responsibilities

Members of the workforce shall be made aware of their obligation to 'Stop Work' that they consider to be unsafe, and that they have the authority, obligation and responsibility to stop any task or operation where there are concerns or questions regarding the control of the hazards or risks associated with a task or operation that is being performed.

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No work will resume until 'Stop Work' concerns or questions have been adequately addressed and associated risks have been eliminated or mitigated to acceptable levels. Instances of work being stopped for reasons of safety shall be recorded, properly investigated, and the results documented, either on the Daily Tailgate Meeting Form (Appendix D) or Incident Investigation Form (Appendix E), as appropriate.

Field personnel, including BC project field staff, are expected to have received comprehensive H&S training that meets applicable requirements of 29 CFR 1910.120. Depending on project activities, additional specialized H&S training may be required. Additional training requirements that may be required are outlined in Section 3 Hazard Analyses.

Subcontractors are expected to provide any specialized training for their personnel necessary to perform respective scope of work in addition to meeting applicable requirements of 29 CFR 1910.120. Subcontractors shall ensure that their employees have been trained in hazard recognition and mitigation per OSHA training requirements. Required training should be current within 3 years or as applicable by training requirements.

2.3 Project Management Team

The following are the key management roles and associated responsibilities for this project.

2.3.1 BC Project Manager

The PM is responsible for evaluating hazards anticipated at the Site and with the scope of work along with being responsible for working with designated field staff, the SSO and the SM to prepare this HASP to address the identified hazards. The PM is also responsible for the following:

- Empowering project team members to implement **THINK SHARP** philosophy.
- Informing project participants of H&S hazards identified at the Site.
- Providing a copy of and requiring that each project team field member, including subcontractors, reads or is briefed on the HASP. This shall be documented by individual signatures on the Acknowledgement Form (Appendix C).
- Checking that the BC project team is adequately trained and performing 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 SM for determining corrective actions, as applicable.

2.3.2 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 H&S issues as noted on-site. The SSO is responsible for the following:

- Implementing and encouraging the implementation of **THINK SHARP** philosophy.
- Reporting unforeseen or unsafe conditions or work practices at the Site to the PM or SM.
- Stopping operations that threaten the H&S of BC field team members, subcontractors, client personnel or members of the surrounding community.

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- Monitoring the safety performance of Site personnel to evaluate the effectiveness of H&S procedures.
- Performing or verifying the performance of 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 Pages of the Daily Tailgate Form and the HASP Acknowledgement Form).
- Limiting access to BC work areas on the Site to BC field team members and authorized personnel.
- Enforcing the "buddy system" or minimum 2-person teams as appropriate for Site activities.
- Performing periodic inspections to evaluate safety practices at the Site.
- Identifying the location and route to a nearby medical facility with emergency services, identifying emergency contact information, and coordinating appropriate responses in the event of emergency.

2.3.3 BC Safety Manager

The SM 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 SM. In addition, the SM has the following responsibilities:

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

2.4 Field Personnel

BC employees and subcontractors are responsible for familiarizing themselves with H&S aspects of the project and for conducting their activities in a safe manner. This includes attending Site briefings, communicating H&S 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 field 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:

- Implement **THINK SHARP** philosophy.
- Review safety-related information from other parties (i.e., client or contractors) as it relates to BC's activities.
- Inspect 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.
- Set up, assemble, and check out all equipment and tools for integrity and proper function before starting work activities.

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- Assist in and evaluating the effectiveness of Site procedures (including decontamination) for personnel, PPE, sampling equipment and containers, and heavy equipment and vehicles.
- Practice the "buddy system" as appropriate for site activities.
- Do not use faulty or suspect equipment.
- Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.
- Practice contamination avoidance whenever possible.
- Do not smoke, eat, drink, or apply cosmetics while in chemically affected areas of the Site or before proper decontamination.
- Wash hands, face and arms before taking rest and lunch breaks and before leaving the Site at the end of the workday.
- Check in and out with the SSO upon arrival and departure from the Site.
- Perform decontamination procedures as specified in this HASP.
- Notify 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.
- Do not approach or enter 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.
- Use respirators correctly and as required for the Site; check the fit of the respirator with a negative or positive pressure test; do not wear respirator with facial hair or other conditions that prevent a face-to-face piece seal.
- Confined spaces will not be entered without appropriate evaluation, equipment, training, and support personnel.

2.5 BC Subcontractors

Subcontractors are responsible for developing, maintaining and implementing their own H&S 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 H&S program documents.

Due to the level of work, the subcontractor's HASP should contain safety guidelines in greater detail pertaining to their activities during the remedial activities. Subcontractor personnel are expected to comply fully with subcontractor's HASP and to observe the minimum safety guidelines applicable to their activities that 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.

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Section 3

Hazard Analysis

Hazards at the Site may include physical hazards, chemical hazards or biological hazards. Each type of hazard is briefly addressed in the following section. 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.

It is important to note that BC personnel may be exposed to the potential hazards presented below, but may not be creating them, or be responsible for hazard mitigation or safe operation of equipment that is the responsibility of the client or their contractor(s).

3.1 Hazard Communication

In accordance with the Hazard Communication standard, safety data sheets (SDSs) formerly known as 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 SDSs for chemical products they bring on-site. In addition, containers will be clearly labeled in English to indicate their contents with appropriate hazard warnings. Please note that labeling containers includes, but is not limited to, any waste, used PPE, and/or decontamination materials collected. Containers should be labeled in accordance with the Globally Harmonized System (GHS) specified in OSHA's Hazard Communication Regulation.

3.2 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.

Site-Specific Chemicals of Concern

Known or Suspected Compounds	Source (soil/water/sludge, etc.)	Known Concentration Range Specify (mg/kg, mg/l)	
		Lowest	Highest
Benzene	Soil	Not Detected (ND)	6.3 mg/kg
	Groundwater	ND	46 ug/l
Toluene	Soil	ND	22 mg/kg
	Groundwater	ND	120 ug/l
Ethylbenzene	Soil	ND	130 mg/kg

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Site-Specific Chemicals of Concern			
Known or Suspected Compounds	Source (soil/water/sludge, etc.)	Known Concentration Range Specify (mg/kg, mg/l)	
		Lowest	Highest
	Groundwater	ND	390 ug/l
Xylene, Total	Soil	ND	195 mg/kg
	Groundwater	ND	460 ug/l
Total Polycyclic Aromatic Hydrocarbons (PAHs)	Soil	ND	16,410 mg/kg
	Groundwater	ND	2,041 ug/l
Cyanide, Total (Typically present at MGP sites as iron cyanide complexes)	Soil	ND	3.95 mg/kg
	Groundwater	ND	15 ug/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.

3.2.1 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 and Cal/OSHA PEL is listed as 1 ppm and a Short Term Exposure Limit (STEL) of 5 ppm.
- The ACGIH TLV is listed as 0.5 ppm and 2.5 ppm STEL.

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

3.2.2 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 with a Ceiling Limit of 300 ppm.
- The Cal/OSHA PEL is listed as 10 ppm and 150 ppm STEL.

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- The ACGIH TLV is listed as 20 ppm.

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

3.2.3 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 and 125 ppm STEL.
- The ACGIH TLV is listed as 20 ppm and 125 ppm STEL.

3.2.4 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 (o-), meta (m-_, and para (p-). 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 and 150 ppm STEL.
- The ACGIH TLV is listed as 100 ppm with a ceiling limit of 150 ppm.

3.2.5 Polynuclear Aromatic Hydrocarbons (PAHs)

PNAs constitute a class of materials of which benzo[a]pyrene (BaP) is one of the most common and also the most hazardous. In general, PNAs can be formed in any hydrocarbon combustion process. The less efficient the combustion process, the higher the PNA 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. PNAs may also be released from oil spills. Because of the large number of sources, people are exposed to very low levels of PNAs every day.

Certain PNAs, such as the more common 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 PNAs' 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 PNA hazards.

- The OSHA PEL is listed as 0.2 mg/m^3 (as coal tar pitch volatiles).
- The ACGIH TLV is listed as 0.2 mg/m^3 (coal tar pitch volatiles, as benzene soluble aerosol).

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3.2.6 Hydrogen Cyanide

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, unsteadiness 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/m^3).
- The ACGIH TLV Ceiling Limit is listed as 4.7 ppm for hydrogen cyanide and 5 mg/m^3 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.

3.3 Physical Hazards

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

☒ Slips, Trips, and Falls	☒ Housekeeping	☒ Materials and Equipment Handling or Lifting
☒ Noise	☒ Driving	☒ Sharp Objects/Cutting Utensils
☐ Ladder Use	☒ Traffic	☐ Elevated Platforms/Working Surfaces
☒ Overhead Utilities	☒ Underground Utilities	☐ Water Hazards (non-boating)
☒ Electrical Hazards	☒ Equipment Refueling	☒ Cutting Acetate Sample Sleeves
☒ Lockout/Tagout	☒ Arc Flash Protection	☐ Removing/Replacing Manhole Covers
☒ Heavy Equipment	☒ Excavations	☒ Personal Safety - Violence/Crime Prone Areas
☐ Drilling	☐ Fire/Explosion	☐ Personal Safety - Forested Areas
☐ Confined Spaces	☐ Troxler Nuclear Density Gauge	☐ Personal Safety - Hunting Areas
☐ All-Terrain Vehicle (ATV)	☐ Boating Safety	☐ Personal Safety - Shooting Ranges
☐ Building Collapse	☒ High-Pressure Hazards	☒ Opening Wells and Well Vaults
☐ Groundwater Sampling	☐ Other:	

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

3.3.1 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

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enforcing proper procedures, including good housekeeping practices, and wearing appropriate protective equipment.

3.3.2 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 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.

3.3.3 Materials and Equipment Handling or 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, do not bend 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.

3.3.4 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 arm's length (3 feet) without raising voice levels or if noise is greater than 85 decibels. If loud noise is present or normal conversation becomes difficult, hearing protection in the form of earplugs, or equivalent, will be required.

3.3.5 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

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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 collisions/incidents to BC's Property Loss Risk Manager.

3.3.6 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.

3.3.7 Overhead Utilities

If work is to be conducted near 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 10 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 0.5 inches for every 1 kV over 50kV will be used.

3.3.8 Cutting Acetate Sample Sleeves

The cutting of acetate sleeves presents a potential hazard to sampling personnel, especially when performing oversight during direct-push technology (DPT) activities. 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 retracts into the handle of the safety blade holder.
- Replace blades when they become dull. If material becomes hard to cut then 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.

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- If you lay the knife down, make sure the blade is retracted into the holder or the knife is placed in a protective holder.

3.3.9 Opening Wells and Well Vaults

Direct-reading instrumentation, specified in Section 5, will be used to monitor any work in or immediately around a well vault at the Site if VOCs are a concern. The well vault (outer protective casing/cover and/or well plug) will be opened carefully with personnel staying upwind as much as possible and then left open for a minimum of three (3) minutes to allow the well to vent. 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.

3.3.10 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 (e.g., 811, USA, Dig Alert, Blue Stake, etc.) 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 un-located 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.

3.3.11 Excavations

BC employees should not perform excavation work; however, these activities may be performed on-Site by a subcontractor or prime contractor. Personnel should maintain a safe distance from the open excavation and coordinate with equipment operators and designated competent person prior to accessing the immediate work area. BC employees may need to enter some excavations, up to 10-feet

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in depth, for the purpose of collecting soil samples. For excavation entry, no greater than 10-feet in depth, BC employees will do the following each time prior to entering the excavation:

- Employees will communicate with the designated excavation competent person to ask:
  - If this excavation is designated as a permit-required confined space,
  - What are the safe procedures for entering the excavation, and
  - Has the excavation been inspected that day and determined safe for entry.
- Employees will not enter excavations unless above questions are addressed to satisfaction. If an excavation is a permit-required confined space then BC will pause work to develop an entry procedure.
- 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 (Section 5). 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.
- If excavation area is considered potentially chemically impacted, additional precautions should be implemented to protect personnel from exposure such as donning Tyvek booties and potentially additional air monitoring. These additional precautions should be coordinated with the SM prior to entry.

Workers will not enter unstable excavations or excavations greater than 4 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 the 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.

3.3.12 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.

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- 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 behind, 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.

3.3.13 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, workbench 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.

3.3.14 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. 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 buildup 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, molten 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 must comply with BC's Electrical Safety and Lock-Out/Tag-Out Policy in the Health and Safety Manual and treat electrical equipment and circuits as energized until:

- 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
- The equipment or circuit has been physically isolated from every power source, tested, and clearly labeled.

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

- BC employees will 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, with the exception of those BC employees who have completed NFPA 70 E and have appropriately planned, including appropriate PPE, for the task.
- BC employees that closely supervise work within the flash protection boundary should document the possible electrical hazards, appropriate PPE, and mitigation techniques to be implemented during the project with a detailed project work plan attached to this plan's appendices. The Electrical Safety Officer (ESO) or similarly qualified person must approve all project work plans with identified shock or arc flash hazards.
- Prior to performing this work, the Project Manager (PM) will verify that the above-mentioned project work plan is prepared and approved and reviewed by the PM, the project field team, the SSO, and cognizant Health and Safety Manager.
- Only BC employees with NFPA 70E Qualified Person training 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.

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 may 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 situations.
- BC employees and management shall review the Arc Flash policy in BC's Health and Safety Manual for detailed requirements.
- Questions concerning this policy should be directed to the BC Electrical Safety Officer (ESO).

Definitions

- **Energized Electrical Work.** Work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts or greater. Electrical system testing, thought to be de-energized, but not 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 appropriate 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 must maintain a 4-foot minimum observation distance (10 feet is preferred) from the exposed (i.e. doors open, covers off) live electrical equipment rated 600V and below. In the event that the flash protection boundary must be crossed, qualified BC personnel will don PPE appropriate for Hazard/Risk Category 2. For equipment rated above

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600V, BC personnel must maintain a 10-foot minimum observation distance and not enter the flash protection boundary unless qualified and approved to do so.

- **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 must be established by the employee's supervisor or other designated knowledgeable management representative.

3.3.15 Electrical Hazards

Electrical hazards may be present at the Site in various forms. This subsection touches on the more common situations that may be encountered by BC Personnel working in the field. For additional information or to appropriate plan for hazard mitigation beyond those identified within this subsection, the BC Electrical Safety Officer (ESO) should be contacted. If concerns are identified in the field, the BC Electrical Safety Officer should be notified immediately.

Extension Cords

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 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.

Temporary Grounding

For portable generators greater than 5 kilowatt (kW), refer to the operator's manual for grounding requirements. When temporary grounding is required, a ground rod or listed grounding wire cable clamp must be utilized. Minimum ground rod requirements are 5/8"Φx10', must be driven perpendicular to the surface, and should be considered disposable after installation (unlikely to be able to be removed).

Portable generator manufacturers have different operation requirements so it is prudent to review the owner's/operations manual prior to renting or transporting to a remote field location.

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Equipment Interaction

When interacting with electrical equipment, it is important to understand that a hazard exists when operating circuit breakers and switches. An arc flash hazard is a state that occurs when exposed parts are present or when you are interacting with a piece of equipment in such a way that you could cause an arc flash. A risk assessment and determination of the proper level of PPE must be performed prior to interacting with electrical equipment. Additional training may be needed to perform some of these interactions under BC's Electrical Safety Program. Training needs should be assessed as part of the afore-mentioned risk assessment. Contact BC's Electrical Safety Officer if this risk assessment has not yet occurred. Interactions include, but are not limited to:

- opening or closing doors or removing a cover,
- operating switches or circuit breakers,
- racking a circuit breaker, or
- using tools or test equipment.

Prior to operating switches or circuit breakers, first perform a risk assessment to determine if the equipment is in good working order and what level of PPE is required. Don the appropriate PPE and use the Left-Hand rule when operating the circuit breaker or switch. The Left-Hand rule includes the following steps:

- Step to the right of the switch or circuit breaker handle.
- Turn your head to the right.
- Take a deep breath and hold it.
- Operate the switch or circuit breaker handle with your left hand.

Machinery/Equipment Observation and/or Repairs

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 the 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.

3.3.16 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 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

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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 Site) 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. When applicable, BC shall request an owner's representative to initiate the LO/TO procedure and apply the first lock. When initiated by others, BC will remove their locks prior to leaving a facility. 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:

- Each person will maintain their own lock, key, and lockout device so that no one else can remove the lock.
- Always notify the operator when work is to be done.
- 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."
- Bleed all pressure from pneumatic, hydraulic, or other fluid lines, or safely isolate them from the area where work is being done.
- Drain contents of lines or tanks as needed. Lock valves open or closed to prevent buildup of pressure.
- Ground electrical systems as needed.
- Secure any device under tension or compression to prevent accidental movement. Move suspended parts that could drop or cycle to a safe position and block, clamp, or chain them in place.
- Verify (test) that the mechanism has been isolated from the source of energy.
- Ensure that all workers remove their individual locks after work is completed. The last worker should remove the locking devices.
- 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.

3.3.17 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.

The following good operating practices will be implemented, at a minimum, when working in or near traffic areas:

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- Site personnel will wear high-visibility traffic safety vests or outerwear whenever activities are conducted in areas of heavy traffic.
- 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.
- 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 and implemented. Consider using amber/yellow warning lights to alert traffic to the work zone. Note that amber/yellow warning lights may be required by specific clients or ordinances.

The following are minimum suggestions for vehicle and barricade positioning:

- **Vehicle and Positioning.** Whenever possible, place a vehicle between your work area and oncoming traffic. Not only is the vehicle a large, visible warning sign, but also 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 area of work. 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 on the characteristics of the traffic.

3.3.18 High-Pressure Hazards

Personnel may be exposed to high-pressure scenarios while performing work at this Site. High-pressure exposure may come from, but not be limited to, ruptures in pressurized lines/pipes, use of pressurized equipment (i.e. cleaning equipment), when working with compressed gas, or even develop in normally non-pressured vessels (i.e. volatilization in sealed waste drum).

Direct exposure to high-pressure streams may cause lacerations, burns, loss of eyesight, infections from water and/or debris trapped beneath the skin, or even the loss of an appendage. Additional injuries could also be inflicted from whiplash from a broke pressurized line.

Drummed/Sealed VOC Waste:

If high VOC concentrations are present and/or drums or other sealed containers are stored in direct sun, due to volatilization the vessel may become pressurized. Prior to moving, sealed drums should be inspected for signs that the drum is under-pressure, such as bulging. If determined to be under-pressure, care should be taken to ensure pressure is relieved before opening or removing. A face shield should be utilized while relieving the pressure in addition to appropriate gloves and/or outerwear for chemical

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exposure (Section 4). Refer to Drum Handling for additional information regarding safe drum handling procedures.

Compressed Gas Cylinders:

Compressed gases are stored in steel cylinders, typically at an initial pressure about 2,000-lb./sq. in. (136 atm or 138 bar) above normal atmospheric pressure. These steel cylinders must be stored and handled safely. Careful practices are essential. The potential of a serious problem exists if an incident does occur with a compressed gas cylinder.

The U.S Department of Transportation has established regulations for the Labeling of compressed gas cylinders. The contents of a cylinder must be determined prior to use. No Label should be defaced, missing, or obscured in any manner. A cylinder whose Label fits one of the preceding descriptions shall not be used, but returned to the supplier.

The valves must be protected, and the cylinders must be secured when they are stored or moved. Cylinders should be strapped to a firm support. The valve protection cap shall be kept on until the cylinder is secured in place and ready for use. Cylinders shall only be moved with a suitable hand brake truck. They should never be rolled or dragged. They should never be subjected to a flame or be allowed to be a part of an electrical circuit. Cylinders and valves are equipped with various safety devices such as a fusible plug that melts at about 70°C (158°F). Under no circumstances may safety devices be tampered with.

Blasts of compressed gases for such purposes as blowing away dust should not be employed; the moving particles can cause harm.

Cylinders of hazardous gases shall be kept in such a manner that they do not contaminate breathing air. All cylinders shall be stored in the in the Lab or an appropriate storage location. The location will have the approval of the LM.

Used cylinders shall be capped and tagged with the appropriate “empty” tag. The date and initials of the individual transferring the cylinder to empty stock shall be placed on the “empty” tag.

The following represents a summary of safety factors relevant to compressed gas cylinders:

- Keep cylinders away from heat.
- Replace the protective cap prior to moving the cylinder and before disconnecting the security straps or chains.
- Any cylinder that is moved shall be strapped onto a cart designed for moving cylinders, and the cap must be attached.
- Use a chain, strap, or similar device to secure cylinders in an upright position. Only after this has been completed shall the protective caps be removed.
- Regulators, tubing or fittings contaminated by oil, grease, or chemicals shall not be used.
- Full cylinders shall be stored in the designated storage space.

Pressurized Hoses:

Pressurized hoses may be used at the Site to run tools like air knives and pressure washers. While the tools they power can make a worker's job much easier, the hoses themselves can be dangerous if handled improperly. The hoses derive power from the liquid or gas that moves inside them; however, that power also creates a reactive force. If the force is strong enough, it can cause the hose to whip, possibly causing serious injury if it strikes a worker and property damage.

The following tips can help prevent hose whipping hazards:

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- Inspect hoses for torn outer jackets, damaged inner reinforcing or soft spots before using them. Hoses with these types of damage should be removed from service.
- Reduce the pressure in the hose to a lower level if possible. Setting pressure regulators to 30 psi or less can minimize the possibility of the hose whipping.
- Restrain pressurized hoses that are unavoidably located near other employees with guards that are strong enough to keep the hoses in place if a leak or rupture occurs.
- Use solid lines with tight fittings if possible instead of flexible hoses when working near other employees. Solid lines do not whip or leak as readily as flexible hoses, which can develop leaks from vibration, pressure cycles and aging.
- Examine the connections on pressurized hoses frequently to prevent any accidental detachment of the line, which would result in uncontrollable whipping. Hose clamps with a restraining chain should be used to minimize the whipping effect if hose connections should accidentally become loose.
- Never connect or disconnect pressurized hoses, always depressurize first.
- Don't stop the airflow in a hose by bending or crimping with pliers as this could cause major hose damage.

3.3.19 Personal Safety – Violence/Crime Prone Areas

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 fieldwork. Once in the field, work in parties of two or more and stay within view of the 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 principles, 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 possible, work/travel in groups. Do not venture out alone.
- Be alert. Notice who passes you and who is 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. Do not 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.
- Do not overburden yourself with bags or packages, which might impede running or taking care of yourself.

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- 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's car.
- If you feel that you are in danger, do not be afraid to scream and run.
- Toss wallet/keys away from direction of escape.
- Do not attach car keys to house keys.
- Leave large valuables (purse, laptop) locked and hidden in the vehicle.

3.4 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
☒ Lightning/Electrical Storms	☒ Hurricanes/Nor' Easters	☐ Tornados and Strong/Straight Line Winds
☐ Earthquakes	☒ Flooding	☒ Snow/Freezing Rain

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

3.4.1 Sunburn

Working outdoors with the skin unprotected for extended periods 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.

3.4.2 Heat Stress

Climate conditions, particularly 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. Workers should be trained and aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions, summarized in the table below. The SSO and Site workers will monitor each other for signs of heat stress. If an employee exhibits signs or symptoms of

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heat-related illness, the SSO or designee must be notified and the appropriate response procedures initiated.

Heat Related Illness			
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.

The effects of ambient temperature can cause physical discomfort, loss of efficiency, personal injury and can increase the probability of mishaps. 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 are encouraged to drink plenty of water/fluids to stay properly hydrated. in addition, a work schedule will be established that will provide sufficient rest periods for cooling down (at least five minutes when workers feel the need to do so) and have access to shade from the sun (which, in addition to natural shade or canopies, includes resting inside a vehicle with the air conditioner running). **Personnel must 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.**

3.4.3 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 footwear, 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.

Cold Stress Symptoms and Response			
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.

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Cold Stress Symptoms and Response			
Condition	**Signs**	**Symptoms**	**Response**
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.

3.4.4 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 is connected to the building is electrical wiring.
- Stay away from tall isolated objects, such as trees, drill rigs, telephone poles, or flagpoles.
- 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 is not the highest part of the body, without letting it touch the ground. Under no circumstances lay down.

If a person is 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.

3.4.5 Hurricanes/Nor' Easters

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 near 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.

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Nor'easters have the potential to cause as much damage as hurricanes, with powerful winds, rain or snow and large waves. They can pound and erode beaches with heavy surf, affect inland areas with flooding, or coat the land with thick layers of ice and snow.

Nor'easters result from the counterclockwise rotation of a low-pressure system and the clockwise rotation of a high-pressure system, combining to bring wind and moisture to the northeast. The nor'easter's ferocity will depend on the strength of the two systems.

One reason nor'easters are so dangerous is that they tend to move much more slowly than hurricanes. That slow movement allows the storm's effects to accumulate in a given area.

A nor'easter's wind circulation can cause tidal waters in back bays to be held in place, and not allow the water to drain through inlets into the ocean. The accumulation of more and more water in tidal areas can cause widespread flooding.

Nor'easters can occur all year long, but are primarily a risk between September and April.

In the event of a hurricane or nor'easter, be prepared by:

- Checking NOAA Weather Radio All Hazards, your local radio and TV stations (i.e., The Weather Channel) for updates, watches, warnings or emergency instructions.
- Know the Coastal Evacuation Route for coastal areas or an inland area with chronic flooding.

For long term projects with temporary or permanent offices, 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 will not go bad.

3.4.6 Flooding

Flooding may occur at or en-route to and from the Site and may be the result of weather conditions or due to thawing of ice and snow (especially in the Spring).

In the event flooding occurs:

- Stay tuned to NOAA Weather Radio All Hazards, your local radio and TV stations (i.e., The Weather Channel) for updates, watches, warnings or emergency instructions.
- Know the Coastal Evacuation Route for coastal area or an inland area with chronic flooding
- If the waters start to rise inside before you have evacuated, retreat to higher ground, including the roof. Use cell phone or landline to call for help. Take a flashlight and a portable radio. Then, wait for help. Do not try to swim to safety; wait for rescuers to come to you.
- Avoid flooded areas. Do not attempt to cross any flooded areas in a vehicle or on foot. Floodwaters may be deeper than they look.
- Avoid low-lying areas like ditches, creeks, and rivers.

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- Before entering or re-entering a building, check for any signs of structural damage.
- When entering a building, do not use matches, lighters, or open flame. Use a flashlight only.
- After a flood, steps and floors are often slippery with mud and covered with debris, including nails and broken glass. Be careful walking around.

3.4.7 Snow/Freezing Rain

If a winter storm "watch" is issued for your area, it means that conditions are right for severe weather. If a winter storm "warning" is issued, it means that severe weather exists and may be moving into your area. Stay tuned to local weather information for updates on changing conditions. If a winter storm "warning" is issued for your area, stay indoors and travel only if it is absolutely necessary.

If a snow or ice storm occurs while at work, BC personnel should stay or leave at his or her own discretion. If you must travel during serious winter weather, do the following:

- Keep your gas tank full.
- Be sure your car is winterized with the proper anti-freeze.
- Keep survival supplies in your trunk.
- Let someone know your destination and the exact route you will be taking, in case you become stranded.

If you become stranded, stay with your car. Start your car and let it run with the heater on for approximately 10 minutes per hour. Be sure the exhaust pipe is clear of snow. When your car is running, leave the dome light on so that it is easier for someone to see you. Keep a window open a crack that is not exposed to strong winds. Move your arms and legs frequently to help keep blood circulating.

Avoid downed power lines. If power lines contact your car, stay inside until professional rescuers arrive. Most cars are insulated, providing protection from electricity as long as you avoid contact with metal parts of the car. Similarly, avoid rescuing anyone from a car that has come into contact with downed power lines.

When conducting Site activities in snow/freezing rain conditions, exposure to the elements should be limited. This is particularly important for the extremities such as hands/fingers, feet/toes, and the face/nose. See Section 3.3.3 for information about Cold Stress signs, symptoms and treatment.

3.5 Biological Hazards

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

☐ Bloodborne Pathogens/Sanitary Waste	☒ Rodents	☒ Other Mammals/Predators
☒ Venomous Insects	☒ Mosquitoes	☒ Poisonous Plants
☐ Fire Ants (Venomous Insects)	☒ Ticks	☐ Phragmites
☒ Spiders/Scorpions	☐ Pets/Farm Animals	☒ Snakes
☐ Alligators		

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

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3.5.1 Rodents

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 Hantavirus. Avoid generating dust near rodent feces.

3.5.2 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.

- **Timber Rattle Snake:** Timber rattlesnakes have a reddish-brown stripe running down the center of their back and black cross bands. 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 riverbeds, 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 rattlesnakes 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.
- **Copperhead:** Copperheads have dark coppery red-brown hourglass cross bands 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.

3.5.3 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.

3.5.4 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.

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3.5.5 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 lumber, 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.

3.5.6 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 fieldwork 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.

3.5.7 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.

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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

3.5.8 Other Mammals/Predatory Animals

Animals such as stray dogs, bears, or wild predators (i.e., cougars or coyotes) may pose an attack hazard.

Do not attempt to enter or work in an area if you observe an aggressive animal or predator in that area. If you are working an aggressive animal or predator moves into your area, then slowly back away in a non-threatening manner. In order to avoid such encounters, use the buddy system and make noise when working in areas where such animals may be present.

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Section 4

Personal Protective Equipment

A hierarchical approach that employs engineering and administrative controls including Personal Protective Equipment (PPE) will be utilized to mitigate hazards likely to be encountered during the performance of the project scope of work. Because of this hazard management approach, PPE will be required for Site personnel. The amount and type of PPE used will be based on the nature of the hazard encountered or anticipated.

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 or sludge) is 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 SM or SSO.

Based on the hazards identified for this project, the following levels of 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 SM.

4.1 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 indicates that airborne concentrations of chemicals of concern are maintained below the Site-specific action levels defined in Section 5. 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.

The following is the minimum PPE (Level D) required to conduct activities at the Site:

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

Additional task-specific PPE that should be donned as appropriate includes the following:

- 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).
- Full-body Tyvek suits (non-chemical resistant) to prevent exposure to ticks, chiggers and other insects.
- Chemical goggles and/or face shield if flying debris is observed during soil mixing activities.

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- Hearing protection.
- Sturdy work gloves (i.e., leather, Kevlar, others as appropriate), Chemical goggles when in contact with chemical liquids can be reasonably expected or when handling corrosive chemicals. In addition, a face shield may be required to protect the face from splash hazards.

It is important to note that dermal protection is required whenever contact with chemically affected materials is anticipated. Other personal protection readily available for use, if necessary, includes the following items:

- Chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected materials or wastewater/sewage is anticipated.
- Safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected materials or wastewater/sewage is anticipated.

4.2 Level C Protection

As previously stated, respiratory protection may be required when an airborne hazard has been identified using real-time air monitoring devices. If air monitoring indicates that the Site-specific action levels defined in Section 5 are exceeded, workers in the affected area(s) will upgrade PPE to Level C. In addition to the PPE specified for Level D, Level C also includes the following:

- NIOSH-approved half- or full-face air-purifying respirator (APR) equipped with appropriate cartridges (reference Section 5). Note: Safety glasses are not required when wearing a full-face APR.

Respirator Cartridge Replacement	
Type of Cartridge	**Cartridge Change-out Schedule**
Particulate (i.e., HEPA)	At least weekly or sooner, the 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.

Respirator Use Guidelines:

- 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 29 CFR 1910.134.
- Respirators must be certified or approved by the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services certified respirators. A label or statement of certification should appear on the respirator or respirator packaging. The label will describe the intended use of the respirator along with providing a respiratory protection factor used in part to determine the Air Monitoring Action Limits specified in Section 5.3.
- Respirators will be stored in clean containers (i.e., self-sealing bag) when not in use.
- Personnel should familiarize themselves with instructions provided by the manufacturer on respirator use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
- Respiratory protection should only be worn in atmospheres appropriate for the specific respirator and cartridge.

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NOTE: Dust Masks (i.e., filtering face-piece respirators) may be used in nuisance dust situations where respirator use is not otherwise required (i.e., voluntary use).

4.3 Stop Work Conditions

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

If air monitoring indicates that the Site-specific action levels defined in Section 5 are exceeded, activities will cease, and personnel must evacuate the designated Exclusion Zone. The PM and SM 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 SM for consultation.

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Section 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 SM, real time measurements may cease being taken when sufficient 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.

The presence of benzene will be monitored using a calibrated UltraRAE Benzene Monitoring (or similar) Model PGM-7200 which utilizes as 9.8 eV lamp combined with benzene filter tubes to assess to the presence of benzene.

5.1.2 Real-Time Aerosol Monitor (Dust Monitoring)

When there is a potential for airborne dusts to be generated as part of 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.

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5.1.3 Colorimetric Tubes

During intrusive activities on-site when purifier wastes could be encountered, a hand-held Draeger pump along with Cyanide 2/a colorimetric Draeger tubes will be used to monitor changes in exposure to cyanide. 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.

5.1.4 Multiple Gas Monitoring (H_2S and LEL Monitoring)

During intrusive activities or when performing work around or within an open sanitary sewer, a multi-gas detector will be used to monitor changes in levels/exposure to combustible gases (lower explosive limit; LEL) and hydrogen sulfide gas. The SSO, or designee, will perform routine monitoring during site operations to evaluate atmospheric conditions within the work zone. If suspect atmospheric conditions are detected above predetermined action levels specified below, work will cease and the SM will be contacted immediately. For purposes of this project, acceptable atmospheric concentrations for these compounds are as follows:

- hydrogen sulfide less than 10 parts per million (ppm);
- LEL less than 10%;
- oxygen between 19.5% and 23.5%; and
- carbon monoxide less than 25 ppm.

5.2 Site Specific Alert and 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 alert and 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 are indicated, the monitoring frequency will be increased, as appropriate. If during this time, sustained measurements are observed, the following actions will be instituted, and the PM and SM 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.

“Actions levels” referred to concentrations of VOC or PM10 that exceed the standard NYSDOH guidance levels. Levels below the standard guidance document values where the Remedial Contractor needs to take action in order to not reach an “action level” will be referred to as an “alert level.”

5.2.1 Alert and Action Levels for Volatile Organic Compounds

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VOC – Alert and Action Levels		
Activity	**Alert and Action Level**	**Level of Respiratory Protection**
Groundwater monitoring/NAPL gauging	< 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** < 0.5 ppm	Increase engineering control efforts and re-monitor effectiveness. If unable to maintain levels below 5 ppm, then upgrade respiratory protection. Level C: Half- or full-face air-purifying respirator fitted with organic vapor cartridges/ **Note**: For each incremental increase of 0.5 ppm on PID/FID, the presence of benzene will be screened/recorded. If the presence of benzene is confirmed, increase engineering controls. If unable to maintain benzene levels below 0.5 ppm with engineering controls, then stop work and evacuate the area. **Contact Director or SM prior to respirator upgrade**.
	> 25 ppm above background (**no benzene indicated**) or **Benzene indicated** = 1.0 ppm	Cease operations and evacuate work area. Contact **Director or SM and PM** immediately.

5.2.2 Action Levels for Airborne Dust

Dust – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
Not required based on current scope of work, but may be implemented if site conditions or scope changes.	< 0.5 mg/m^3 above background	Level D: No respiratory protection required.
	0.5 to 2.5 mg/m^3	Level C: Half- or full-face air-purifying respirator fitted with HEPA (P-100) cartridges: Increase engineering control efforts and re-monitor effectiveness. **Contact Director and SM prior to respirator upgrade**.
	> 2.5 mg/m^3	Cease operations and evacuate work area. Contact **Director or SM and PM** immediately.

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5.2.3 Action Levels for Cyanide

Cyanide – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
Not required based on current scope of work, but may be implemented if site conditions or scope changes.	< 2.5 ppm	Level D: No respiratory protection required.
	≥ 2.5 ppm	Cease operations and evacuate work area. Contact **Director or SM and PM** immediately.

5.2.4 Action Levels for Hydrogen Sulfide and LEL

Atmospheric Conditions – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
Not required based on current scope of work, but may be implemented if site conditions or scope changes.	**O_2 (>19.5%; <23.5%)** **H_2S (<10 ppm)** **LEL (<10%)** CO (<25 ppm)	Level D: No respiratory protection required.
	O_2 (<19.5%; >23.5%) **H_2S (>10 ppm)** **LEL (>10%)** CO (>25 ppm)	Cease operations and evacuate work area. Contact **Director or SM 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. "Actions levels" referred to concentrations of VOC or PM10 that exceed the standard NYSDOH guidance levels. Levels below the standard guidance document values where the Remedial Contractor needs to take action in order to not reach an "action level" will be referred to as an "alert level."

5.3.1 CAMP VOC Alert and Action Levels

The following action levels for VOCs are in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan:

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Alert and Action Level	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 SM or designee immediately.

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

5.3.2 CAMP Particulate Action Levels

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	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
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 SM or designee immediately.

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

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Section 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 notes or field logbook.

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 H&S 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.

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Section 7

Decontamination Procedures

Despite protective procedures, personnel may come in contact with potentially hazardous compounds while performing work tasks. Decontamination will take place in the decontamination area identified on-site and needs utilize an Alconox®, Liqui-Nox® or Trisodium Phosphate (TSP) wash followed by a rinse with clean water.

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.

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®, Liqui-Nox® 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.

Section 8

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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.

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.

Exception: When there is only one employee performing field activities for the project, a formal and documented daily tailgate safety meeting (or completion of the form) is not required. However, personnel are still expected to plan their work activities and attend any Site-specific safety meetings or training so that tasks are performed safely.

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Section 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.

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Section 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 3.4: 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 confirm 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 SM 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 Incident Investigation Report will be completed within 24 hours by the SSO, or other designated person. A copy of the 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 SM, 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.

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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, 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 must contact the NYSDEC Spill Hotline (1-800-457-7632) in the case of an accidental release of petroleum or other hazardous materials at the Site. Site personnel should locate the source of the spill and determine the hazard to the H&S 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.

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- 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.

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Section 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 H&S records is maintained electronically by the H&S Data Manager.

H&S documentation and forms completed, as specified by this plan, are to be retained in the project file.

Other relevant project-specific H&S documents, such as SDSs or client-specified procedures, will be attached to this HASP in Appendix F.

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Appendix A: Air Monitoring Form

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AIR MONITORING FORM

Project Name:	Project Number:
Site Location:	
Employee/Company Performing Air Monitoring (Name/Signature):	Date:

Instrument(s)

Manufacturer/Model: **Manufacturer/Model:**

Does the instrument(s) have a current calibration per the manufacturer's instructions? ☐ **Yes** ☐ **No**

Was the instrument(s) field checked (i.e., bump tested or field calibrated) per the manufacturer's instructions? ☐ **Yes** ☐ **No**

Remarks:

Monitoring Data

Time	Location and Activity	P/FID (ppm)	Colorimetric Tubes (PPM)	RAM (mg/m^3)	Multi-Gas Detection			
					%LEL	H_2S	O^2	Other

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AIR MONITORING FORM

Monitoring Data (continued)								
Time	Location and Activity	P/FID (ppm)	Colorimetric Tubes (PPM)	RAM (mg/m^3)	Multi-Gas Detection			
					%LEL	H_2S	O^2	Other

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Appendix B: Site Safety Checklist

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SITE SAFETY CHECKLIST

Project Name:	Project Number:
Site Location:	
Employee/Company Completing Checklist (Name/Signature):	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):

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Appendix C: HASP Acknowledgement Form

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FWSP ACKNOWLEDGMENT FORM

Project Name:	Project Number:
Site Location:	
Employee/Company Performing Review (Name/Signature):	Date of Review:

BC Employee Acknowledgement:

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

Print	Sign	Date	Print	Sign	Date

Subcontractor Acknowledgment:

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 should 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 Safety Plan for this project or other health and safety program documents for review.

BC's 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 Safety Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor will 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 Safety 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 Safety 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

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Appendix D: Tailgate Meeting Form

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TAILGATE MEETING FORM

Project Name:	Project Number:
Site Location:	
Employee/Company Performing Briefing (Name/Signature):	Date of Briefing:

Tailgate Meetings

A tailgate meeting is an informal safety meeting, which is conducted at the job site prior to the commencement of fieldwork and covers topics on safety aspects related to the specific job for that day. Meetings are normally short in duration and cover topics such as work related hazards, processes, PPE, equipment, tools, materials, environment, and safe work practices. It is a very effective way to refresh the team's knowledge, inform all team members of the specific risks in their surroundings, exchange information on the tasks to be performed, and cover last minute safety checks.

Tailgate meetings may have the following safety impacts:

- Promotes safety awareness to the forefront. Team members get actively involved in safety matters and reduce safety risks.
- Motivates team members to follow standard operating procedures.
- Provides vital information to the team on potential accident causes and preventive actions.
- Emphasizes planning, preparation, supervision, and documentation.
- Introduces team to new equipment, hazards, or preventive practices.
- Introduces team to recent changes in safety laws, industry standards, or the company or client's policies and procedures.
- Encourages team members to discuss their past experiences with safety, benefiting the team.

PAUSE - Plan of the Day

(Describe the activities that are planned to be performed today. Discuss what is the worst that could happen?)

THINK - Potential Hazards and Controls

(Describe the potential hazards and controls that may be associated with planned activities. Are all necessary precautions in place?)

☐ Physical ☐ Natural Phenomena ☐ Chemical ☐ Electrical ☐ Biological ☐ Radiological

☐ Other (specify):

GO - Only when work can be performed safely!

Field Personnel Acknowledgement:

The following signatures indicate that these personnel (BC and Subcontractors) have read and/or been briefed on this Safety Plan and understand the potential hazards/controls for the work to be performed and have reviewed these hazards and/or task-specific hazards prior to commencing activities on a daily basis.

Print	Sign	Date	Print	Sign	Date

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Appendix E: Incident Investigation Form

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INCIDENT INVESTIGATION FORM

Privileged and Confidential - Do Not Distribute

Instructions:

If an 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, witness statements, or other information that may be helpful in understanding how the accident/incident occurred. For assistance in completing this form, contact your office H&S Coordinator/Specialist or your Safety Unit Manager (SUM).

HSC – Review and enter report into the BC Online 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.

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INCIDENT INVESTIGATION FORM

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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/inc
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)

- ☐ Failure to recognize hazard(s)
- ☐ Failure to use equipment or use it properly
- ☐ Failure to use PPE or use it properly
- ☐ Failure to warn, secure, or barricade
- ☐ Horseplay
- ☐ Improper lifting
- ☐ Improper loading, placement, or position for task
- ☐ Performing excessive repetitive activities
- ☐ Operating equipment without authority
- ☐ Removing or making safety devices inoperable
- ☐ Servicing equipment in operation
- ☐ Using defective equipment
- ☐ Unclassified (not determined)
- ☐ 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)

- ☐ Congested or restricted area
- ☐ Defective tools, equipment, or materials
- ☐ Fire or explosion hazards
- ☐ Hazardous environmental conditions (vapors, dusts, etc.)
- ☐ High or low temperature exposures
- ☐ Inadequate guards or barriers
- ☐ Inadequate or excessive illumination
- ☐ Inadequate ventilation
- ☐ Inadequate walking/working surfaces
- ☐ Noise Exposures
- ☐ Poor housekeeping
- ☐ Radiation exposures
- ☐ Unclassified (not determined)
- ☐ 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 Factor Codes

- ☐ Alcohol or drug influence (possible)
- ☐ Fatigue
- ☐ Inadequate skill, capability, knowledge, or training
- ☐ Inattention
- ☐ Rushing to complete work
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Job Factor Codes

- ☐ Inadequate engineering
- ☐ Inadequate leadership/supervision
- ☐ Inadequate maintenance, wear, abuse, or misuse
- ☐ Inadequate planning or accelerated schedule
- ☐ Inadequate tools/equipment
- ☐ Inadequate work standards/procedures
- ☐ Unclassified (not determined)
- ☐ 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)

- ☐ Equipment repair or replacement
- ☐ Improve design or construction
- ☐ Improve housekeeping
- ☐ Improve PPE
- ☐ Install safety guard or device
- ☐ Reinstruction or reprimand of personnel involved
- ☐ Temporary/permanent reassignment of personnel
- ☐ Work method change
- ☐ Use safer materials or equipment
- ☐ Develop and publish lessons learned
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

DRAFT

Appendix K: Technical Specifications

Technical Specifications
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 153021

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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SECTION 01 09 00

DEFINITIONS, CODES, AND ABBREVIATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Reference standards.
   2. Abbreviations.
   3. Definitions.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.

1.02 REFERENCE STANDARDS AND ORGANIZATION ABBREVIATIONS

A. The following standards and organizations may be referred to in these specifications by the identified abbreviations. The latest version of all noted standards shall apply to this work, unless otherwise specified. Reference standards include, but are not necessarily limited to, the following:
   1. American Association of State Highway and Transportation Officials (AASHTO)
   2. American Industrial Hygiene Association (AIHA)
   3. American National Standards Institute, Inc. (ANSI)
   4. American Society for Testing and Materials (ASTM)
   5. American Society of Civil Engineers (ASCE)
   6. Code of Federal Regulations (CFR)
   7. New York Standards and Specifications for Erosion and Sediment Control (NYSSESC)
   8. New York State Department of Environmental Conservation (NYSDEC)
   9. New York State Department of Health (NYSDOH)
   10. New York State Department of Transportation (NYSDOT)
   11. Occupational Safety and Health Act (Current Standards) (OSHA)
   12. United States Environmental Protection Agency (USEPA)

1.03 DEFINITIONS

A. Abbreviations may be similar but have different meanings. If clarification is required, National Grid shall be consulted.

B. Within the context of this Contract, the terms below will have the meanings associated therewith:
   1. Addenda: Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Documents or the Contract Documents.

2. Agreement: The written agreement between the Owner and Contractor covering the Work to be performed; other Contract Documents are attached to the Contract and made a part thereof as provided therein.
3. Bid: The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices and the Work to be performed.
4. Bidder: One who submits a Bid directly to the Owner, as distinct from a sub-bidder, who submits a bid to Bidder.
5. Bidding Documents: Includes the Invitation to Bid, Instructions to Bidders, the Bid Form, and the "Contract Documents" (including all Addenda issued prior to receipt of Bids).
6. Bonds: Bid, performance and payment bonds and other instruments of security.
7. Change Directive: A document which is signed by the Owner authorizing an addition, deletion, or revision in the Work, or responding to differing Site conditions under which the Remediation to be performed as provided in the General Conditions of the Agreement, or an adjustment in the Contract Price or Contract Time, issued to the Contractor on or after the Effective Date of the Contract. The Change Directive will not change the Contract Price or Contract Times, but is evidence that the parties expect that the change directed or documented by a Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.
8. Change Order: A document which is signed by Contractor and the Owner authorizing an addition, deletion, or revision in the Work, or an adjustment in the contract price or the contract time, issued on or after the Effective Date of the Contract.
9. Competent Person: A person who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, incompliant, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The Construction Superintendent can serve as a competent person, in some instances, if approved by National Grid and/or approved representative.
10. Construction Phase: The time period, generally beginning with mobilization, during which the remaining portion of the Contractor's Scope of Work is to be performed (i.e., the portion not completed during the Preconstruction Phase).
11. Container: A portable unit in which a material is stored, transported, treated, disposed of, or otherwise handled. Examples include but are not limited to drums, dumpsters, roll-off boxes, bulk cargo containers commonly known as "portable tanks" or "totes," cargo tank trucks, and tank railcars.
12. Contract Documents: The documents so identified in the executed Subcontract. Documents consisting of the Design Drawings, Technical Specifications, and Remedial Design Report in which the implementation of the remedial work is based upon.
13. Contract: All project work covered by the Contract documents including Terms and Conditions, Remedial Design Report, Technical Specifications, and Design Drawings.
14. Contractor: The person, firm or corporation with whom National Grid has entered into the Contract. The party contracted directly with National Grid to furnish and perform the work in accordance with the Contract Documents.
15. Construction Manager: The person, firm or corporation contracted directly with National Grid to be their Representative and perform quality assurance during the work in accordance with the Contract Documents.

16. Construction Superintendent: A representative assigned the duties and responsibilities of managing the construction activities for the Contractor as specified herein.
17. Decontamination Zone: Transition area, the Exclusion Zone(s) and the Support Zone(s) or other non-exclusion areas where impacted material and other undesirable materials can be cleaned from personnel and equipment.
18. Design Drawings: Drawings included with the Contract Documents that the Contractor shall use as a guide during the remedial construction work.
19. Design Engineer: Brown and Caldwell Associates (BC).
20. Effective Date of the Contract: The date indicated in the Contract on which it becomes effective, but if no such date is indicated it means the date on which the Contract is signed and delivered by the last of the two parties to sign and deliver.
21. Exclusion Zone: An area with controlled access due to the presence of impacted materials and other potential threats to human health or safety.
22. Laws and Regulations: Laws or Regulations: Laws, rules, regulations, ordinances, codes, and/or orders of any governmental entity having jurisdiction over the Work, which apply to the Work.
23. Lump Sum Price Work: Work to be paid for on the basis of Lump Sum prices as shown on Contractor's Schedule of Values.
24. Manufacturer: A manufacturer, fabricator, distributor, material supplier or vendor having a direct contract with Contractor or with any Sub-Contractor to furnish material or equipment to be incorporated in the Work by the Contractor or any Sub-Contractor.
25. MGP: Manufactured Gas Plant.
26. MGP Waste: Byproducts resulting from the manufactured gas plant process including but not limited to coal tar and purifier waste.
27. National Grid: Project Owner who has entered into an Administrative Order on Consent with the NYSDEC to perform the environmental investigation and remediation at the Site.
28. Notice of Award: The written notice by the Owner to the apparent successful Bidder stating that upon compliance by the apparent successful Bidder with the conditions precedent enumerated therein, within the time specified, the Owner will sign and deliver the Contract.
29. Notice to Proceed: A written notice given by the Owner and Contractor to perform Contractor's obligations under the Contract.
30. Non-Conforming: Refers to Work that is unsatisfactory, faulty, or deficient, in that it does not meet the requirements of a specified inspection, reference standard, test, approval, or performance requirement referred to in the Specifications or Design Drawings, or has been damaged prior to the Construction Manager's recommendation of final payment (unless responsibility for the protection thereof has been assumed by the Owner at Substantial Completion).
31. Owner: National Grid the Project Owner who has entered into an Administrative Order on Consent with the NYSDEC to perform the environmental investigation and remediation at the Site.
32. PPE: Personal Protective Equipment.
33. Project: The total construction of which the Work to be provided under this Contract may be the whole, or a part as indicated elsewhere in the Contract Documents.

34. Record Drawings: The drawings, diagrams, and details which are prepared by Contractor or his Subcontractors to record actual construction, are updated concurrent with construction progress, and are converted to a final set of documents to be submitted to the Owner with a claim for final Application for Payment. Record Drawings shall include necessary survey information, field changes of dimension and detail, details not on original Contract Drawings, and any other information as required by the Contract Documents.
35. Schedule of Values: Contractor's itemized listing of activities of the Work, setting forth in a form acceptable to the National Grid, Contractor's allocation of the contract price by activity. The same activities shall be incorporated into Contractor's progress schedule.
36. Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data which are specifically prepared by or for Contractor to illustrate some portion of the Work; and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by Contractor to illustrate materials or equipment for some portion of the Work.
37. Site: The Patchogue Former Manufactured Gas Plant Site is located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, New York.
38. Site Safety Officer (SSO): A representative assigned the duties and responsibilities of providing Health and Safety monitoring of construction activities as specified herein, including Section 01 30 65.
39. Submittals: The Submittals described in the Specifications including, but not limited to, Specifications Section 01 33 00.
40. Supplemental Conditions to the National Grid Remedial Construction Purchase Orders (Supplemental Conditions): National Grid's proprietary specifications and conditions in regards to remedial construction purchase orders.
41. Technical Specifications: Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.
42. State: State of New York
43. Subcontractor: Any individual, firm or corporation contracted directly with the Contractor or any other Subcontractor for the performance of work at the Site (e.g., Land Surveyor, Well Driller, ISS Contractor, etc.).
44. Successful Bidder: In the event the Owner makes an award, means the Bidder to whom the Owner awards a Contract.
45. Supplier: A manufacturer, fabricator, distributor, materialman, or vendor.
46. Underground Facilities: All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasement containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control system or water.
47. Unit Price Work: Work to be paid for on the basis of unit prices as shown on Contractor's Schedule of Values.
48. Unit Price: The price of a unit of Work as shown in Contractor's Schedule of Values.
49. Work: The entire completed construction or the various separately identifiable parts therefore required to be furnished under the Contract Documents. Work is the result

of performing services, furnishing labor, and furnishing and incorporating materials and equipment into the Construction, all as required by the Contract Documents.

50. Written Amendment: A written document of the Contract Documents, signed by the National Grid and Contractor on or after the Effective Date of the Contract and normally dealing with the non-engineering or non-technical rather than strictly work-related aspects of the Contract Documents.

1.04 ABBREVIATIONS

A. Abbreviations may be similar but have different meanings. If clarification is required, National Grid shall be consulted.

Ac.	Acre
BZ	Breathing Zone
bgs	Below ground surface
BMP	Best Management Practices
CAMP	Community Air Monitoring Plan
CQAPP	Construction Quality Assurance Project Plan
CMP	Construction Management Plan
COC	Chain of Custody
CQC	Construction Quality Control
CQCPP	Construction Quality Control Project Plan
cu.	Cubic
C.F.	cubic feet
C.Y.	cubic yards
^{o}C	degrees Centigrade
^{o}F	degrees Fahrenheit
DER	Division of Environmental Remediation
DI	Deionized water
DNAPL	Dense non-aqueous phase liquid
C	Drawing
el. or elev.	Elevation
ESC	Erosion and sediment control
ft.	feet
FER	Final Engineering Report
FFS	Focused Feasibility Report
gal.	Gallons
gpm	gallons per minute
HASP	Health and Safety Plan
ICON	ICON Shoring System
ISS	In-Situ Solidification
LIPA	Long Island Power Authority
L.F.	linear feet
max.	maximum
min.	minutes or minimum
msl	Mean sea level
MGP	Manufactured Gas Plant
MPTP	Maintenance and Protection of Traffic Plan

MTBE	Methyl tertiary butyl ether
NAD	North American Datum
NAPL	Non-aqueous phase liquids
NAVD	North American Vertical Datum
NYCRR	New York State Codes, Rules and Regulations
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSDEC	New York State Department of Environmental Conservation
NYSSESC	New York Standards and Specifications for Erosion and Sediment Controls
N.T.S.	not to scale
O.D.	Outside diameter
OM&M	Operation, Monitoring and Maintenance
PDI	Pre-design Investigation
PID	Photoionization detector
PSA	Preliminary Site Assessment
PVC	Polyvinyl chloride
ppm	parts per million
psi	pounds per square inch
%	percent
QA	Quality Assurance
QC	Quality Control
RAOs	Remedial Action Objectives
RDR	Remedial Design Report
RDWP	Remedial Design Workplan
RFP	Request for Proposal
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
SCDHS	Suffolk County Department of Health Services
SCOs	Soil Cleanup Objectives
SPDES	State Pollutant Discharge Elimination System
SPT	Standard Penetration Test
S.F.	square feet
S.Y.	square yards
SSO	Site Safety Officer
TCLP	Toxicity Characteristic Leaching Procedure
TS	Treatability Study
UCS	Unconfined Compressive Strength
UCWP	Utility Corridor Work Plan
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VHB	Vanasse, Hangen, Brustlin
VOCs	Volatile organic chemicals

WMP	Waste Management Plan
w.w.	Wet weight
Owner	National Grid
Design Engineer	Brown and Caldwell Associates

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Site Description.
   2. Selected Remedy.
   3. Contractor's Scope of Work.
   4. Contract/Bid Items.
   5. Submittals.
   6. Contractor's Use of Site.
   7. Work Sequence.
   8. Contingency.
   9. Waste Management, Transportation and Disposal.
   10. Property Owner Occupancy.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's Standard General Conditions, apply to this Section.
   2. 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 (FFS).
   3. New York State Department of Environmental Conservation (NYSDEC), 2011. "Record of Decision, K-Patchogue MGP, Patchogue, Suffolk County, Site No. 152182", March 31 (ROD).
   4. NYSDEC, 2011. "Proposed Remedial Action Plan, Patchogue Former MGP, Patchogue, Suffolk County, Site No. 152182", February (PRAP).
   5. NYSDEC, 2017. "Explanation of Significant Difference, Patchogue Former MGP Site, Village of Patchogue, Suffolk County, Site No. 152182", May (ESD).
   6. Brown and Caldwell Associates, 2017. "Remedial Design Report (90-95% Submission) Patchogue Former Manufactured Gas Plant (MGP) Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York", October. (RDR)
   7. Brown and Caldwell Associates, 2012 "Construction Completion Report Utility Corridor Work Plan Implementation, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York, December.

1.02 SITE DESCRIPTION

A. The Site is located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York. The Site (referred to as "on-Site" in the ROD) is in a mixed commercial and residential area, and is currently undeveloped and vacant. The Site encompasses approximately 3.6 acres and is informally divided into three areas: the Northern Area, the Central/Core Area, and the Southern Area. The Northern Area is a

rectangular area comprising the northern portion of the Site and is enclosed with a chain-link fence. This area is mostly clear of vegetation and 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/are located. The Central/Core area is also rectangular in shape and is enclosed by a chain-link fence. The surface cover in this area consists of grasses and low brush vegetation and stone.

B. In the western Central/Core area, an IRM was performed to relocate the overhead utility lines and provide overhead clearance during implementation of the full-Site remedy. The IRM work consisted of soil excavation (to depths of approximately five and 10 feet below ground surface (bgs)) and off-Site disposal of impacted soils. The IRM also included excavation of soil in excess of the applicable SCOs. This two-foot excavation was performed to establish the environmental cap in this area. A crushed stone cap was installed.

C. A steep slope runs along the western boundary of the Site. The Southern Area comprises the tapered southern end of the property. This area has considerable concrete debris and dense vegetation.

D. The Off-Site property, located at 210 West Main Street, is immediately adjacent to and east of the Site (referred to as "off-Site" in the ROD). The Off-Site property is owned by Above All Store Fronts, Inc. The property is currently leased to National Grid for implementation of the remedial action and is not occupied.

E. The overall layout of the Site, including the Off-Site property, is depicted on the Design Drawings.

F. Remedial work will be performed within the Central/Core area of the Site and on the adjacent property.

1.03 SELECTED REMEDY

A. The Selected Remedy for the Site and Off-Site property was based on the results of the Focused Feasibility Study (FFS), the public's input into the Proposed Remedial Action Plan (PRAP), and is documented in the ROD, as amended by the ESD. The components of the remedy are presented in detail in the Design Drawings and these Technical Specifications including: excavation and off-Site disposal of any existing former MGP structure, in-situ solidification (ISS) of impacted soils, excavation and off-Site disposal of excess ISS material, Site grading, installation of an environmental cap, construction of stormwater management swale and wet meadow, and restoration of areas that incur damage during the remedial action implementation including existing asphalt, existing fencing, etc., as necessary.

1.04 CONTRACTOR'S SCOPE OF WORK

A. The scope of work includes all construction activities associated with the implementation of the Selected Remedy for the Site.

B. Site mobilization activities shall generally include: establishment of construction entrances and access roads, implementation of a 24/hour Site security program in accordance with Section 01 54 00 for Site security during working hours and after hours,

set-up of staging areas for stockpiling materials, equipment, and remediation derived wastes; surveying, set-up of decontamination pads, temporary facilities and controls, and implementation of health and safety measures. National Grid will employ the services of a third-party consultant to implement the Community Air Monitoring Plan (CAMP). The Contractor must have a Contractor Site Specific Health and Safety Plan (CSSHASP). Soil erosion and sediment controls shall be implemented in accordance with the Design Drawings, Technical Specifications, and Stormwater Pollution Prevention Plan (SWPPP).

C. Pre-implementation activities shall generally include: confirmation of presence/absence of known or suspected utilities; utility/subsurface structure clearance; demolition of existing surface features (e.g., asphalt pavement); Site clearing and grubbing; removal of catch basin and associated stormwater piping on the Off-Site property, removal of historic and currently abandoned Long Island Railroad tracks, removal of former MGP structures located in the Core area, sheet pile installation, monitoring well decommissioning; protection of monitoring wells to remain; and installation of slope protection measures.

D. ISS activities shall generally include: implementation of field pilot-scale ISS, construction of a stable working platform for equipment utilized throughout ISS implementation; mixing of soils and ISS reagents; demolition and incorporation of MGP-related structures into the ISS implementation; removal, management, and processing, if necessary per disposal facility requirements, of ISS-related swell; excavation, management and processing, if necessary per disposal facility requirements, of solidified soils to accommodate installation of the environmental cap (Site Covers); and equipment decontamination.

E. The Site and Off-Site property will be restored with an environmental cap consisting of a total of four feet of imported approved fill placed on top of the ISS area, and two feet of soil meeting the requirements for cover material set forth in 6 NYCRR Part 375-6.7(d) within the Central/Core Area (including beyond the limits of the ISS area). The Site restoration activities will include the construction of a stormwater management swale and wet meadow. Additionally, the Off-Site property will receive asphalt pavement surface to match the grades and elevations as show on the Site restoration drawings.

F. Project Scope of Work includes but is not limited to completion of the following activities, including all supervision, labor, materials and equipment, in accordance with the Design Drawings and Technical Specifications:

G. Pre-Mobilization:

1. Preparation of required submittals in accordance with National Grid's Standard General Conditions, Technical Specifications, Environmental Procedures, and Environmental Guidance for review and approval of National Grid;
2. Preparation of CSSHASP to apply to all personnel On-Site during construction, including but not limited to, Contactor's employees and Subcontractor's employees. At a minimum, the HASP must meet the requirements of 29 CFR 1910 and 29 CFR 1926, as applicable. Perform construction activities in accordance with the CSSHASP;
3. Preparation of project-specific plans including, but not limited to the Construction Management Plan (CMP);

4. Preparation of Work Schedule including a detailed description of the proposed sequence of construction, and a list of non-working holidays for the Contractor and subcontractors;
5. Obtain and verify all necessary constructions permits and provide necessary notifications.
    a. Contractor shall conduct all remedial activities in accordance with substantive requirements of the federal regulations.
6. Assist National Grid with a Process Hazard Analysis in accordance with Section 01 30 65.
7. Schedule and conduct pre-construction inspection with National Grid and the Construction Manager to document Site conditions;
8. Submit all applicable documents a minimum of 1 month prior to start of mobilization to equipment or material to the Site; and
9. Preparation of a photolog to document pre-existing conditions at the Site and Off-Site property, including fencing, ground surface conditions, building interior, building exterior, utilities, etc. A copy of the existing conditions report will be submitted to the Construction Manager and the Engineer a minimum of 1 month prior to the start of mobilization of equipment or material to the Site. National Grid will also conduct a Pre-Construction Survey.

H. Mobilization and Demobilization:
1. Mobilize necessary personnel, equipment, and materials to the Site.
2. Remove equipment and temporary facilities.
3. Demobilization of personnel, equipment, and materials.
4. Conduct final Site/office cleaning.
5. Submittal of project close-out documentation.

I. Temporary Facilities and Controls:
1. Includes all items required by National Grid's Standard General Conditions.
2. Establish construction entrances and access roads and laydown and staging areas including material storage, imported fill, stockpile, excavated soil stockpile.
3. Maintain temporary utilities, including electricity, lighting, gas, internet, phone line, and water, as necessary, to complete the work in accordance with the Contract Documents. National Grid has accounts with the above utilities and will continue to pay for the services listed above, however the Contractor is responsible for making sure they are in proper working condition.
4. Maintain temporary facilities including sanitary facilities, parking, etc. National Grid has leased the off-Site building (210 West Main) and Site personnel can utilize the building. The Contractor is responsible for maintaining such building.
5. Provide and maintain temporary controls including temporary fencing, staging areas, traffic control, and dust, odor and noise controls.
6. Employ a third-party Subcontractor to implement the NYSDEC-approved Contractor Site Specific Health and Safety Plan (CSSHASP).
7. Provide Work Zone air monitoring for all Contractors and Subcontractors.
8. Provide and maintain soil erosion and sediment control measures in accordance with the NYSDEC-approved Stormwater Pollution Prevention Plan (SWPPP), Technical Specifications, and Design Drawings.

9. Setup equipment, vehicle, and personnel decontamination areas.

J. Survey and Record Documents
   1. Employ Surveyor to conduct Site surveying work, including documenting:
      a. Limit of Work and Existing Site Conditions, if different than shown on Design Drawings,
      b. Location of known utilities and utilities suspected to be present,
      c. Location of all former remaining MGP structures, railroad tracks, etc.,
      d. Boundary of each ISS area prior to commencement of the remedial activities,
      e. ISS depth measured as extending from existing ground elevation to bottom of ISS (i.e., not including height of imported fill placed to construct a stable work platform),
      f. Top of ISS grade following excavation to accommodate placement of Site Covers
      g. Base grade (i.e., two feet below Site Cover final grade),
      h. Site Cover final grades;
      i. Stormwater management swale and wet meadow grades and invert elevations; and
      j. Final Site conditions.
   2. Provide Progress surveys for verifying field quantities for pay items.
   3. Provide As-Built Surveys and Record Drawings.

K. Pre-Implementation Activities
   1. Conduct a Level A Utility/Subsurface clearance including excavation of a 2-foot-deep bgs trench along the perimeter of the limits of soil remedial action (ISS and excavation) and cut and cap any utilities. Level A Subsurface Utility Engineering (SUE) investigation and as-built map shall be conducted as defined by the National Consensus Standard titled ASCE C-1 38-02, Standard Guidelines for the collection and Depiction of Existing Subsurface Utility Data.
   2. A copy of the Level A Survey will be submitted to the Construction Manager and the Engineer 1 month prior to the start of mobilization of equipment and material to the Site.
   3. Demolish, remove, and stage existing surface features to accommodate implementation of ISS.
   4. Remove former MGP Structures (above or below ground) and railroad tracks encountered during remedial activities. Contractor to demolish and appropriately size former MGP structures for off-site disposal.
   5. Remove, handle, and stage catch basin located within ISS area on the Off-Site property and implement temporary stormwater controls.
      a. Remove, handle, stage, and dispose of stormwater catch basin, pipe associated with this catch basin, and water/sediment/debris within these items in accordance with Section 02 41 19.
   6. Decommission or protect monitoring wells as designated on the Design Drawings and the Specifications.
   7. Design, install, maintain, and remove the slope protection measures at the location identified on the Drawings and in accordance with Section 31 41 16 and applicable local, state, and OSHA regulations.

8. Clear and grub vegetation, trees, and shrubs within Limit of Work as needed to perform remedial activities and as designated on the Design Drawings.
9. Design, install, maintain and remove the settlement and vibration monitoring equipment in accordance with Section 01 10 56.

L. In-Situ Solidification
   1. Mobilization, assembly, and testing of grout plant to produce the design mix meeting the requirements of the Specifications.
   2. Conduct Field Pilot Scale.
   3. Implementation of Full-Scale ISS.
   4. Demolish and re-size, to a maximum of 1 foot in size or less, former historical MGP structures for and incorporation into the ISS treatment after approval from the Design Engineer.
   5. Management, on-Site staging, and processing of excess swell material generated from ISS activities for off-Site management in accordance Section 31 70 00.

M. Soil Excavation
   1. Conduct soil excavation to the target depth shown on the Design Drawings.
   2. Demolish and re-size, and if needed, and remove underground historical MGP structures that may be encountered in during excavation.

N. Waste Management
   1. Perform waste management activities for waste materials generated during remedial action, including but not limited to:
      a. Excavated Soils
      b. Excess ISS Treated Soils
      c. Wastewater.
      d. Impacted Demolition Debris.
      e. Non-Aqueous Phase Liquid (NAPL).
      f. Miscellaneous Debris and Wastes.
   2. Waste management activities include:
      a. Perform waste characterization sampling and analysis;
      b. Coordinate with Construction Manager and the National Grid and NYSDEC approved disposal facilities for waste profiling and waste acceptance;
      c. Schedule and coordinate off-Site transportation and treatment/disposal;
      d. Load waste materials into licensed/registered haulers;
      e. Transport waste materials to permitted treatment/disposal facilities on National Grid's list of pre-approved disposal facilities; and
      f. Execute and manage waste documentation (including manifests, bills of lading, disposal certificates, weight tickets.

O. Site Cover Installation and Site Restoration
   1. Backfill and grade to establish base grades with imported fill materials prior to installation of Site Cover.
   2. The On-Site cover will consist of a minimum of two feet of crushed stone meeting the requirements for cover material set forth in Section 31 05 13.

3. The Off-Site cover will consist of asphalt to be installed in accordance with the requirements of Section 32 12 16.
4. Construct stormwater management concrete swale and vegetated wet meadow.
5. Re-establish utilities temporarily disconnected/isolated.
6. Install new chain-link fence and gates as shown on the Design Drawings.

P. Miscellaneous:
1. Provide any other miscellaneous items required to complete the work.

1.05 CONTRACT/BID ITEMS

A. Furnish all supervision, labor, materials, services, insurance, tools, equipment, temporary facilities, decontamination facilities, and incidentals to perform Work in accordance with the Contract Documents (including Bid Form and Payment Item Descriptions), Design Drawings and Specifications and applicable laws, regulations, codes, ordinances and standards.

1.06 SUBMITTALS

A. Prepare and submit a submittal register and the required submittals, including Contractor prepared plans, documents, data, drawings, and other information related to the materials, equipment, and methods, in accordance with Section 01 33 00 - Submittal Requirements.

B. Provide submittals to Brown and Caldwell, National Grid and/or the National Grid authorized representative.

C. Prepare and submit a Construction Management Plan (CMP) for review and acceptance by National Grid, the National Grid approved representative and the Design Engineer. The CMP shall contain, at a minimum:
1. Proposed detailed remedial construction schedule, including holidays that Contractor or Subcontractors will not be working.
2. Contractor Remedial Action Contingency Plan (CRACP) (Section 01 10 00).
3. Pre-Existing Conditions including Level A Survey and Photolog (Section 01 10 56).
4. Settlement and Vibration Monitoring Plan (Section 01 10 56).
5. Survey Control Plan (Section 01 30 00).
6. Contractor Site Specific Health and Safety Plan (Section 01 30 65).
7. Construction Quality Control Project Plan (CQCPP) (01 40 00).
8. Traffic Control Plan (Section 01 50 00).
9. Work Zone Control Plan (Section 01 52 00).
10. Decontamination Plan (Section 01 52 20).
11. Site Security Plan (Section 01 54 00).
12. Selective Demolition Plan (Section 02 41 19).
13. Excavation Plan (Section 31 23 16).
14. Erosion and Sediment Control (ESC) Plan (Section 31 25 13).
15. Slope Protection Measures Plan (Section 31 40 00).
16. Waste Management Plan (Section 31 70 00).

17. In-Situ Solidification Pilot Scale-Study Work Plan (Section 31 80 00).
18. In-Situ Solidification Work Plan (Section 31 80 00).
19. Utility Support and Protection Plan (Section 33 05 18).

1.07 CONTRACTOR'S USE OF SITE

A. Access to Site: Restricted to Limit of Work shown on the Design Drawings. Equipment staging areas, material storage areas, and decontamination stations shall be located within the Limit of Work.

B. The Contractor shall not perform Work or conduct activities at the Site outside of the Contractor's Limit of Work, wetland areas, or use any other means of ingress or egress to and from the Site without the approval of National Grid.

C. Disturbed areas outside the Limit of Work shall be restored to original conditions at no additional cost to National Grid.

D. Contractor shall assume full responsibility for Site security of equipment, materials, and work area.

E. Contractor shall conform to all applicable laws, regulations, permits and Contract Documents

F. Contractor shall assume full responsibility for the health and safety of the Contractor's employees while at the Site and for implementation of the CSSHASP for the project.

1.08 WORK SEQUENCE

A. Work sequencing shall be in accordance with the general sequence identified in the Drawings, unless otherwise approved by the National Grid and/or the Construction Manager.

B. Contractor must ensure that neighboring operations or activities are not disturbed, interrupted, or prohibited as a result of the Work.

C. Work sequencing shall be conducted in a manner that prevents contamination or recontamination of areas not contaminated or already decontaminated.
   1. ISS implementation of the Site ISS area shall be completed prior to ISS of the Off-Site property ISS area, and shall progress in a direction from north-northwest to south-southeast following the gradient of Site groundwater.
   2. ISS implementation of the ISS on the Off-Site property shall not begin prior to the completion of ISS on-Site, and shall progress in a direction from northwest to southeast following the gradient of Off-Site property groundwater.

D. Work sequencing shall be conducted in a manner to coordinate staging, stockpiling and loading of waste to be transported and disposed off-Site.

E. The proposed work sequence shall be reflected in the Contractor’s schedule. Contractor shall notify the Construction Manager and submit an updated project schedule with any modifications to the sequence of work.

1.09 CONTINGENCY

A. Prepare, submit, and implement a CRACP that includes, at a minimum:
   1. A Spill Response Plan (SRP) for addressing spills that occur On-Site and Off-Site during remedial construction activities. The SRP will describe the methods, means, and facilities required to prevent soil, water, structure, equipment, and material impacts caused by spills; provide information regarding spill containment and cleanup; and provide information related to decontamination measures. Spill response procedures shall comply with National Grid requirements and procedures.
   2. Procedures that Contractor's personnel will conduct in response to an emergency.
   3. Designations of an emergency coordinator.
   4. Include a current list of all emergency equipment and evacuation plans.
   5. Procedures and routes for emergency vehicular access/egress.
   6. Procedures for the evacuation of personnel from the Site.
   7. A listing of contact personnel with phone numbers that, at a minimum, includes fire officials, ambulance service, local, county, and state police, local hospitals, a spill response team, NYSDEC 24-hour Spill Hotline, and procedures for notifying each party.
   8. Routes to local hospitals, including written directions and a map that depicts the location of the Site relative to the hospital(s).

1.10 WASTE MANAGEMENT, TRANSPORTATION AND DISPOSAL

A. Wastes generated from remedial activities and other construction activities shall be transported by the Contractor and disposed at a National Grid and NYSDEC approved facility in accordance with Waste Management Plan and the Technical Specifications.

B. Waste treated/disposed off-Site shall be at an approved disposal facility listed in the National Grid USA Environmentally Approved Hazardous Waste Disposal and Recycling Facilities, included with the Contract Documents.

1.11 PROPERTY OWNER OCCUPANCY

A. The National Grid and the adjacent Off-Site property owner will not occupy the Site during the remedial construction activities.

B. It shall be assumed that other adjacent property owners/tenants will occupy their respective properties/facilities and that construction activities shall be performed and sequenced in a manner that does not interfere with operations on adjacent properties.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 10 56

PROTECTION OF WORK AND PROPERTY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Precautions and programs to protect the work, existing surface structures and all public and private property from damage.
   2. Protection of active utilities and associated support structures designated to remain.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. National Grid's Health and Safety Requirements Specified in the Contract Documents.
   3. Section 01 10 00 – Summary of Work.
   4. Section 01 30 50 – Work Restrictions.
   5. Section 01 30 65 – Health and Safety Requirements.
   6. Section 01 33 00 – Submittal Requirements.
   7. Section 01 50 00 – Temporary Facilities and Controls.

C. References
   1. Occupational Safety and Health Administration (OSHA) Regulations

1.02 SUBMITTALS

A. Contractor shall conduct pre- and post-construction inspections of the Site including the off-Site property and shall submit assessments and photo and/or video documentation of the inspections. These assessments shall include features which might be or were affected by the work, including buildings and structures in the vicinity of the Work area, fencing, and utility infrastructure. The assessments shall include descriptions the location, nature and extent of damage.

B. Prepare a Settlement and Vibration Monitoring Plan for monitoring settlements and vibrations at sensitive receptors including the Patchogue River and the building at 210 West Main Street. It shall include monitoring locations, frequency, action limits, and reporting requirements. This shall be included as part of the Construction Management Plan.

1.03 PROTECTION REQUIREMENTS AND COORDINATION

A. The Contractor shall be liable for all damage and expense for direct or indirect damage caused to the Work and/or existing structures and environment. Contractor shall repair any damage during construction operations to the satisfaction of National Grid and the affected party.

B. The Contractor shall have equipment and materials available on-Site that is suitable and sufficient for sustaining and supporting any and all existing structures that are uncovered, undermined, weakened, endangered, threatened, or otherwise materially affected during the Work.

C. Necessary changes in the location of the proposed remedial activities shall be made by National Grid and/or the Construction Manager to avoid unanticipated underground structures. If permanent relocation of an underground structure or other subsurface facility is required and is not otherwise provided for in the Contract Documents, National Grid will direct the Contractor in writing to perform the necessary Work.

D. Conduct surveys of buildings and existing features (e.g., exposed foundation components, retaining walls, roadways, bridges, fences, monitoring wells, gas lines, etc.) on and adjacent to the Site to document their conditions prior to the start of remedial construction. The surveys will include visual assessment of the condition of these features documented using photographs or video.

E. All other existing surface facilities, including but not limited to fencing, guard rails, posts, guard cables, signs, poles, markers, and curbs which are temporarily removed to facilitate the performance of the Work shall be replaced and restored to their original condition.

1.04 PROJECT CONDITIONS

A. Underground utilities are defined to be, but are not limited to: sanitary, sewer, water, stormwater, gas, oil water separator, cable, communications, and electrical conduits.

B. Underground structures known to National Grid and the Design Engineer are shown on the Design Drawings. This information is shown to assist the Contractor in accordance with the best information available, but is not guaranteed to be correct or complete.

C. The Contractor shall notify Dig Safely – New York (800-962-7962) – for a utility stakeout request prior to conducting any intrusive activities. The Contractor shall field verify and field mark-out all underground utilities and structures indicated on the Design Drawings. The Contractor shall request an official mark-out of utilities and in the immediate vicinity of the Site and limits of work to verify the location of underground utilities with the appropriate agencies.

D. All overhead lines on-Site that have the potential to be damaged by the work or access/egress shall be flagged by the utility purveyors. Contractor shall coordinate with the appropriate utility purveyors to flag overhead lines, as necessary, prior to the start of the work.

E. Coordinate with the utility company who owns the utility during the performance of the work to determine which electrical and gas lines or other utilities, presented on the Design Drawings, reference drawings, utility mark-up and encountered in the field, are active and which may be abandoned.

F. Support and protect active utilities to prevent damage and to prevent service interruption. The Contractor shall meet the substantive requirements of the pertinent utility companies with regard to support and protection of any existing utilities impacted by the proposed remedial construction activities.

G. The Contractor shall be liable for all damage and expense for direct or indirect damage caused to an active utility and is responsible to have it repaired promptly. The Contractor shall repair any damage to protected structures and utilities during construction operations in accordance with the pertinent New York State, Village of Patchogue/ Town of Brookhaven and/or Department of Public Works, and utility authorities and as directed by National Grid and/or the Construction Manager.

H. Surface structures are defined as all existing structures and other facilities at or above the ground surface. Surface structures include, but are not limited to, monitoring wells, piezometers, utility poles (including anchors and support cables), fire hydrants, electrical panels, curbs, piles, fencing, foundations, and all other facilities that are visible above the ground surface.

I. The locations of the proposed remedial activities are fixed and any proposed changes in the location of Work shall be approved by the Design Engineer and/or the Construction Manager to avoid unanticipated underground structures or impediments.

J. All utilities affected by the works shall be de-energized and/or shut down in accordance with the appropriate lockout/tagout procedures when interrupted. The Contractor shall not interrupt utilities unless permitted in writing by the utility owner and then only after arranging for temporary utility services, if required. No users shall be left without utility services.

K. All utilities whose facilities may be affected by the implementation of the Work shall be notified at least 72 hours in advance of the start of any operation that might affect such facilities.

L. Coordinate with utility company and the appropriate local and county authorities when working within utility easements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 PROTECTION OF WORK

A. In order to prevent damage, injury or loss, the Contractor's actions shall include, but not be limited to, the following:
   1. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with the progress of the Work or the work of any other Subcontractor.
   2. All flammable materials to be maintained on-Site shall be stored in appropriate flammable storage cabinets. All temporary fuel storage tanks shall have secondary containment.
   3. Provide suitable storage facilities in accordance with manufacturer's recommendations for all materials which are subject to damage by exposure to weather, theft, breakage or otherwise.

4. Frequent clean up of all refuse, rubbish, scrap materials, and debris caused by site operations, so that the area of the work shall present a safe, orderly and workmanlike appearance at all times.
5. Furnish and erect barricades, fences, lights, warning signs, and danger signals as required and take other precautionary measures for the protection of persons or property and of the work, where work is performed on or adjacent to any roadway, right-of-way, or public place.
6. Failure to comply with these provisions could result in stoppage of work until they are met. Any costs incurred due to this work stoppage shall be borne by the Contractor.

B. Immediately repair damages to curbs, monuments, overhead utilities, subsurface utilities, or other property caused by the Contractor, and to the satisfaction of National Grid, the Construction Manager, the Design Engineer, and/or the pertinent utility company, following completion of the work. The costs for these repairs will be borne solely by the Contractor, as determined by National Grid.

C. Immediately notify the Construction Manager of any and all claims and complaints arising as a result of the work and provide assistance, as required, to resolve all claims and complaints.

3.02 VIBRATION MONITORING FOR SENSITIVE STRUCTURES/RECEPTORS

A. Perform the remedial construction in a manner that will limit the potential for adverse impacts due to vibrations and settlement.

B. Perform vibration monitoring during the Work, in accordance with the Settlement and Vibration Monitoring Plan as described

C. Perform vibration and settlement monitoring during the Work:
1. Vibration monitoring during the Work will be performed by the Contractor at a location adjacent to the existing building, and between Work activities and the existing building and as directed by the Construction Manager.
2. The threshold criterion for ground-borne vibrations is 0.5 inches per second (in/sec) peak particle velocity (PPV). If this criterion is exceeded, the Contractor shall promptly inform the Construction Manager and stop work immediately at no additional expense. Work shall resume after implementing measures to reduce vibrations as approved by the Construction Manager or National Grid.

D. Perform settlement monitoring during the Work:
1. The Contractor shall establish and conduct the settlement monitoring program specified herein.
2. All surveying shall be performed by a surveyor licensed to practice in the State of New York.
3. Settlement monitoring program:
   a. Establish settlement monitoring points at a minimum of 8 locations evenly spaced along the western, southern, and eastern sides of the existing building.
   b. Survey the monitoring points on two (2) separate days prior to commencing excavation, demolition, and/or ISS activities when work activities are within 25 ft. of the existing building.

c. Survey all monitoring points weekly throughout the duration of the Work.

d. Perform a daily survey of monitoring points identified by the Construction Manger when either of the conditions occur:

   1) Work activities are occurring within 25 feet of the existing building, or

   2) Vibrations measured at the existing building as described in Part 3.2B, exceed the threshold criterion.

e. Preliminary settlement monitoring point elevation survey results shall be submitted to the Construction Manager by the surveyor prior to leaving the Site. The survey final results of settlement monitoring points shall be submitted to the Construction Manager electronically within 24 hours of performing the survey. The survey results shall be reported at the full resolution recorded by the instrument.

f. If the settlement at any monitoring point reaches or exceeds 0.02 feet, the Contractor shall inform National Grid and the Construction Manager immediately.

g. Examine the construction activities in the vicinity of the monitoring point for causes of the settlement. Propose alternative construction procedures and/or support methods that will minimize or prevent additional settlement.

   1) Continue to survey the monitoring points designated by the Owner's Representative daily.

h. If the settlement at any monitoring point reaches or exceeds 0.04 feet, the Contractor shall stop work at no cost to National Grid and inform National Grid and the Construction Manager immediately. Work shall resume following an investigation by the Contractor into the causes of the settlement and the implementation of repairs and/or solutions to prevent further settlement, and upon approval by National Grid and/or the Construction Manager.

3.03 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Protect and support existing on-Site utility poles that are actively in service and are within the planned remedial work areas. Protect and support the existing on-site utility poles that are to remain in place in accordance with the requirements of the pertinent utility company.

B. Contractor must field verify the clearance of subsurface utilities by physical means (i.e., soft digging).

   1. Contractor must physically remove the soil at boring and excavation locations to a depth below where utilities would be expected to be encountered.

   2. A geophysical survey must be conducted by a survey Contractor to confirm utility structures prior to intrusive work.

C. Contractor shall protect all existing structures outside the limits of the excavation areas. If Contractor damages any structures, Contractor shall repair or replace the damaged structure to the original construction standards at Contractor's own expense without reimbursement

D. Contractor shall be responsible for protection of utilities. If Contractor damages any utilities, Contractor shall repair or replace the damaged utility to the original construction standards at Contractor's own expense without reimbursement

E. Contractors shall sustain in place and protect underground and surface structures from direct or indirect damage, the designated utilities (active or inactive) to remain.

F. Contractor shall flag, barricade or otherwise suitably protect existing buildings, above and below ground facilities, and public roadways during construction operations.

G. Contractor shall place demarcation flags on all below grade telecommunication lines. Contractor shall also place signs on all on-Site and off-Site utility poles stating "OH LINES ABOVE."

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. General conditions.
   2. Schedule of values.
   3. Applications for payment.
   4. Progress payments.
   5. Payment for material delivered.
   6. Change procedures.
   7. Defect assessment.
   8. Unit prices.
   9. Alternates.

1.02 GENERAL CONDITIONS

A. For lump-sum items, payment will be made set forth in the Contract on the basis of actual Work completed.

B. For unit-price items, payment will be based on the actual amount of Work accepted and for the actual quantity of materials in place, as shown by final measurement.

C. All units of measurement shall be standard United Stated convention as applied to the specific items of Work by tradition and as interpreted by Design Engineer.

D. At the end of each day's work, Contractor's Representative shall meet with the Construction Manager and determine the quantities of unit price Work accomplished and/or completed during the workday.

E. Contractor's Site Manager shall prepare a "Daily Work Summary" report which shall be signed by the Contractor's Site Manager.

F. Each month, Contractor shall prepare a "Monthly Progress Summation" form from the month's accumulation of "Daily Work Summary" reports, which shall be signed by the Contractor Project Manager.

G. These completed forms will provide the basis for National Grid and/or Construction Manager review and verification of monthly applications for payment submitted by Contractor.

1.03 SCHEDULE OF VALUES

A. Submit Schedule of Values in duplicate within 5 days after Notice of Award.

1.04 APPLICATIONS FOR PAYMENT

A. Submit a template of the payment application to National Grid and/or the Construction Manager for approval.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Submit at intervals stipulated in the executed Contract.

E. Submit with transmittal letter as specified for Submittals in Section 01 33 00 - Submittal Requirements.

F. Substantiating Data: When Construction Manager requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
   1. Partial release of liens from major Subcontractors and vendors.
   2. Record documents as specified in Section 01 70 00, for review by National Grid and/or the Construction Manager which will be returned to Contractor.
   3. Construction progress schedules, revised and current as specified in Section 01 33 00.

1.05 PROGRESS PAYMENTS

A. Progress payments shall be made monthly as the Work progresses in accordance with the Contract. All progress invoices and payments shall be subject to correction in the final quantity invoice and payment.

B. No monthly payment shall be required to made when, in judgment of National Grid and/or the Construction Manager, the Work is not proceeding in accordance with the provisions of the Contract Documents, or when, in his/her judgment, the total value of the Work performed since the last payment amounts to less than $1,000.00 other than for the final payment.

C. A retainage of 10% (ten percent) will be made on all progress payment. Retainage shall be paid after National Grid and/or the Construction Manager determines that a Work has been satisfactory performed and completed in accordance with the Contract Documents.

D. Neither the final payment nor any part of any retained percentage shall become due until Contractor shall deliver to the National Grid and/or the Construction Manager a complete waiver and release of any and all liens, and claims and rights of lien under the laws and regulations of the State wherein the Work is performed relating to Mechanic's Liens or materialmen's liens on account of labor or materials or both, arising out of the Work performed hereunder, and an affidavit stating that the waiver and release include all the work, labor, materials, equipment, services and all other indebtedness in connection with the Work for which a lien might be filed. Contractor's affidavit shall recite that there are no unsatisfied or outstanding claims or demand by virtue of said Work which can be asserted against National Grid and/or the Construction Manager or the real estate or improvements upon which the Work is performed, by way of Mechanic's Lien or

materialmen's lien or similar lien or action, however called. All affidavits, waivers and releases shall be satisfactory in form and content to the Construction Manager.

E. The final payment, including any retained percentage, due to the Contractor for Work performed shall be paid within thirty (30) days after (1) the furnishing by Contractor to Construction Manager of the necessary documents required by Paragraph D above, (2) proof satisfactory to Construction Manager that there are no unsatisfied claims for injuries to persons or property, and no other indebtedness in connection with the Work, (3) the Work is complete, and (4) written acceptance of the Work by Construction Manager.

F. Payment shall not be made for materials and equipment not incorporated into the Work.

G. No progress payment shall be made upon fuels, supplies, falsework, or other materials that are not a permanent part of the Contract.

1.06 CHANGE PROCEDURES

A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Construction Manager will advise of minor changes in the Work not involving adjustment to Contract Price or Contract Time by issuing supplemental instructions. The Construction Manager will manage the work on behalf of National Grid. The Construction Manager shall receive and direct all scope change requests, correspondence, and communications from the Contractor and will coordinate with National Grid.

C. The Construction Manager may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 5 days.

D. Contractor may propose changes by submitting a request for change to the Construction Manager, describing proposed change and its fill effect on the Work. Include a statement describing reason for the change, and effect on Contract Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors.

E. Stipulated Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for Change Order as approved by the Construction Manager.

F. Unit price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit prices basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under Construction Change Directive. Changes in Contract Price or Contract Time will be computed as specified based on method determined by the Construction Manager in the Construction Change Directive.

G. Construction Change Directive: Construction Manager must issue directive, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change

Order. A Change Directive will not change the Contract Price or the Contract Times, but is evidence that the parties expect that the change directed or documented by a Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

H. Field Order: Minor changes in the Remediation, that does not involve a change in the Contract Price or Contract Schedule, will be in a written order issued by National Grid.

I. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. The Construction Manager will determine change allowable in Contract Price and Contract Time as provided in Contract Documents.

J. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs in the Work.

K. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.

L. Execution of Change Orders: National Grid and/or the Construction Manager will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

M. Out-of-scope work performed by the Contractor shall be documented and brought to the attention of the Construction Manager immediately. Under no circumstances shall any out-of-scope work be performed prior to Construction Managers' notification and National Grid's approval. Written notification must follow within 24 hours of the verbal notification.

N. Correlation of Contractor Submittals.
   1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Price.
   2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
   3. Promptly enter changes in Project Record Documents.

1.07 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Design Engineer, it is not practical to remove and replace the Work, National Grid and/or the Construction Manager will direct appropriate remedy or adjust payment.

C. At the discretion of the Construction Manager, defective Work will be partially repaired to instructions of the Engineer, and unit price will be adjusted to new price at discretion of Construction Manager.

D. Individual specification sections may modify these options or may identify specific formula or percentage price reduction.

E. Authority of Construction Manager to assess defects and identify payment adjustments, is final.

F. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products stored improperly.
   4. Products not completely unloaded from transporting vehicle.
   5. Products placed beyond lines and levels of required Work.
   6. Products remaining on hand after completion of the Work.
   7. Loading, hauling, and disposing of rejected products.
   8. Products placed or used beyond the lines and levels of the required Work.
   9. Repair or replacement of monitoring wells, utilities, the off-Site building, or any other property located within or adjacent to the Work Area.

1.08 UNIT PRICES

A. Authority: Measurement methods are delineated in individual specification sections.

B. Measurement methods delineated in individual specification sections complement criteria of this section. In event of conflict, requirements of individual specification section govern.

C. Take measurements and compute quantities. The Construction Manager will verify measurements and quantities.

D. Unit Quantities: Quantities and measurements indicated in Bid Form are for contract purposes only. Actual quantities provided shall determine payment.
   1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at unit prices contracted.
   2. When actual Work requires 25 percent or greater change in quantity than those quantities indicated, National Grid or Contractor may claim for Contract Price adjustment.
   3. Under no circumstances may the Contractor exceed stated quantities without prior written approval from the Construction Manager and National Grid.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, transportation, services and incidentals; erection, application or installation of item of the Work; overhead and profit.

F. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Construction Manager multiplied by unit price for Work incorporated in or made necessary by the Work.

G. Measurement of Quantities (verified by the Construction Manager):
   1. Weigh Scales: Inspected, tested and certified by applicable New York Weights and Measures department within past one year.

2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
3. Metering Devices: Inspected, tested and certified by applicable New York department within past year.
4. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
5. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
6. Measurement by Area: Measured by square dimension using mean length and width or radius.
7. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
8. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

1.09 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Construction Manager's option. Accepted Alternates will be identified in the executed Contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTRACTOR SUBMITTALS

A. Contractor shall promptly revise Progress Schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of Work affected by the change, and resubmit as defined in the Agreement.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Project coordination and conditions.
   2. Preconstruction meeting.
   3. Site mobilization meeting.
   4. Progress meetings.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 30 50 – Work Restrictions.
   4. Section 01 50 00 – Temporary Facilities and Controls.

1.02 SUBMITTALS

A. Meeting Minutes (pre-construction, Site mobilization, progress)

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 COORDINATION AND PROJECT CONDITIONS

A. Coordinate and cooperate with National Grid, the Construction Manager, and the Design Engineer, as necessary, in all activities, to ascertain compliance with the Contract Documents, including but not limited to providing data, providing working record drawings, collecting samples, Site security, Site access, transportation and off-Site disposal of remediation derived waste, and any reasonable requests for information or use of personnel and equipment.

B. Regardless of how extensive or intensive the monitoring of Work quality, the Contractor will be responsible for construction means, methods, techniques, sequences or procedures, safety precautions and programs in connection with the Work. National Grid will not be responsible for Contractor's failure to carry out the Work in accordance with the Contract Documents. National Grid's duties, services, and work will in no way supersede or dilute Contractor's obligation to perform Work in conformance with all Contract requirements. An authorized representative (e.g., Construction Manager) is empowered by National Grid to act on behalf of National Grid with respect to the proper execution of the Work and to issue a Stop Work order or to give instructions when necessary to require such corrective measures as may be necessary, in the professional

opinion of the National Grid authorized representative, for the proper execution of the Contract or to protect National Grid's interest.

C. National Grid, the Construction Manager, New York State Department of Environmental Conservation (NYSDEC) representatives, Design Engineer, other employees and any other parties who may enter into contracts with National Grid for doing Work within the area covered by the Contract or representatives of local, State and Federal regulatory agencies shall, for all purposes which may be required by their contracts or authority, have access to the Work and the premises used by Contractor, and Contractor shall provide safe and proper facilities therefore.

D. The Construction Manager, Design Engineer, or others may conduct independent observations or sampling and analyses to assess the Work by Contractor. Contractor shall fully cooperate with the Construction Manager and/or Design Engineer in the collection of any such samples, and shall provide assistance (labor or equipment) as appropriate.

E. Coordinate scheduling, submittals, and Work of various sections of project design documents to ensure efficient and orderly sequence of installation of interdependent construction elements.

F. Provide a full-time capable and experienced Construction Superintendent, Resident Quality Assurance/Quality Control (QA/QC) Engineer, Competent Person(s) and Site Safety Officer (SSO) for the duration of the remedial construction activities at the Site. These individuals shall be totally responsible for the execution of the work as representatives of the Contractor and shall coordinate all activities with National Grid and the Construction Manager. If qualified, the Construction Superintendent can act as a Competent Person.

G. Coordinate, supervise, direct and cooperate fully with Subcontractors, manufacturers, fabricators, suppliers, distributors, installers and testing agencies whose services, materials or equipment are required to ensure the completion of the work and comply with the project schedule. The Contractor shall have no claim against National Grid, the Construction Manager, or the Design Engineer for delay caused by conflicts with their Subcontractors and utility service companies.

H. Provide all necessary coordination with the pertinent utility companies and governmental entities regarding the implementation of the proposed remedial construction activities.

I. Coordinate with National Grid access to the Site for correction of defective Work and Work not in accordance with Contract Documents.

J. Minimize direct communications with regulatory agency personnel outside of regular progress meetings and members of the public and other interested parties (excluding regulatory agency personnel). Direct communication with these entities is the sole responsibility of National Grid.

K. Participate in all project coordination or progress meetings to comply with the project schedule.

3.02 PRECONSTRUCTION MEETING

A. The Construction Manager will schedule meeting after Notice of Award.

B. Attendance Required: National Grid (or a National Grid authorized representative), Construction Manager, Contractor Project Manager and Superintendent, Contractor Site Safety Officer, and Design Engineer.

C. Agenda:
   1. Execution of National Grid-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing parties in Contract and Engineer.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

D. The Construction Manager will record minutes and distribute copies within five days after meeting to participants, with electronic and hard copies to: National Grid, the Construction Manager, Design Engineer, Contractor and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. The Construction Manager will schedule meeting at Project Site prior to Contractor occupancy.

B. Attendance Required: National Grid, the Construction Manager, Contractor Project Manager and Superintendent, Contractor Site Safety Officer, Design Engineer, NYSDEC Representative, and major Subcontractors.

C. Agenda:
   1. Use of premises by National Grid and Contractor.
   2. National Grid's requirements.
   3. Survey and remedial activities layout.
   4. Security and housekeeping procedures.
   5. Schedules.
   6. Application for payment procedures.
   7. Procedures for testing.
   8. Procedures for maintaining record documents.
   9. Inspection and acceptance of equipment put into service during construction period.

D. The Construction Manager will record minutes and distribute copies within five days after meeting to participants, with electronic and hard copies to: National Grid, the Construction Manager, Design Engineer, Contractor, NYSDEC Representative and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. The Construction Manager will schedule and administer meetings throughout progress of the Work, to be attended by the Contractor Project Manager and Site Superintendent, at maximum weekly intervals.

B. Construction Manager will make arrangements for meetings, prepare agenda with copies for participants and preside at meetings.

C. Attendance Required: National Grid, the Construction Manager, Contractor Project Manager and Superintendent, Contractor Site Safety Officer, Design Engineer, and major Subcontractors and suppliers, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems impeding planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Maintenance of progress schedule.
   7. Corrective measures to regain projected schedules.
   8. Planned progress during succeeding work period.
   9. Coordination of projected progress.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to Work.

E. The Construction Manager will be responsible for recording the minutes of meetings and will include any significant proceedings and decisions. The Construction Manager will provide the minutes of the meetings to National Grid, the Construction Manager, Contractor, and Design Engineer for review and approval. Once approved, copies of the minutes shall be distributed to each participant in the meeting and to parties affected by decisions made at the meeting. Deviations or clarifications to the meeting minutes shall be made in writing and are subject to acceptance and approval by National Grid and/or the Construction Manager.

END OF SECTION

SECTION 01 30 20

SURVEY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Surveying Requirements.
   3. Quality Requirements.
   4. Survey Control.
   5. Surveying Scope of Work.
   6. Drawing Requirements.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General and Supplementary Conditions, apply to this Section.
   2. National Grid's Health and Safety Requirements.
   3. Section 01 10 00 – Summary of Work.
   4. Section 01 30 65 – Health and Safety Requirements.
   5. Section 01 33 00 – Submittal Requirements.

C. References:
   1. Occupational Safety and Health Administration (OSHA) Regulations

1.02 SUBMITTALS

A. Provide surveyor name and qualifications.

B. Provide a Survey Control Plan as part of the Construction Management Plan. Plan shall identify survey control points and include methods for recording survey data. Survey Control Plan shall include preparation and submittal of drawings showing elevation tracking locations to be used during remedial activities. Grid survey locations shall be co-located. The grid spacing shall be as follows for each remedial activity:
   1. Targeted excavation of MGP-related source material: 5-foot grid.
   2. In-Situ Solidification: 10-foot grid.
   3. Excavation of the Central/Core Area to accommodate Site Cover: 20-foot grid.
   4. Asphalt Pavement or Crushed Stone Restoration and Site Covers: 20-foot grid.

C. Submit surveys as required in this section:
   1. Survey point file in electronic ASCII format, comma delimitated with all data points (PNEZD), field code/description used to develop the mapping.
   2. Provide a surface file or the TIN file used to generate contours.
   3. Digital aerial photographs used in jpg or tiff file format geo-referenced to the project coordinate system, if needed.

4. Hard copies and, if applicable, electronic copies of all drawings used to generate the locations of right-of-way lines, center lines, utilities, etc.
5. Provide an electronic copy of the complete survey in AutoCAD Civil 2017.
6. Provide three (3) printed copies of the signed/stamped surveys as well as a PDF file.

1.03 SURVEYING REQUIREMENTS

A. Employ Land Surveyor registered in State of New York and approved by National Grid and/or Construction Manager. All surveying work products shall be signed and sealed by a registered State of New York Licensed Land Surveyor.

B. Surveyor shall comply with OSHA 40-hour HAZWOPER training requirements and have met the medical requirements to perform work.

C. Locate and protect survey control and reference points. Promptly notify the Construction Manager and/or the Design Engineer of discrepancies discovered.

D. Surveyor shall identify survey control points prior to the start of Work and submit to the Design Engineer as part of Survey Control Plan.

1.04 QUALITY REQUIREMENTS

A. Confirm drawing dimensions and elevations. Statements that design features were built "to plan" will not be an acceptable substitute for final as-built survey information.

B. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the Design Engineer.

C. Maintain complete and accurate log of control and survey work as Work progresses.

D. Survey information shall be entered into AutoCAD at the actual elevation.

E. Vertical survey tolerance to be maintained during construction is 0.10 foot for general Site grading and 0.01 foot for structural features (e.g., pipes, manholes, etc.) unless otherwise specified in the Drawings or approved by the Design Engineer.

1.05 SURVEY CONTROL

A. Provide physical horizontal and vertical control points based on the project's control system and information for Contract Documents including survey points, a basis of bearing, benchmarks, and datum information.

B. Surveys shall be performed in a Global Coordinate System datum in the State Plane Coordinate System for New York.

C. Coordinates shall reference the North American Datum (NAD) of 1983 in units of feet. Elevations shall reference the National Geodetic Vertical Datum (NGVD) of 1929 in units of feet.

D. Incorporate record information into CAD base map files based on field survey, boundary information and record information and the review and resolution of conflicting field and/or record information.

E. Electronic CAD files shall be prepared in AutoCAD Civil 2017. Field codes, code blocks, and associated layering shall be in accordance with AIA standards.

1.06 SURVEYING SCOPE OF WORK

A. Initial Review:
   1. Review the Design Drawings with the Design Engineer prior to mobilization.

B. Initial and Progress Surveying:
   1. Verify set-backs and easements; confirm drawing dimensions and elevations.
   2. Establish and demarcate the Limit of Work, property lines, limits of ISS area per targeted depth, excavation, existing utilities, subsurface structures, and other items as directed by the Design Engineer.
   3. Survey horizontal and vertical limits of the demarcation area, common fill, gravel, topsoil, asphalt, MGP structures, rail road tracks/spurs, and sidewalk and curb elevations.
   4. Submit progress surveys signed by an NY licensed Land Surveyor at intervals specified in the Contract Documents.
   5. Re-survey limits of ISS target areas once (at a minimum) during remediation activities to confirm compliance with the Design Drawings.
   6. Perform additional surveying when requested by the Design Engineer.

C. Post-ISS Survey:
   1. Post-ISS target area survey shall include, but not be limited to, horizontal and vertical limits of the ISS area and depth to document that treatment target limits and depths are met, structures and utilities encountered, if any. Survey shall extend a minimum 20 feet outside the ISS limits.
   2. Three (3) signed/sealed copies of the post-ISS survey and the electronic files shall be provided to the Design Engineer within one week after completion of the survey work.
   3. Based on surveys, calculate ISS target area volume from each area and submit calculations along with backup to the Design Engineer.

D. Post-Excavation Survey:
   1. Post-Excavation survey shall include, but not be limited to, horizontal and vertical limits of the targeted excavation area, post-ISS excavation, and excavation of areas to receive final Site Cover. Spot elevations on a 20-foot grid of the base grades and topographic contours. Survey shall extend to the Limit of Work.
   2. Three (3) signed/sealed copies of the base grade survey and the electronic file shall be provided to the Design Engineer within one week after completion of the survey work.
   3. Based on surveys, calculate excavation volume and submit calculations along with backup to the Design Engineer.
   4. Placement and installation of the Site cover shall not commence until authorized to do so by the Design Engineer.

E. Final Site Conditions Survey:
   1. Final Conditions survey shall include, but not be limited to, horizontally and vertically locate the limits of the final Site covers, spot elevations on a 20-foot grid and at

grade break lines (e.g., top and toe of slope, foundation or structure, etc.), topographic contours, stormwater swale invert elevations, wet meadow weir outlet elevation, and re-established utilities. Survey shall extend to the Limit of Work.

2. Three (3) signed/sealed copies of the final Site conditions survey and the electronic file shall be provided to the Design Engineer within one week after completion of the survey work.
3. Based on surveys, calculate excavation and backfill volumes and submit calculations along with backup to the Design Engineer.

1.07 DRAWING REQUIREMENTS

A. Final Site Survey:
   1. Survey drawing (electronic or hardcopy) shall be provided at a scale of 1" = 30' plotted on a full size (24" x 36") drawing. Provide a key map as needed.
   2. Base maps shall have one-foot contours with each contour identified.
   3. Provide north arrow for true north and for plan north (when used).

B. Quality Requirements:
   1. Confirm drawing dimensions and elevations.
   2. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to National Grid and/Design Engineer.
   3. Maintain complete and accurate log of control and survey work as Work progresses.
   4. Survey information shall be entered into AutoCAD at the actual elevation.
   5. Vertical survey tolerance to be maintained during construction is 0.10 foot for general Site grading and 0.01 foot for structural features (e.g., pipes, manholes, etc.) unless otherwise specified in the Drawings or approved by the Design Engineer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 30 50

WORK RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Work Schedule.
   2. Use of Site.
   3. Restrictions on performing work.
   4. Open Excavations.
   5. Housekeeping.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. National Grid's Health and Safety Requirements Specified in the Contract Documents.
   3. Section 01 10 00 – Summary of Work.
   4. Section 01 10 56_- Protection of Work and Property.
   5. Section 01 30 65 – Health and Safety Requirements.

C. References:
   1. Occupational Safety and Health Administration (OSHA) Regulations

1.02 WORK SCHEDULE

A. The work of this Contract shall be scheduled in a manner mutually acceptable to the National Grid, Construction Manager, Design Engineer, and the Contractor. Unless otherwise especially permitted, no work shall be performed between the hours of 5:00 pm and 7:00 am, nor on Sundays, holidays (July 4, Thanksgiving Day and the day after, Christmas Day and the day before, New Year's Day, and the Monday designated holidays for Memorial Day and Labor Day), except as necessary for the proper care and protection of work already performed. The Contractor shall provide a list of the expected holidays for 1 full year from the time of proposed start of construction with consideration for union practices.

B. If it shall become absolutely necessary to perform work at night, the Design Engineer shall be informed a reasonable time in advance of the beginning of performance of such work. Only such work shall be done at night as can be done satisfactorily and in a safe manner, and approved by National Grid, Construction Manager, and Engineer. Good lighting and all other necessary facilities for carrying out and inspecting the work shall be provided and maintained at all points where such work is being done. Minimum permissible illumination intensities are identified in 29 CFR 1910.120.

C. National Grid shall not be responsible for extra costs associated with the Contractor's expenses/fees for work outside the normal work hours in order to meet scheduled deadlines/constraints.

D. Contractor personnel shall not work on the Project Site alone.

1.03 USE OF SITE

A. General requirements:
   1. Limit of Work: Confine constructions operations to areas indicated on Design Drawings. Do not disturb portions of the Site beyond areas in which Work is indicated.
   2. Site Boundary: Defines the extent of the project location as indicated on Design Drawings.
   3. Work Area Access: The Contractor shall coordinate with National Grid and/or the Construction Manager, for arranging access to the work areas and to designate areas for decontamination, parking, materials and equipment storage, contaminated waste storage and other operations as needed in support of the Work. Access for both vehicles and personnel to the Site area shall be as depicted on the Design Drawings.
   4. Roadways, Driveways and Entrances: Keep roadways, driveways and entrances serving premises clear and available to personnel, authorized visitors and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Contractor shall be responsible for any damage to roadways, facilities, utilities, trees, or structures on, or adjacent to, the Project Site due to negligence, carelessness, actions, errors, or omissions on the part of the Contractor.
      b. Two (2) dedicated flaggers shall be on-Site to preserve the safety of pedestrians, highway workers, and motorists during construction.
   5. Deliveries: Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-Site.

1.04 RESTRICTIONS IN WORKING IN PROXIMITY TO OVERHEAD UTILITIES

A. Overhead electrical lines are present at the Site and shall be flagged as necessary in accordance to Section 01 10 56 prior to mobilization to the Site. The Contractor shall use extreme care during the implementation of the construction activities so as not to damage or interfere with the utilities in the vicinity of the installation.

B. The Contractor shall coordinate with the National Grid and utility purveyors of these lines to establish minimum setbacks from these overhead lines for all equipment and personnel.

1.05 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing barricades, caution signs, lights, and other means to prevent unwanted/unknowing access, accidents to persons, and damage to property. Such measures shall be installed and maintained pursuant to all applicable regulations.

B. The Contractor shall sequence their work so that all excavations are backfilled at the end of each work day. No open excavations shall be maintained outside of work hours.

1.06 RESPONSIBILITY FOR HEALTH AND SAFETY

A. Contractor is responsible for conducting all Work in accordance with Laws and Regulations concerning noise, vibrations, and dust levels, including any state, local, or village codes.

B. Noise, vibrations, dust, and odor levels must be monitored and controlled, as necessary, in accordance with Sections 01 30 65 and the Community Air Monitoring Plan (CAMP).

1.07 HOUSEKEEPING

A. As work progresses, remove all unused tools and equipment, surplus materials, waste materials, rubbish, refuse, and other debris from the Site in a timely manner and ensure that the Site is at all times maintained in a neat and orderly condition.

B. At the completion of the Project, promptly remove all construction tools and equipment surplus materials, waste materials, rubbish, refuse, and other debris from the Site and leave the Site in a neat and orderly condition.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 30 65

HEALTH AND SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Contractor Site-Specific Health and Safety Plan (CSSHASP).
   3. References and Standards.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's Standard General Conditions, apply to this Section.
   2. National Grid's Incident Reporting Requirements – Best Practices.
   3. National Grid - Contractor Safety Requirements.
   4. Section 01 10 00 – Summary of Work.
   5. Section 01 33 00 – Submittal Requirements.
   6. Section 01 52 00 – Work Zone and Community Site Monitoring and Control.

C. References:
   1. Occupational Safety and Health Administration (OSHA) Regulations
   2. Federal OSHA Standards:
      a. Air Contaminants - Permissible Exposure Limits; OSHA 3112; latest edition.
      b. General Industry Standards and Interpretations; Volumes 1 - 3- OSHA 2077; U.S. Department of Labor, Occupational Safety and Health Administration; Specifically Sections: 29 CFR 1910.1000 1050 (air contaminants), 1910.120 (Hazardous Waste Operations and Emergency Response), 1910.1200 (Hazard Communication), 1910.301 Subpart S (Electrical), 1910.146 (Permit Required Confined Space) 1910.147 (Control of Hazardous Energy (Lockout/Tagout)), 1904 (Recordkeeping and Reporting Occupational Injuries and Illnesses), 1990 (Identification, Classification and Regulation of Potential Occupational Carcinogens), and 1926 (Safety and Health Regulations for Construction).
      c. Hazardous Waste Inspections Reference Manual; U.S. Department of Labor; Occupational Safety and Health Administration, latest edition.
      d. OSHA Field Operations Manual; 2nd Edition; U.S. Department of Labor; Occupational Safety and Health Administration, latest edition.

1.02 SUBMITTALS

A. Submit a Contractor Site-Specific Health and Safety Plan (CSSHASP) in accordance with Section 01 33 00.
   1. Within 14 calendar days of Award of Contract but no less than 14 calendar days prior to commencement of field activities. Contractor shall submit the following to the Owner's Representative:

a. Written CSSHASP containing all requirements under 29 CFR 1910.120. The plan shall be written to avoid misinterpretation, ambiguity, and mistakes that verbal orders cause.
b. CSSHASP approval and certification by a certified Industrial Hygienist for review and approval by National Grid and Construction Manager.
c. A Health and Safety risk or Job Safety Analysis (JSA) associated with each portion of the Work (i.e., list potential physical hazards), including JSAs for excavation work around active utilities, structure demolition, excavation safety, crane operation safety, drill rig safety, ISS bucket mixing safety, and truck traffic into and out of the Site.
d. Documentation of medical monitoring.
e. Documentation of 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and applicable 8-hr annual HAZWOPER refresher training and other applicable training (e.g., confined space entry).
f. Documentation of personnel respirator qualification and fit testing.
g. Process Hazard Analysis (PHA) documentation and checklists based on requirements in Section 3.03.

B. During Construction Activities:
1. All required forms and OSHA records will be kept on Site as applicable.
2. Work Zone Monitoring Results and Community Air Monitoring results shall be completed in accordance with Section 01 52 00.
3. All Site personnel has stop work authority at ANY TIME if unsafe conditions are noted.
4. National Grid representatives evaluate Contractor compliance by conducting routine Site visits, Compliance Assessments (CA), Safe/Unsafe Acts (SUSA) visits and attending periodic Contractor safety meetings. The Contractor shall also perform and document safety self-assessments to ensure compliance to federal, state, local and National Grid regulations.

C. Contractor shall submit:
1. Daily Health and Safety reports.
2. Weekly Health and Safety summary reports.
3. A summary of the total number of labor hours worked at the Site during that month and total number of labor hours worked at the Site without any incident. Present this information in weekly meetings.
4. A record of weekly Health and Safety meetings.
5. Internal Health and Safety audits performed by the Contractor as part of the Contractor's HASP.
6. Contractor shall conduct a JSA (attached) for significant activities (Section 101.A.c) or if a revision of work procedures is needed and submit the documentation to the Construction Manager for review prior to the start of the activities.

1.03 HEALTH AND SAFETY PLAN DESCRIPTION

A. The Contractor shall be responsible for providing all personnel, facilities, equipment and materials to protect all on-Site workers from physical injury and adverse health effects due to exposure to Site hazards.

B. Contractor shall prepare a CSSHASP which establishes policies and procedures to protect workers and the public from the potential hazards posed by implementation of the Work and employ the services of an independent third-party Subcontractor to implement the CSSHASP. The CSSHASP shall apply to all personnel on Site during Work, including but not limited to, Contractor's employees and Subcontractor's employees.

C. The CSSHASP shall be reviewed and certified by an Industrial Hygienist.

D. Contractor shall retain the services of an independent third party to perform all duties of the Site Safety and Health Officer (SSHO) to implement the CSSHASP. The designated SSHO shall be certified in applicable OSHA Hazardous Waste Operations and Construction Safety training. At a minimum, shall have at least 4 years of experience as a SSHO and have 40-hour OSHA Hazardous Waste Operations training and 8-hour OSHA Supervisor training. Contractor's SSHO shall be solely dedicated to Health and Safety issues and shall remain on-Site from the start of the Site activities until completion.

E. At a minimum, the CSSHASP shall:
   1. Ensure National Grid Safety requirements and procedures are incorporated in project specifications and contract terms and conditions, including but not limited to the following:
      a. Comply with the requirements of National Grid Documents: Standard General Conditions of the Contract Between Owner and Environmental Remediator and Contractor Safety Requirements.
      b. Include the Work Zone and Perimeter Dust Action Levels for this project, specified in Section 01 52 00.
      c. Include any additional requirements that the Contractor deems to be appropriate or applicable to the Work, the Site, or the Contractor's methods and/or equipment.
      d. Name key personnel and alternates responsible for Site safety. Provide contact information for each person.
      e. Describe operations to be conducted to implement the Work. Identify "high loss" activities, permitted activities (i.e. hot works, confined space, etc.) and any other activities identified as having the potential for creating a hazardous situation/work environment.
      f. Describe risks associated with each operation conducted.
      g. Confirm that personnel are adequately trained to perform their job responsibilities and to handle the specific hazardous situations they may encounter.
      h. Describe the protective clothing and equipment to be worn by personnel during various Site operations.
      i. Describe any Site specific medical surveillance requirements.
      j. Describe the program for periodic work zone and Site air monitoring, personnel monitoring, and environmental sampling.
      k. Describe the actions to be taken to mitigate existing hazards to make the Work environment less hazardous.
      l. Define Site control measures and include a Site map.
      m. Establish decontamination procedures for personnel and equipment.
      n. Set forth the Site's Standard Operating Procedures for Health and Safety.

o. Describe audit/inspection program to ensure compliance with CSSHASP.
p. Describe safety stops and measures to be taken during changed conditions/hazards.
q. Describe accident reporting and safety stand downs after near misses or incidents.
r. Describe back-in parking policy and the requirement of spotters for backing-up vehicles.
s. Describe the policy to reduce vehicle idling in compliance with applicable federal, state, and local laws.
t. Describe procedures that incorporates National Grid's Circle of Safety Procedures for all vehicles at the Site.
u. Describe procedures to ensure subcontractor safety.

1.04 INCIDENT REPORTING

A. Contractor shall immediately (no later than 1 hour) verbally report to National Grid the occurrence of any and all Health and Safety incidents. As appropriate, and Incident Report or Near-Miss Report shall be submitted in DRAFT form no later than 4 hours after occurrence. The Final Reports should be submitted no later than 24 hours after incident. An incident is defined as the following:
   1. Injury: Actions or activities that cause harm to people;
   2. Property Damage: Actions or activities that cause damage to property;
   3. Adverse Public Impact: Actions or activities that disrupt service to the public or result in adverse public reaction;
   4. Near-Miss: Actions or activities that had the potential under different circumstances to result in injury, property damage, and /or adverse public impact;
   5. Hazardous Condition: Defined as unsafe condition that requires others to take actions to correct and if not corrected can result in an injury or event; and
   6. Significant Hazard: Condition that requires others to take actions to rectify and requires further investigation as to how the situation came to occur.
   7. Refer to National Grid Site Investigation and Remediation Departments Incident Management Best Practices for Incident reporting requirements.

B. Following a high consequence incident, National Grid reserves the right to direct the shutdown of Contractor operations immediately following the establishment of a safe and secure worksite. This stand-down will be in effect while a preliminary investigation is conducted. The results of any preliminary investigations will determine the extent of the stand-down for the remainder of the Contractor's operations being performed for National Grid.

C. Contractor/National Grid shall conduct an incident investigation to determine the casual factors that led up to the incident and develop recommendations. Depending on the severity of the incident, a TapRoot analysis may be required to mitigate the factors that led up to the incident.

D. Contractor shall develop a detailed action plan to address the casual factors for the incident and address any additional recommendation's that resulted from the investigation.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall be responsible for providing all personnel, facilities, equipment and materials to protect all on-Site workers from physical injury and adverse health effects due to exposure to Site hazards.

B. National Grid reserves the right to remove any Contractor or its employees who violates safety rules or poses a safety risk.

C. All on-Site personnel shall comply with the requirements of the CSSHASP.
All Stop: Any crew member, observing visitor, or person involved with a project are allowed to stop any activities that have the potential to cause injury or harm. An All Stop should be called when:

1. Any activity deviates from a predetermined plan.
2. Any activity occurs that will cause potential damage, harm, injury, or unnecessary destruction.
3. Any crew member, observing visitor, or person involved with the work is not comfortable with the plan in place or does not fully understand the plan or activities occurring.
4. Upon an All Stop being called, crews will stand down from their activities, review the All Stop reason, re-analyze and re-plan the activities, and only proceed when all involved are satisfied with the new direction.
5. All Stops should be reported to the project team if they were called due to a near miss or after an incident.
6. When work is to begin after an All Stop, the project team will review the JHA as part of the safety brief and modify it for any changes in situation.
7. All crew members must sign off on the updated or new safety brief.

3.02 MEETINGS

A. Prior to the start of construction, all employees working at the Site will be required to attend a safety on-boarding session and review the Site specific H&S Plan before being released to work. This session will be conducted by the Contractors Safety Officer and will include discussion of safety expectations while working for National Grid, including the Job Hazard Analyses, personal protective equipment, incident reporting, interactions with the public, job briefs, etc.

B. All meetings begin with a safety moment intended to improve safety through information sharing. The safety moment can be specific to a project, the company, or industry.

C. Contractors must hold weekly construction meetings where a portion is dedicated to safety topics, recent incidents, safety initiatives, and lessons learned.

D. Contractors shall conduct daily H&S meetings (i.e. Job Brief), prior to beginning Work for that day, to address H&S issues, changing Site conditions, activities and personnel. All Contractor and Subcontractor employees working on the Site on that Day shall attend the meeting. All meetings shall be documented in writing and attendees shall sign acknowledgement of their presence at the meeting. Daily meetings shall include an evaluation of the Work to be conducted and associated paperwork shall document meeting attendance and discussion points.

E. A Health and Safety meeting will be held at the beginning of each fiscal year with the Contractor. Attendees will:
   1. Discuss prior year's results.
   2. Review changes to Contractors, safety rules, etc.
   3. Review and refresh safety expectations consistent with Corporate, Safety Health Environment (SHE) and Site Investigation and Remediation (SIR) objectives for next year.

F. A semiannual meeting will be held with the Contractor. This meeting will include:
   1. A review of incidents and lessons learned from previous half year.
   2. A review of safety initiatives for sharing best practices.

G. National Grid hosts Safety Leadership Days quarterly. Contractor is responsible for helping to communicate Safety Leadership Day (SLD) materials and participate.

H. Maintain a lesson's learned list during construction to identify areas of future improvement.

I. Develop a mechanism to incorporate lessons learned from other projects into project HASP (periodic HASP review).

3.03 PROCESS HAZARD ANALYSIS

A. PHAs are required for any scenario that could result in a major release of energy or significant environmental and/or reputational damage, as well as scenarios not previously approved by the Process Safety Committee and or/not covered by a generic PHA checklist. The PHA process is described in EP-27. The following lists the general PHA process that should be followed:
   1. Identify the high-potential incident scenario(s) in the project, finalize the best practice/safe means and methods with the establish a team, and schedule a checklist review meeting.
   2. The Site Safety Officer (SSO) should assemble the required information to support the hazard scenario evaluation.
   3. With the PHA team, review the information, identify the risks/hazards and establish a safeguards list that addresses all the risks/hazards. Review past PHAs and assemble a list Environmental Management Contractor Safety Management Playbook Page 13 of 55 Version 1.00 – 08/01/2017 of lessons learned that apply to the current scenario. Assemble an action items list determining the responsibilities of personnel for each of the actions for preparation of the safeguards.
   4. Compile all the information from the previous three steps, formalize in one document, and schedule a review/approval meeting with the SIR Area Manager.

5. Upon approval, SSO will schedule the PHA to be reviewed with all project employees/Contractors. All personnel working on the PHA must sign an attendance sheet. Any changes to employees will require a PHA review, and the employee must sign an attendance sheet. Any visitors to the Site will also review the PHA and sign an attendance sheet.
6. Attendance sheets or copies will be kept on-Site, preferably with the HASP.
7. The risk and actions to mitigate the hazard and risks identified in the PHA will be reviewed by every person on the job every day the PHA activities are being performed and will be re-reviewed after any changes in work scope subject to the Memorandum of Change (MOC) process.
8. Finalize best practice/safe means and methods with Contractor.

3.04 INDEPENDENT INSPECTIONS

A. Contractor shall comply with monthly Compliance Assessments (CA), quarterly Safe/Unsafe Acts (SUSA), and Site inspections conducted by an independent third party safety consultant. The contractor shall participate in joint CAs with National Grid representatives.

B. Contractor shall follow Management of Change procedures for Sites under the PHA process.

C. Contractor shall document safety stand downs for near miss and safety incidents and implement Safety Stops for changed conditions/hazards.

END OF SECTION

SECTION 01 33 00

SUBMITTAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittal procedures.
   2. Work Plans.
   3. Construction progress schedule.
   4. Proposed products list.
   5. Product data.
   6. Shop drawings.
   7. Design data.
   8. Certificates.
   9. Manufacturer's instructions.
   10. Manufacturer's field reports.
   11. Construction photographs.

B. Related Sections and Documents
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 10 00 - Summary of Work.
   3. Section 01 40 00 - Quality Requirements.
   4. Section 01 70 00 - Execution Requirements.

1.02 SUBMITTAL PROCEDURES

A. Transmit each submittal with a Design Engineer approved form.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

D. Schedule submittals to expedite Project, and deliver to National Grid, Design Engineer and Construction Manager. Coordinate submission of related items.

E. For each submittal for review, allow 20 calendar days excluding delivery time to and from Contractor.

F. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

G. Allow space on submittals for Contractor and Design Engineer review stamps.

H. When revised for resubmission, identify changes made since previous submission.

I. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

J. Submittals not requested will not be recognized or processed.

K. Submit three (3) hard copies and an electronic copy of each submittal for review and approval submittal.

L. After review and approval, produce copies and distribute to National Grid, Design Engineer and Construction Manager.

1.03 WORK PLANS

A. The Contractor(s) shall prepare and submit four (4) copies of the required plans to the Construction Manager for review within 20 business days after date of National Grid-Contractor Agreement.

B. During the development of the remedial design, provide submittals to National Grid and the Construction Manager, some of which will be incorporated into the design and subsequent design submittals to the NYSDEC (i.e., 100% RDR). The Plans to be submitted include:

1. Construction Management Plan (Section 01 10 00).
2. Contractor Remedial Action Contingency Plan (Section 01 10 00).
3. Pre-Existing Conditions Level A survey and Photolog (Section 01 10 56).
4. Settlement and Vibration Monitoring Plan (Section 01 10 56).
5. Schedule of Values and Payment Application Template (Section 01 20 00).
6. Survey Control Plan (Section 01 30 00).
7. Contractor Site Specific Health and Safety Plan (Section 01 30 65).
8. Construction Quality Control Project Plan (Section 01 40 00)
9. Traffic Control Plan (Section 01 50 00).
   Work Zone and Community Air Monitoring Control Plan (Section 01 52 00).
10. Decontamination Plan (Section 01 52 20).
11. Site Security Plan (Section 01 54 00).
12. Selective Demolition Plan (Section 02 41 19).
13. Excavation Plan (Section 31 23 16).
14. Backfill Plan (Section 31 23 23).
15. Amendments to Erosion and Sediment Control (E&SC) Plan (Section 31 25 13).
16. Slope Protection Measures (Section 31 40 00).
17. Waste Management Plan (Section 31 70 00).
18. In-Situ Solidification Pilot Scale-Study Work Plan (Section 31 80 00).
19. In-Situ Solidification Work Plan (Section 31 80 00).
20. Utility Support and Protection Plan (Section 33 05 18).

21. Sequencing of the implementation of the remedial construction activities.
22. A detailed construction schedule.
23. Site preparation activities including the implementation of soil erosion and sediment control measures.
24. Methods for protection of work and property.
25. Proposed equipment, supplies, materials, labor and methodology for implementing the proposed remedial construction activities.
26. Proposed staging areas for equipment and materials.
27. Proposed equipment and personnel decontamination areas.
28. List of Subcontractor(s) to be used by the Contractor.
29. Manufacturer's specifications and details on the Vibration and Settlement Monitoring system.
30. Proposed trucking Subcontractors to be utilized including the estimated number of trucks per day.
31. Procedures for removal and demolition of subsurface foundations (i.e., former gas holder, industrial piping, foundations, and tunnel entrance).
32. Procedures for implementing construction activities in proximity to overhead and underground utilities.
33. Proposed disposal facilities to be utilized during the remedial work.
34. Materials Data Sheets for all materials brought on Site.
35. Sources for backfill material including required certifications and analytical data.

C. After approval by National Grid and Design Engineer, the Plans will be compiled to create a Construction Management Plan.

1.04 CONSTRUCTION PROGRESS SCHEDULE

A. Submit initial schedules within 15 business days after date of National Grid-Contractor Agreement and at least ten (10) business days prior to the commencement on on-Site activities. After review, resubmit required revised data within ten (10) business days. Work and progress payment shall not start without an Initially Acceptable Baseline Schedule reviewed by and approved by Construction Manager, Engineer, and National Grid. The baseline shall not be altered for the duration of the project.

B. Submit Progress Schedules with each Application for Payment and during weekly construction meetings.

C. Revisions to Construction Progress Schedule:
   1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
   2. Identify activities modified (with approval from Construction Manager) since previous submittal, major changes in scope, and other identifiable changes.
   3. Prepare narrative report to define problem areas, anticipated delays, and impact on Progress Schedule, **PRIOR TO THE SCHEDLE BEING DELAYED.** Payment will only be considered for any delay in schedule with prior approval. Report corrective action taken, or proposed, and its effect.

D. Distribute copies of reviewed schedules at each Weekly Progress Meeting and to Project Site file, Subcontractors, suppliers, and other concerned parties.

E. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

F. Submit computer generated chart with separate line for each section of Work, identifying first work day of each week.

G. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

H. Indicate estimated percentage of completion for each item of Work at each submission and at each Weekly Progress Meeting.

I. Indicate delivery dates for products.

1.05 PROPOSED PRODUCTS LIST

A. Within 15 business days after date of National Grid-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.06 PRODUCT DATA

A. Product Data: Submit to National Grid, the National Grid authorized representative and Design Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

1.07 SHOP DRAWINGS

A. Shop Drawings: Submit to National Grid, the National Grid authorized representative and Design Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. When required by individual specification sections, provide shop drawings, signed and sealed by professional engineer licensed in the State of New York, and responsible for designing components shown on shop drawings.
   1. Include signed and sealed calculations to support design.
   2. Make revisions and provide additional information when required by authorities having jurisdiction.

1.08 DESIGN DATA

A. Submit to National Grid, the Construction Manager and Design Engineer for approval.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.09 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application Subcontractor, or Subcontractor to National Grid, Design Engineer and Construction Manager.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to National Grid, Design Engineer and Construction Manager.

1.10 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to National Grid, the National Grid authorized representative, and the Design Engineer.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.11 MANUFACTURER'S FIELD REPORTS

A. Submit to the Construction Manager and the Design Engineer.

B. Submit report within five (5) days of observation for information for limited purpose of assessing conformance with information given and design specified in Contract Documents.

1.12 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of Site and construction throughout progress of Work to National Grid, the National Grid authorized representative, and Design Engineer.

B. Each month submit photographs with Application for Payment.

C. Digital photographs: Provide high resolution photographs on a CD.

D. Take Site photographs from differing directions indicating relative progress of the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Construction Quality Control Project Plan (CQCPP).
   2. General requirements.
   3. Quality control and control of installation.
   4. Examination.
   5. Inspection.
   6. Testing.
   7. Errors and omissions.
   8. Records.

B. Related Sections and Documents
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General apply to this Section.
   2. Section 01 10 00 - Summary of Work.
   3. Section 01 70 00 – Execution and Closeout Requirements.
   4. Section 01 33 00 - Submittal Requirements.

1.02 SUBMITTALS

A. Prepare and submit to the Design Engineer for review and approval, a Site-Specific Construction Quality Control Project Plan (CQCPP). A Site-Specific Construction Quality Assurance Project Plan (CQAPP) has been provided in the Remedial Design Report, Appendix M. The CQCPP will be based on the CQAPP and shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. Construction will be permitted to begin only after acceptance of the CQCPP by Construction Manager and Design Engineer.

1.03 CQAPP REQUIREMENTS

A. A CQAPP has been prepared and is contained in the Remedial Design Report, Appendix M. The Contractor will review this CQAPP and develop a CQCPP for review and acceptance by Design Engineer. The CQCPP must meet, at least, the minimum requirements of, and may be more stringent than the CQAPP.

B. The CQCPP shall include procedures for controlling activities related to inspection, testing, and documentation, including those of Contractor's suppliers and laboratories, as necessary.

C. The CQCPP shall also include the following:
   1. Control, verification and acceptance testing procedures for each specific test, to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test.
   2. Procedures for tracking inspections, verification, and acceptance tests including documentation.
   3. Procedures for tracking construction deficiencies for identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

1.04 GENERAL REQUIREMENTS

A. The Contractor shall be responsible for quality control and shall establish and maintain an effective quality control system in compliance with the contract. The quality control system shall consist of plans, procedures and the organization necessary to produce an end product that complies with the Contract Documents. The system shall cover all construction operations, both on-Site and off-Site, and shall be keyed to the proposed construction sequence.

B. Activities affecting quality shall be accomplished under controlled conditions. Controlled conditions include the use of appropriate equipment; suitable environmental conditions for accomplishing the activity such as adequate cleanliness; and assurance that all prerequisites for the given activity have been satisfied.

C. Prior to the initiation of the remedial work, the Contractor shall review Design Drawings, Technical Specifications, Remedial Design Report, applicable codes, standards and other contract documents to assure proper knowledge of the contract requirements. Any inconsistencies in the above shall be immediately brought to the attention of National Grid and Design Engineer.

D. Quality control testing shall include all the tests required by the Technical Specifications along with field inspection of the work.

E. Deliver materials to the Site in the approved manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to approved samples. Certifications from the manufacturer for materials shall be included with the shipment.

F. Store materials in accordance with manufacturer's recommendations, under cover (if appropriate) in a clean, dry, aboveground location. The Contractor shall remove materials which are damaged or otherwise not suitable for installation from the Site and replace with acceptable materials.

G. Construction Manager shall be responsible for management of Quality Control/Quality Assurance (QC/QA) activities in the field in accordance with the CQAPP. The Contractor shall be responsible for management of QC/QA activities in the field in accordance with the CQCPP. Personnel performing QC/QA functions, employed by either the Contractor or its Subcontractors shall report to their respective Project Manager or Site Superintendent.

H. The Contractor's Site Superintendent shall possess adequate experience, skill, and training to be knowledgeable about the QC/QA work specified in the CQCPP and be capable of implementing the CQCPP.

1.05 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. All items of equipment and materials of like type furnished under one Purchase Order shall be the product of one manufacturer, unless otherwise specified.

B. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.

C. Comply with manufacturers' instructions, including each step, in sequence.

D. When manufacturers' instructions conflict with Contract Documents, request clarification from the Design Engineer before proceeding. Notify Construction Manager regarding the conflict as well as modifications and/or changes made per discussions with the Design Engineer.

E. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

F. Perform Work by persons qualified to produce required and specified quality.

G. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Examine and verify specific conditions described in individual specification sections.

C. Verify utility services are available, of correct characteristics, and in correct locations.

3.02 INSPECTION

A. Implement the CQCPP for inspection of construction methods and materials. These inspections shall be performed to verify compliance with the Contract Documents.

B. Establish a program for inspection of activities affecting quality and shall include all construction activities. The quality of the products of the Contractor's and suppliers must also meet requirements of the Contract Documents. Inspections shall be performed to verify compliance to documented instructions, drawings, procedures and specifications.

3.03 TESTING

A. Employ and pay for services of independent testing agencies or laboratories acceptable to National Grid to perform testing as required in the Specifications.

B. All testing procedures shall incorporate or reference the requirements contained in the Specifications, Design Drawings and Contract Documents. Test procedures shall also be in conformance with reference standards.

C. The CQCPP shall state the types of testing equipment to be utilized.

D. All testing equipment shall be calibrated and maintained as required by the manufacturer and/or applicable standards.

E. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

F. Re-testing or re-inspection required because of non-conformance to specifications shall be performed by same independent firm on instructions by Construction Manager.

3.04 ERRORS AND OMISSIONS

A. The work shall be done and completed in a thorough, workmanlike manner, notwithstanding any omission in the Contract Documents.

B. It shall be the responsibility of the Contractor to call to the attention of Construction Manager and Design Engineer any apparent errors or omissions and request instructions in writing before proceeding with the work.

C. National Grid and the Design Engineer may, by appropriate written instructions, correct errors and omissions, and supply instructions, which shall be as binding upon the Contractor as though contained in the original Contract Documents. All written instructions from National Grid and the Design Engineer will be provided to the Contractor by the Construction Manager.

3.05 RECORDS

A. Sufficient records shall be prepared as the work is performed to furnish documentary evidence that QC/QA testing was performed in accordance with the approved CQCPP. These records shall be submitted to Construction Manager and Design Engineer for review as they become available.

B. The records shall include, but not be limited to, the results of reviews, inspections, tests, and audits. The records shall also include, but not be limited to, the procedures, equipment used, date, name of the inspector, results, inspections, and corrective measures. These records shall be maintained in an identifiable, meaningful, and organized manner.

C. The Contractor shall maintain current records of QC/QA operations, activities and tests performed by suppliers and Subcontractors.

D. Project records shall be stored on-Site and shall be readily retrievable.

3.06 AUTHORITY OF CONSTRUCTION MANAGER AND DESIGN ENGINEER

A. National Grid and/or Construction Manager and Design Engineer may observe all work done and inspect materials and equipment furnished and perform additional testing as required. Such observation may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials and equipment to be used.

B. The Contractor will keep Construction Manager informed as to the progress of the work and the manner in which it is being done.

C. National Grid's Construction Manager will call the Contractor's attention to any non-conformance with the Contract Documents.

D. National Grid's Construction Manager may reject defective materials, equipment, or work that does not meet the requirements of the Contract Documents.

E. Facilitate and allow Construction Manager and Design Engineer to perform any QC/QA testing.

F. Notify and give Construction Manager and Design Engineer sufficient time to inspect any work that will be made inaccessible by future construction. If notification and inspection is not conducted, the Contractor shall remove, at their own cost, elements that will allow for proper inspection.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Temporary Utilities.
   3. Construction Facilities.
   4. Temporary Controls.
   5. Removal of Utilities, Facilities, and Controls.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 10 56 – Protection of Work and Property.
   3. Section 01 33 00 – Submittal Requirements.
   4. Section 01 52 00 – Work Zone and Community Air Monitoring and Control.
   5. Section 01 52 20 – Decontamination Requirements.
   6. Section 31 23 16 – Excavation.

1.02 SUBMITTALS

A. Traffic Control Plan: Prepare and submit amendments to the Traffic Control Plan for approval by National Grid and the Construction Manager. The plan shall include proposed procedures and methods for on-Site and off-Site traffic construction traffic. Obtain approval from local municipality and county, as required. Refer to Section 31 20 00 – Temporary Construction Access for additional requirements.

B. Project Signage Sketch: Prepare, submit and obtain approval for the proposed sign configuration, contents, appearance, and materials of construction and a figure showing the proposed sign location.

C. Occupancy Permits: Obtain permits and/or approvals for use and occupancy for the temporary offices and other buildings, shed, etc., as necessary. Contractor shall provide to National Grid at least 5 days in advance of occupying structures.

D. Product and Equipment Data: Provide product and equipment data for items in this section. Contractor shall provide to National Grid at least 5 days prior to use.

1.03 TEMPORARY UTILITIES

A. Temporary utilities shall be provided for implementation of the Remedial Design. Temporary utilities may include but are not limited to:
   1. Electricity and lighting.

2. Heating and cooling.
3. Ventilation and humidity control.
4. Telephone and facsimile service.
5. Water supply.
6. Decontamination water generation handling.
7. Sanitary facilities.

B. Electricity and Lighting
   1. Provide all temporary electric service required throughout Site and comply with OSHA and other applicable electrical codes. Coordinate electric service installation with the National Grid or the Construction Manager, if needed. There will be electric service located in the off-Site property building.
   2. A licensed electrician shall perform all electrical work.
   3. The Contractor is responsible for confirming that local utilities are capable of supporting the required electric loads to perform the work. The Contractor is responsible for providing and/or extending electrical service to the operate the temporary facilities, as needed.
   4. Service shall be brought to immediate work areas of the Site, as required, by construction-type power cords. Distribution boxes and circuit wiring shall be provided, if required, to meet the required power needs. All electrical service shall meet the substantive requirements of applicable building codes.
   5. Electrical Distribution: Provide Ground Fault Circuit Interrupter (GFCI) receptacle outlets adequate for connection of power tools and equipment.
   6. Electrical Distribution: The Contractor shall furnish and install GFCI outlets every 50' linear feet along the perimeter fence to power the perimeter air monitoring stations.
   7. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
      a. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
      b. Provide warning signs at power outlets other than 110 to 120 V.
      c. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades or other traffic areas.
      d. Provide metal conduit enclosures or boxes for wiring devices.
      e. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
   8. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, if necessary.
      a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
      b. Provide one 100-W equivalent fluorescent light bulb per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
      c. Install exterior-yard Site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is

being performed. Where possible, angle exterior-yard lighting below the horizontal so vertical and off-sight illumination and light-pollution of the area is avoided.

9. Provide and maintain lighting of the Site after dark as necessary for security purposes.
10. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.
11. Maintain lighting and provide routine repairs.

C. Temporary Heating and Cooling

1. Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that is EnergyStar certified and will not have a harmful effect on completed installations or elements being installed.
2. Heat/cooling for support zone/office in Off-Site building will be supplied by National Grid.

D. Temporary Ventilation and Humidity Control

1. Provide temporary ventilation and required by construction activities for curing or drying of completed installations, protecting installed construction from adverse effects of high humidity and to prevent accumulation of dust, fumes, vapors and gases. Select equipment that is EnergyStar certified and will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

E. Temporary Water Service

1. The Contractor shall determine the Site water requirements and provide adequate water from accepted sources. The Contractor shall adhere to Item SC-4.0 of the Supplemental Conditions to National Grid Remedial Construction Purchase Orders (NG SC 5/18/2005).
2. Non-potable Site water may be stored in holding tanks and distribution piping or by tank trucks or any combination thereof.
3. A high-pressure steam-cleaning system shall be provided for equipment and vehicles use, after the mud and/or dirt has been cleaned from the equipment.
4. Ensure that the available water source on-Site is adequate to implement odor suppression and dust control measures as required by the Construction Manager during the implementation of the planned remedial construction activities.
5. Collect and use non-potable rainwater as a potential water supply during dust control, as practical.
6. Water is available on the off-Site property.

F. Decontamination Water Handling

1. The Contractor shall be responsible for collecting the wastewater resulting from the cleaning of the equipment and pump to containers (i.e., Frac/Baker Tanks, drums, etc.) for disposal. The collected wastewater shall be managed in accordance with the requirements of the Technical Specifications.

G. Temporary Sanitary Facilities

1. Bathrooms are available in the off-Site property building, however it will be necessary to provide additional temporary toilets, wash facilities, and drinking-water fixtures for Contractor's use. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
    a. Disposable Supplies: Provide toilet tissue, soap, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
    b. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
    c. Wash Facilities: Install wash facilities supplied with water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled. Provide eyewash stations and similar facilities for convenience, safety, and sanitation of personnel.
    d. Drinking-Water Facilities: Provide bottled-water, and/or drinking-water units where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degrees F.
    e. Locate toilets and drinking-water fixtures so personnel need not walk more than 200 feet to facilities from work area.
    f. Contractor shall provide and maintain in clean, good working order, an emergency decontamination and eye wash station.
    g. Contractor shall provide and maintain in clean, good working order, other personnel decontamination facilities required by the Contract Documents or the HASP.

1.04 CONSTRUCTION FACILITIES

A. Construction facilities shall be provided for implementation of the remedy. Construction facilities which may include but are not limited to:

1. Field offices and sheds, as needed.
2. Parking.
3. Progress cleaning and waste removal.
4. NYSDEC project sign.
5. Traffic regulation.
6. Equipment storage.
7. Decontamination facilities.
8. Health and safety equipment storage.
9. Stockpiling and material storage areas.
10. Fences and barriers.
11. All other temporary facilities required to perform the work.

B. Field Offices and Sheds

1. Prior to installation of offices and sheds, coordinate with the Construction Manager regarding requirements, locations, access, and related facilities. The Contractor shall be responsible to obtain necessary permits and/or approvals for use and occupancy of these facilities.

2. National Grid, NYSDEC representative, Construction Manager and the Design Engineer shall use the second floor of the off-Site building for office space.
3. Contractor's use of the existing off-Site building shall be restricted to the first floor. Contractor may use the first floor for temporary field office and storage, except for heavy equipment.
4. Office trailers, if needed, and storage sheds shall be provided with the following minimum requirements:
    a. Grounded Lighting - Lighting shall be electric, non-glare type producing a minimum illumination level of 50 foot-candles measured at desk height.
    b. Heating and Cooling - Heating and cooling shall be capable of maintaining ambient temperatures within the trailer of approximately 70°F. Heating and cooling apparatus shall be EnergyStar certified.
    c. Potable water - Potable water shall be provided for Site personnel.
    d. Fire Protection - Fire extinguishers shall be non-toxic dry chemical type, UL approved for Class A, 8 and C fires (minimum rating of 2A, 108, 10C).
    e. Health and Safety - First aid kits shall be provided.
    f. Office Equipment - Folding chairs to accommodate personnel during weekly meetings.
    g. Rubbish- Rubbish containers shall be provided and emptied each day.
5. Facilities shall be structurally sound and weather-tight, with floors raised above ground and open to allow free circulation of air.
6. All trailers and equipment supplied by the Contractor shall be removed from the Site at demobilization.
7. Locate offices and sheds minimum distance of 50 feet from Work areas.
8. Preparation: Fill and grade Sites for temporary structures sloped for drainage away from buildings.
9. Installation
    a. Install office spaces ready for occupancy upon Site mobilization.
    b. Employee Residential Occupancy: Not allowed on Site.
10. Maintenance and Cleaning
    a. Monthly cleaning by a professional is required for the existing Off-Site building, and periodic cleaning and maintenance for trailers and storage areas.
    b. Maintain approach walks (on-Site, off-Site, and all adjacent sidewalks/roadways) free of mud, water, and snow.
11. Off-Site Building Alarm
    a. National Grid will obtain a building Alarm permit through the local police for the off-Site building.
    b. The Contractor shall be responsible to pay for all costs/fees associated with the police responding to false building alarms at the Site during remedial work.

C. Vehicle Idling
    a. Vehicle idling on-Site shall be minimized or avoided.
    b. If vehicle idling occurs on-Site, idling time shall be reduced to be in compliance with applicable federal, state, and local laws.

D. Parking
   1. Provide temporary gravel surface parking areas, as needed, to accommodate construction personnel.
   2. Parking area locations shall be approved by the Construction Manager.
   3. When Site space is not adequate, provide additional off-Site parking.
   4. Use of existing on-Site roads and driveways used for construction traffic is permitted. Tracked vehicles not allowed on paved areas.
   5. All field personnel and visitors must back all vehicles into parking spots.
      a. Signage for backing into parking spots must be posted in all parking areas. The signage is a black and white sign with two (2) inch high lettering that states the following: MANDATORY BACK IN PARKING.
   6. Do not allow heavy vehicles or construction equipment in parking areas.
   7. Maintenance
      a. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
      b. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.
   8. Removal and Repair
      a. Remove temporary materials and construction at Substantial Completion.
      b. Repair existing facilities damaged by use to original condition.

E. Progress Cleaning and Waste Removal
   1. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in clean and orderly condition.
   2. Collect and remove waste materials, debris, and rubbish from Site weekly and dispose off-Site.

F. Project Signage
      a. NYSDEC Site Project Sign: Contractor shall furnish and post a professionally lettered sign at each entrance, or gate to the Site with the following sign requirements.
         1) Submit a sketch of the project sign (including dimensions and materials) and a figure showing the proposed location and orientation for the project sign for review and approval by National Grid and the Construction Manager.
         2) The sign face background shall be white.
         3) All lettering shall be black in color and a minimum 2 inches in height.
         4) The back of the sign and all supports shall be painted white.
         5) The sign shall be posted in a prominent location at the Site following the notice to proceed.
         6) Obtain any necessary approvals or permits to post the sign.
         7) The sign is to remain on-Site until project completion and upon notification from the Construction Manager. At that time, the sign is to be dismantled and shall become the contractor's property.
      b. Materials
         1) All lumber shall be structural quality and exterior grade (pressure treated).

2) All bolts, nuts, and washers shall be plated or galvanized steel.
3) The project sign shall be rectangular in shape with minimum dimensions of 6 feet (W) by 3 feet (H).
4) Paint shall be weather resistant, suitable for exterior sign applications, and compatible with exterior grade plywood and primer.

c. Sign Content:

National Grid
Remedial Action
Patchogue (West Main Street) Former Manufactured Gas Plant (MGP) Site
(NYSDEC Site No. 1-52-182)
Patchogue, New York
New York State Department of Environmental Conservation
Andrew M. Cuomo, Governor
Basil Seggos, Commissioner
Bill de Blasio, Mayor

Contacts:
NYSDEC – William Wu (518) 402-9662
NYSDOH – Jaquelyn Nealon (800) 458-1158 x 27880
National Grid – Sarah Aldridge (516) 545-2568Back in Parking

d. Signage for backing into parking spots must be posted in all parking areas. The signage is a black and white sign with two (2) inch high lettering that states the following: MANDATORY BACK IN PARKING.

2. Contractor shall furnish and post a professionally lettered sign, minimum 4 feet by 4 feet, at each entrance or gate to the Site with the following text, or other similar text approved by the Construction Manager:
   a. "All Personnel and Visitors Beyond This Point Must Wear Hard Hat, Safety Glasses, High-Visibility Vest, and Steel Toe Boots."
3. Overhead Line signage. Signs must be affixed to utility poles on-Site and off-Site, noting overhead utilities, with special attention to the poles separating the Northern Area from the Central/Core Area. Brightly colored flags can also be hung from the telecommunication lines (not able to reach the OH cables).
4. Post signs at entrance gates and along perimeter fencing at a minimum frequency of one every 100 feet. Signs shall read "UNAUTHORIZED ENTRANCE TO THE WORK AREA IS PROHIBITED", with black lettering on a white surface. Signs shall be rectangular in shape with minimum dimensions of 24 inches wide by 18 inches high. Signs shall be securely attached to the fencing, maintained throughout the work, and removed at the completion of the Project.
5. Post signs at entrance gates directing Site visitors to sign-in at the field office. Signs shall read "ALL SITE VISITORS ARE REQUIRED TO SIGN-IN AT THE FIELD OFFICE", with black lettering on a white surface. Signs shall be rectangular in shape with minimum dimensions of 24 inches wide by 18 inches high. Signs shall be securely attached to the fencing, maintained throughout the work, and removed at the completion of the Project.

G. Traffic Regulation
   1. Signs, Signals, And Devices:
      a. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
      b. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
   2. Flag person Equipment: As required by authority having jurisdiction.
      a. Flag Persons: Provide two (2) dedicated trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
      b. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
   3. Haul Routes:
      a. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and Site access.
      b. Prepare a Traffic Control Plan for review and approval, as required by local jurisdictions and Specifications.
      c. Confine construction traffic to designated haul routes.
      d. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.
   4. Traffic Signs and Signals:
      a. Provide signs at approaches to Site and on Site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
      b. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
      c. Relocate as Work progresses, to maintain effective traffic control.
   5. Removal:
      a. Remove equipment and devices when no longer required.
      b. Repair damage caused by installation.
      c. Remove post settings.

H. Decontamination Facilities
   1. Install and maintain decontamination facilities for equipment and vehicles as specified in Section 01 52 20.

I. Health and Safety Equipment Storage
   1. A partitioned health and safety equipment storage area shall be provided and shall have access through a lockable door. Sufficient shelving shall be installed for storage and inventory control of small items.

J. Stockpile and Materials Storage Areas
   1. Stockpiles shall be protected and managed in accordance with the Drawings and Technical Specifications.

K. Waste Collection Areas

1. Utilize waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label any hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section 01 70 00 for progress cleaning requirements.

L. Fuel Storage Area

1. All bulk fuel storage shall be performed in tanks equipped with secondary containment capable of storing 110% of the volume of the tank.
2. All fuel storage containment shall be protected from accumulation of rain/snow in the containment area.
3. All fuel storage containers shall meet applicable Federal, State and local codes.
4. Fuel storage and dispensing area containers shall meet all applicable fire codes.
5. Maintain a spill response kit including absorbent material at all times.

1.05 TEMPORARY CONTROLS

A. Temporary Controls shall be provided for implementation of the Remedial Design. Temporary Controls may include but are not limited to:

1. Barriers.
2. Enclosures and fencing.
3. Security.
4. Water control.
5. Dust control.
6. Erosion and sediment control.
7. Pollution control.
8. Rodent control.

B. Barriers

1. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
2. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.
3. Provide protection for plants designated to remain. Replace damaged plants.
4. Protect non-owned vehicular traffic, stored materials, Site, and structures from damage.

C. Temporary Fencing and Enclosures

1. Temporary Fencing, if needed:
   a. Fencing shall be constructed of commercial grade chain link fence.
   b. Provide, install, and maintain a 6-foot high fence around the Limit of the Work, waste staging pads, excavations, and ISS treatment area.
   c. The Limit of Work fence shall have vehicular and pedestrian gates with locks.

2. Exterior Enclosures:
    a. Provide, install, and maintain temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons.
    b. Provide access doors with self-closing hardware and locks.

D. Security
    1. Security Program:
        a. Protect Work and existing premises from theft, vandalism, and unauthorized entry.
        b. Prepare and implement a Site-specific security plan
        c. Maintain program throughout construction period until directed by the Construction Manager.
        d. Contractor shall be responsible for maintaining a dedicated Site security guard at the Project Site at all times, 24 hours per day, 7 days per week including weekends and holidays.
            1) The Project Site security guard shall be hired from an experienced security company with experience on construction Sites.
            2) The guard station shall be located near the front gate of the Site.
    2. Entry Control:
        a. Restrict entrance of persons and vehicles into Project Site.
        b. Allow entrance only to authorized persons with proper identification.
        c. Maintain log of workers and visitors, make available to the Group on request.
    3. Restrictions:
        a. Do no work on days indicated in the National Grid-Contractor Agreement or after hours as indicated.

E. Water Control
    1. Grade Site to drain. Provide, operate, and maintain pumping equipment where necessary.
    2. Protect Site from puddling or running water. Provide water barriers as required to protect Site from soil erosion and as described in the Erosion and Sediment Control Plan.
    3. Perform temporary dewatering as necessary and described in design documents.

F. Dust Control
    1. Perform dust monitoring and implement dust control measures as specified in Section 01 52 10.

G. Erosion and Sediment Control
    1. Install and maintain erosion and sediment control measures as specified in Section 31 25 13, the Design Drawings and the NYSSESC.

H. Pollution Control

1. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
2. Comply with pollution and environmental control requirements of authorities having jurisdiction.

I. Rodent Control

1. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.06 REMOVAL OF TEMPORARY UTILITIES, FACILITIES AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.

B. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 52 00

WORK ZONE AND COMMUNITY AIR MONITORING AND CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Dust Monitoring.
   3. Dust Control.
   4. Vapor and Odor Monitoring.
   5. Vapor and Odor Control.
   6. Noise Monitoring.
   7. Noise Control.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General and Supplementary Conditions, apply to this Section.
   2. National Grid's Health and Safety Requirements Specified in the Contract Documents.
   3. Community Air Monitoring Plan, Patchogue Former MGP Site, prepared by Brown and Caldwell Associates, dated February 2018, [Project CAMP].
   4. Section 01 10 00 – Summary of Work.
   5. Section 01 30 65 – Health and Safety Requirements.
   6. Section 01 33 00 – Submittal Requirements.
   7. Section 01 50 00 – Temporary Facilities and Controls.
   8. Section 31 25 13 – Erosion and Sediment Control.

1.02 REFERENCES

A. Occupational Safety and Health Administration (OSHA) Regulations – Part 1910.95 and Part 1910.1000, Table Z-1.

B. New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP) (Appendix A of DER-10).

1.03 SUBMITTALS

A. The Contractor shall provide all materials, equipment and labor to provide odor, vapor and dust control at the Site to comply with the Community Air Monitoring Plan (CAMP) and Odor, Vapor and Dust Control Plan (OVDCP) during but not limited to all excavation, demolition, backfilling, stockpiling, loading of impacted material, and MGP waste handling and transport. Prepare a Dust, Vapor, Odor, and Noise Control Plan as part of the Construction Management Plan identified in Section 01 10 00. The dust, vapor, odor, and noise control plans shall conform to the Project CAMP and specifically include:
   1. A description of each activity and the proposed dust, vapor, and odor control methods and potential receptors for each activity.

2. A list of measures that will be conducted if action levels (work zone action levels, as specified in the CSSHASP and/or community action levels) are exceeded, including specific task and personnel responsible to implement tasks.
3. Mitigation procedures to be implemented for limiting of vibration, noise, and fugitive odors during construction.
4. The implementation of a communication response system for recording an early response to address complaints from the public and a list of personnel responsible to inform the public about the release and subsequent mitigation activities.

B. Work Zone Monitoring Results, shall be continuously reviewed by the Contractor's Subcontractor, as specified in the Contractor Site-Specific Health and Safety Plan (CSSHASP), and the Contractor shall perform the following
1. The Contractor's Site Safety and Health Officer (SSHO) shall immediately notify the Construction Manager and the Design Engineer of concentrations above established action levels for VOCs, dust and odors. These elevated conditions will be recorded in the Contractor's Daily Field Reports and be available for review.
2. Contractor shall submit monitoring results via electronic files daily.
3. Complete monitoring results shall be submitted within seven (7) calendar days of completion of Work.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide sufficient quantities of materials (e.g., water, vapor and odor suppressants) and application of such materials, as required to control dust, odor, and vapors and meet the requirements of this Section to the satisfaction of the Construction Manager.

B. Maintain an adequate supply of water, vapor and odor suppressants as well as the equipment to utilize these materials on-Site. These materials will be maintained at the Site prior to invasive Site activities. Obtain a permit and approval from the Village of Patchogue to utilize a fire hydrant as a water source. Coordinate with the Village, per the requirements of the permit, as necessary.

2.02 MONITORING EQUIPMENT

A. Monitoring equipment shall be as specified in this Section and in the approved Construction Management Plan. All equipment must be checked to ensure that it is operational prior to daily invasive activities. Contractor is responsible for having backup equipment on-Site in the case of equipment failure in order to avoid delays in implementation of the work.

2.03 VAPOR AND ODOR CONTROL

A. Odor and vapor control products shall be specifically designed for use in odor and vapor control and shall have demonstrated success in suppressing the odors and vapors anticipated during construction.

B. Odor and vapor control products (mitigation or foaming agents) shall be Rusmar™ Rusfoam (Model OC, AC-645) or approved equal and BioSolve® Pinkwater or an approved equal. Odor suppressant foam application unit shall have a minimum coverage rate of 270 square feet per minute at a depth of 3 inches. Unit shall have a self-contained storage to allow premixing and be equipped with freeze protection for operation throughout the winter months.

PART 3 EXECUTION

3.01 DUST MONITORING

A. Contractor shall assist the CAMP Consultant to reduce dust in accordance with the approved Construction Management Plan and Project CAMP.

B. The CAMP Consultant will collect background dust data for a period of one week prior to beginning Work. The background readings shall be taken in an area removed and upwind of the Site and shall include data collected during periods of differing wind directions (if possible).

C. The Construction Manager and the Design Engineer reserve the right to request instantaneous perimeter monitoring depending on continuous air monitoring results and/or receipt of complaints.

D. Dust monitoring is not intended to be a substitute for any worker exposure monitoring which the Contractor may deem necessary for the protection of the work force.

3.02 DUST CONTROL

A. Conduct all operations and maintain the work area so as to minimize and suppress dust associated with the Work.

B. Dust control measures shall be employed to mitigate the release of airborne particulate matter in the Work Zone and beyond the property line of the Site in accordance with CSSHASP, approved Construction Management Plan, and Technical Specifications.

C. In the event that it becomes necessary in the opinion of National Grid, the Construction Manager or the Design Engineer, to provide additional measures to control the release of dust, Contractor shall implement such measures immediately, at no additional cost.

D. National Grid and/or the Construction Manager reserves the right to suspend Work at any time, if necessary, due to dust generation which causes a safety or an air quality problem or which may cause contamination of adjacent areas. Contractor shall not be entitled to any additional compensation for suspension of Work under such conditions.

E. Visible dust shall not be permitted to leave the Site.

F. The primary method of dust control will be the application of water spray using water trucks and/or flat hose(s) connected to a water supply.

G. Contractor shall cover stockpiles and disturbed areas when active loading or unloading is not being performed and when an active excavation is not occurring to minimize dust generation.

H. When visible dust or dust above action levels is noted leaving the Work Zone, at the perimeter, or when directed by the Construction Manager or the Design Engineer, Contractor shall apply dust suppression techniques (e.g. potable water spray) and halt Work if necessary, until the condition is mitigated.

I. After implementation of dust suppression techniques, walk perimeter of Work Zone and verify absence of dust, resume work activities and continue monitoring.

J. Trucks exiting the Site shall be inspected to ensure tires and undercarriages are clean and that tarps are secured. Excessive mud and loose soil observed on the trucks shall be manually removed with brooms and brushes, as necessary.

K. Provide a designated area within an exclusion zone where the trucks can be inspected., and where excessive mud and loose soil observed on the trucks will be manually removed with brooms and brushes.

L. Inspect truck routes on-Site and off-Site during high truck traffic periods for accumulation of excessive soil or dust.

M. Truck routes on-Site will be continuously monitored for excessive build-up of Site soils or dust, and cleaned if soils or other debris are present. During freezing temperatures, calcium chloride will be spread in lieu of water to minimize the potential for ice at the Site.

N. Additional dust control measures shall include covering soil stockpiles when active loading or unloading is not being performed and limiting the area of disturbed ground surface to minimize erosion and dust generation.

3.03 VAPOR AND ODOR MONITORING

A. Contractor shall assist the CAMP consultant in odor elimination in accordance with the CSSHASP and the Project CAMP.
   1. Site perimeter shall be monitored for nuisance odors using olfactory methods.
   2. If odors are detected at the perimeter, CAMP consultant shall immediately notify the Construction Manager, Contractor, and the Design Engineer. Contractor will take immediate action to mitigate the odor per the approved plans.
   3. The CAMP consultant will document observed nuisance odors or receipt of an odor complaint.

B. The CAMP consultant will collect background vapor level data for a period of one (1) week prior to beginning Work. The background reading shall be taken in an area removed and upwind of the Site and shall include data collected during periods of differing wind directions (if possible).

C. The Construction Manager reserves the right to request instantaneous perimeter monitoring depending on continuous air monitoring results and/or receipt of complaints.

3.04 VAPOR AND ODOR CONTROL

A. Contractor shall conduct all operations and maintain the work area so as to minimize and suppress vapors and objectionable odors associated with the Work.

B. Contractor shall have on-Site, prior to intrusive Site activities, pressure washers for BioSolve® application and/or Rusmar foam units for application. Contractor will also maintain a sufficient amount of vapor and odor control materials, prior to intrusive Site activities.

C. Vapor and odor control measures shall be employed in accordance with the CSSHASP, approved Construction Management Plan, and the Technical Specifications.

D. Vapor/odor control measures shall be employed to mitigate the release of VOCs and odors beyond the property lines of the Site.

E. Contractor shall implement vapor/odor control procedures (e.g., apply vapor/odor suppressing foam) to suppress vapor or objectionable odors in the work based on the results of air monitoring or at the request of National Grid, Construction Manager, or the NYSDEC on-Site Representative.

F. When vapors/odors above action levels are noted in the Work Zone, at the perimeter, or when directed by the Construction Manager or NYSDEC Representative, implement vapor/odor control measures immediately and halt Work if necessary until the condition is mitigated.

G. National Grid and/or the Construction Manager reserve the right to suspend Work at any time, if necessary, due to vapors or objectionable odors which cause a safety or air quality problem. Contractor shall not be entitled to any additional compensation for suspension of Work under such conditions.

H. After the application of the agent or foam, walk perimeter of Work Zone and verify absence of odors, resume work activities and continue monitoring.

3.05 NOISE MONITORING

A. Contractor shall perform noise monitoring continuously within the Work Zone at the start of the workday (to establish a baseline) and a minimum of twice a day at the nearest property boundary in the direction of the nearest receptor.

B. Contractor shall monitor and record background noise prior to start of Work.

C. Perform noise monitoring during heavy work activities and at the direction of the Construction Manager. The Construction Manager reserves the right to monitor simultaneously and as necessary. Noise levels shall not exceed the levels specified without implementation of a hearing protection program.

D. Submit a daily report presenting the results of the day's noise monitoring.

3.06 NOISE CONTROL

A. National Grid or the Construction Manager reserve the right to suspend Work at any time, if necessary, due to noise generation causing a safety or excessive vibration hazard.

B. Contractor shall comply with all noise ordinances applicable to the Site (OSHA, City, County, State, etc.)

C. No vehicles or equipment shall be started or operated outside of the designated work hours. No idling of vehicles shall occur before the designated work hours. Idling shall be limited to five minutes. Work beyond the normal work hours must be approved by the Construction Manager.

END OF SECTION

SECTION 01 52 20

DECONTAMINATION REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Temporary Water;
   2. Decontamination Requirements.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General and Supplementary Conditions, apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 30 65 – Health and Safety Requirements.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 50 00 – Temporary Facilities and Controls.
   6. Section 01 52 00 – Work Zone and Community Air Monitoring and Control.
   7. Section 31 23 16 – Excavation.
   8. Section 31 70 00 – Waste Management, Transportation and Disposal.

1.02 REFERENCES

A. 40 CFR 268.45 Hazardous Debris Regulations and 57 CFR 371.94.

B. State of New York Rules and Regulations, including Title 6 of the Official Compilation of Codes, Rules, and Regulations (6 NYCRR) Parts 360, 364, and 370 regarding treatment/disposal, transportation, and management of hazardous waste; latest edition.

1.03 SUBMITTALS

A. Decontamination Plan: Submit a Decontamination Plan as part of the Construction Management Plan in accordance with Section 01 10 00. The Decontamination Plan shall detail all equipment and procedures proposed for the decontamination of vehicles, personnel, process equipment and debris leaving the Site.

B. Certification of Potable Water Source
   1. Contractor shall ensure that the available water source on-site is adequate, (i.e. pressure) for use during remedy implementation.
   2. If the existing water source is inadequate, Contractor shall certify to National Grid that all water brought on-Site for decontamination and dust suppression is supplied by a potable water source. Certification shall be in the form of a letter from a municipal agency confirming that the source of water brought on-Site is suitable for human consumption or in the form of current laboratory analyses documenting that the water contains no contaminants above United State Environmental Protection

Agency (USEPA) drinking water standards and/or New York State Department of Health (NYSDOH) standards.

3. All water used on-Site for the purposes of personnel and equipment decontamination will be containerized, characterized, profiled, and disposed at a National Grid-approved disposal facility.

PART 2 PRODUCTS

2.01 WATER

A. Provide potable drinking water from an off-Site source in sufficient quantity and of sufficient quality required for implementation of construction activities.

B. Contractor may obtain water to perform dust suppression and decontamination operations from a water hydrant on or within the proximity of the Site.
   1. Obtain all necessary permits from local authorities and have the water use metered.
   2. A City-approved backflow prevention device shall be installed on all hydrants.
   3. The quantity of water required for equipment and personnel decontamination, dust control, and other Site activities shall be determined by the Contractor.
   4. The Contractor shall be responsible for all notifications to the City regarding the use of hydrants and maintain communications with the City, as necessary, throughout the performance of the work.

C. Contractor shall be responsible for removal of all temporary water supply lines and equipment at the completion of the project.

2.02 HOLDING TANKS

A. Contractor shall provide any holding tanks required for use on-Site to store clean decontamination water. Holding tank(s) should be sized accordingly to prevent down time from insufficient storage capacity.

2.03 TRANSFER PUMP

A. Provide transfer pumps, as necessary, to transfer wash water to and from the decontamination pad and to transfer the waste water to containers for characterization, profiling and off-Site disposal at National Grid-approved facility.

2.04 PRESSURE WASHER

A. Provide two (2) portable low-volume, high-pressure washers for use on-Site. Pressure washer(s) shall be the property and responsibility of the Contractor.

2.05 HOSE AND FITTINGS

A. Provide all necessary hoses and fittings necessary to connect the pressure washer(s) to the water supply and to connect the transfer pumps to the holding tanks.

2.06 DECONTAMINATION FLUID ADDITIVES

A. Contractor may use additives such as surfactants or water-borne abrasives to facilitate removal of hardened material from equipment or demolition debris. All additives are subject to the approval of the Construction Manager.

B. Contractor shall be responsible for the proper collection, waste characterization, profiling, and gaining acceptance of the disposal facility prior to off-Site disposal of decontamination fluids used during the project.

2.07 MISCELLANEOUS EQUIPMENT

A. Provide steam-generating pressure washers for equipment as indicated in Section 01 50 00.

B. Contractor shall also be responsible for providing all miscellaneous equipment such as scrub brushes, buckets, shovels, etc. necessary to handle, transfer, to aid in removal and decontamination activities. This includes removing caked or hardened material from equipment and construction vehicles, removing construction water and associated sediment from the decontamination pad, and removing any necessary storage containers during construction activities.

PART 3 EXECUTION

3.01 GENERAL

A. All vehicles, equipment, and personnel exiting the Exclusion Zone and the Contamination Reduction Zones, as defined in the Contractor Site Specific Health and Safety Plan (CSSHASP), shall be decontaminated when exiting the Exclusion Zone and the Contamination Reduction Zones.

B. All bulky debris such as concrete rubble, empty drums, synthetic liners and miscellaneous utilities such as piping shall require decontamination prior to off-Site transportation and disposal. All bulky debris shall be clean and washed to the extent that visible contamination is removed from bulky debris.

3.02 DECONTAMINATION PAD

A. Install and maintain personnel decontamination stations in accordance with the CSSHASP.

B. Install and maintain equipment and vehicle decontamination pads in accordance with the Design Drawings. Contractor may propose a pre-fabricated decontamination station and/or pad for review and approval by the Design Engineer.

C. The decontamination pad(s) shall consist of an area of suitable size for the decontamination of the largest mobile construction equipment and vehicle. The area to be used for decontamination purposes and constructing of the decontamination pad(s) shall be modified, as needed, to accommodate the pad(s). Large rocks, stones and other obstructions shall be removed from the prepared subgrade to prevent damage to the overlying decontamination pad containment system.

D. The decontamination pad shall be graded to a sump to allow decontamination rinse water to be collected, pumped and containerized pending characterization, profiling and off-Site disposal at a National Grid-approved facility, in accordance with Section 31 70 00.

E. The pad(s) shall be able to hold a minimum of 4 inches of standing water at the shallowest point within the containment.

F. To minimize the volume of decontamination wastewater, Contractor may use a temporary covering to shed rainfall away from the pad. In any event, Contractor shall be responsible for management of wastewater collected by the decontamination pad.

3.03 DECONTAMINATION REQUIREMENTS

A. Personnel decontamination procedures shall be performed in accordance with the CSSHASP.

B. All wash water generated from the decontamination procedures shall be collected, containerized, profiled and disposed of at an off-Site facility approved by National Grid.

C. All vehicles requiring decontamination shall be washed to the extent that visible contamination is removed from the vehicle body, undercarriage, and tires.

D. The decontamination process shall be performed in such a manner that all water used and visible contamination removed during decontamination falls onto the decontamination pad and is captured by the sump provided in the decontamination facility. Barriers shall be erected in such a manner as to capture and redirect overspray onto the decontamination pad.

E. The decontamination pad shall be washed down at the completion of each day of work. Soil and/or sediment captured by the sump shall be removed on a daily basis, as operationally required, or as required by the Construction Manager and/or the Design Engineer.

F. Material that does not infiltrate into the spaces between the crushed stone shall be manually consolidated, stockpiled, and transported for off-Site for disposal. Residual soil or waste materials generated during decontamination shall be collected, segregated, as necessary, and managed in accordance with Section 31 70 00.

G. The pad(s) shall be protected from rainwater with a polyethylene liner when not in use.

H. Upon completion of the Work, the decontamination pad materials will be managed as waste, in accordance with Section 31 70 00.

I. The decontamination areas shall be returned to pre-existing conditions upon completion of the Work.

3.04 INSPECTIONS

A. The Contractor shall oversee all decontamination activities and shall make the determination as to whether or not a piece of equipment, tool, or bulk recyclable remnant structure or pipe being removed from the Site has been properly decontaminated. The

Contractor will seek approval of the Construction Manager once it has been determined that the decontamination is complete. No equipment, tool, or bulk recyclable remnant structure or pipe shall be removed from the Site without approval from the Construction Manager.

B. Inspection forms must be completed by the Contractor and sent to National Grid and/or the Construction Manager after the completion of the decontamination activities. Contractor shall provide photographs to document the decontamination activities.

C. Inspect each decontamination pad on a daily basis and after major storm events.

END OF SECTION

SECTION 01 54 00

SITE SECURITY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals: Site Security Plan.
   2. Site Security Requirements.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, include Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 30 00 – Administrative Requirements.
   3. Section 01 33 00 - Submittal Requirements.

1.02 SUBMITTALS

A. Develop Site Security Plan for incorporation into the design and subsequent design submittals to the NYSDEC (i.e., 100% RDR) in accordance with Section 01 33 00. Site Security Plan shall address the following items at a minimum:
   1. Personnel responsible for implementing and maintaining security measures in the work area including names and assigned functions.
   2. Description of proposed daily security operations.
   3. Description of proposed methods and frequency of security checks at the Site.
   4. Description of proposed methods for responding to the following breaches in security:
      a. Entry of unauthorized personnel into the work area.
      b. Site boundary security provisions are breached.

1.03 SITE SECURITY REQUIREMENTS

A. Contractor shall be responsible for maintaining a dedicated Site security guard at the Project Site at all times, 24 hours per day, 7 days per week including weekends and holidays for the duration of the project.
   1. The Project Site security guard shall be hired from an experienced security company with experience on construction Sites.
   2. The guard station shall be located near the front gate of the Site.
   3. Security guard should never enter exclusion zones or contamination reduction area including working hours, non-working hours, day time, and night time.
   4. Security guard shall document daily inspections of the Site perimeter fence at the end of each work day and complete hourly checks during daylight hours on working and on non-working days.

5. Security guard shall check that the front gate remains locked at the end of each work day and throughout non-working hours.
6. Security guard shall monitor the Site for disturbances during non-working hours.

B. The Contractor may designate an employee to perform security operations during working hours.

C. The Contractor shall:
   1. Protect work from theft, vandalism, and unauthorized entry.
   2. Maintain program throughout construction period. Restrict entrance of persons and vehicles into Site.
   3. Allow entrance only to authorized persons with proper identification.
   4. Maintain log of workers and visitors and submit to Construction Manager weekly. Include the date, name, address, affiliation, purpose of visit, and time in and time out, for each worker/visitor.

D. No claim shall be made against National Grid or Construction Manager for damage resulting from trespass or loss of Contractor's equipment.

E. The Contractor shall make good all damage to property of the National Grid and adjacent property owner's arising from failure to provide adequate security.

F. If existing fencing or barriers are breached or removed for purposes of construction, the Contractor shall notify Construction Manager immediately and provide and maintain temporary security fencing in a manner satisfactory to National Grid.

G. Post signs at entrance gates and along perimeter fencing at a minimum frequency of one every 100 feet. Signs shall read "UNAUTHORIZED ENTRANCE TO THE WORK AREA IS PROHIBITED", with black lettering on a white surface. Signs shall be rectangular in shape with minimum dimensions of 24 inches wide by 18 inches high. Signs shall be securely attached to the fencing, maintained throughout the work, and removed at the completion of the Project.

H. Post signs at entrance gates directing Site visitors to sign-in at the field office. Signs shall read "ALL SITE VISITORS ARE REQUIRED TO SIGN-IN AT THE FIELD OFFICE", with black lettering on a white surface. Signs shall be rectangular in shape with minimum dimensions of 24 inches wide by 18 inches high. Signs shall be securely attached to the fencing, maintained throughout the work, and removed at the completion of the Project.

I. The Contractor shall be responsible for all costs associated with providing the access restriction features, maintaining all features during construction and removal and disposal of temporary features at the conclusion of the Project.

J. Entrance Control:
   1. The Contractor shall require each person to have available proper photo identification.
   2. The Contractor shall maintain a list of persons authorized for Site entry and submit a copy of the list to the Construction Manager.

3. The Contractor shall require all personnel and visitors having access to the Site to sign in and sign out, and shall keep a record of all Site access.
4. Site visitors shall not be permitted to enter active work areas unless authorized by the Construction Manager or National Grid.
5. Vehicular access shall be restricted to authorized vehicles only. The Construction Manager reserves the right to search all Contractor vehicles.
6. Personal vehicles shall not be authorized to enter the Contamination Reduction or Exclusion Zone.

K. Security Station:
1. Provide an area designated for security operations. This area that may be part of Contractor's offices, or a separate enclosure and shall contain one independent telephone line and telephone.
2. Maintain a minimum of two portable two-way radios for the Contractor, two portable two-way radios for the Construction Manager and one base radio station. All sets shall be capable of transmitting to and receiving from any other set, at any point within the Limits of Work. All portable units shall be rechargeable and shall be capable of operating continuously without recharge for eight hours.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Protecting installed construction.
   2. Project record documents.
   3. Product warranties.
   4. Final inspection.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 33 00 – Submittal Requirements.
   3. Section 01 40 00 – Quality Requirements.

1.02 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

1.03 PROJECT RECORD DOCUMENTS

A. Maintain on-Site one set of the following record documents; Record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by National Grid.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of soil excavation areas, ISS remediation areas, Site caps and covers, swale, wet meadow, new asphalt, fencing, gates, underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

G. Submit documents to National Grid with claim for final Application for Payment including the following:
   1. Discussion of major problems encountered and the resolutions.
   2. Accident Injury Report summary.
   3. As-Built Record Drawings in AutoCAD compatible format.

1.04 FINAL INSPECTION

A. Upon written notice from the Contractor; the Construction Manager and Owner will perform the final inspection with Contractor.

B. Construction Manager will notify Contractor in writing of all particulars in which this inspection reveals that the construction is incomplete or defective. If necessary, the Construction Manager shall prepare a punch list of the Work items to be completed and transmit a copy to the Contractor.

C. Contractor shall submit final Application for Payment to the Construction Manager as outlined in the Agreement once all of the other requirements of the Agreement and Contract Documents have been satisfied.

1.05 PRODUCT WARRANTIES

A. Obtain warranties executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three-ring D-style binder with durable plastic cover.

F. Submit prior to final Application for Payment.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 78 00

DEMOBILIZATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Closeout procedures.
   2. Final Site cleaning.
   3. Protecting installed construction.
   4. Project record documents.
   5. Product warranties and product bonds.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 30 65 – Health and Safety Requirements.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 50 00 – Temporary Facilities and Controls.
   6. Section 01 52 20 – Decontamination Requirements.
   7. Section 01 70 00 – Execution and Closeout Requirements.
   8. Section 31 25 13 – Erosion and Sediment Control.

1.02 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Construction Manager's review.

B. Provide submittals in accordance with Technical Specifications to Construction Manager.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.03 FINAL SITE CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean Site, sweep paved areas, and clean first and second floor of the off-Site building by a professional cleaning service. Building shall be broom clean.

C. Remove waste and surplus materials, debris, and construction equipment and facilities from Site.

1.04 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Prohibit traffic on newly landscaped areas.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain on-Site one set of the following record documents; record actual revisions to the Work:
   1. Design Drawings.
   2. Specifications.
   3. Contract Documents.
   4. Permits.
   5. Change Orders and other modifications to the Contract.
   6. Reviewed Shop Drawings, Product Data, and Samples.
   7. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Construction Manager.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of soil excavation areas, ISS remediation areas, Site caps and covers, swale, new asphalt, fencing, gates, underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

G. Submit documents to Construction Manager with claim for final Application for Payment.

1.06 PRODUCT WARRANTIES AND PRODUCT BONDS (AS APPLICABLE)

A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Submit prior to final Application for Payment.

F. Time of submittals:
   1. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

G. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Quality Assurance.
   3. Project Conditions.
   4. Preparation.
   5. Inspection of Structures to be Demolished.
   6. Demolition Requirements.
   7. Demolition.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 30 65 – Health and Safety Requirements.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 52 00 – Work-Zone and Community Air Monitoring and Control.
   6. Section 01 52 20 –Decontamination Requirements.
   7. Section 31 23 16 – Excavation.
   8. Section 31 23 23 – Backfill.
   9. Section 31 80 00 – In-Situ Solidification.
   10. Section 33 05 17 – Perimeter Utility Cut and Cap.
   11. Section 33 05 18 – Utility Support and Protection.

1.02 SUBMITTALS

A. As part of the Contractor Remediation Plan, submit plans for selective demolition of at-grade and sub-surface features, including MGP-related structures, and other obstructions encountered during excavation or ISS activities for incorporation into the design and subsequent design submittals to the NYSDEC (i.e., 100% RDR) in accordance with Section 01 33 00. The plan shall include the following:
   1. Means and methods of selective demolition and removal work, with estimated start and end dates for each excavation and ISS area.
   2. Anticipated interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Plans for protecting existing utilities.
   5. Locations of temporary partitions and means of egress.

B. Submit proof of the utility mark out. This may include but is not limited to the ticket information and responses received from the various utility companies that perform the mark outs and clearances.

C. Submit copy of demolition permits required by local and state regulatory agencies.

D. Project Record Documents: Accurately record actual locations of utilities, subsurface obstructions, and structures.

1.03 QUALITY ASSURANCE

A. Obtain required permits from local, state, and federal agencies, if required.

B. Perform Work in accordance with the Village of Patchogue codes and regulations.

1.04 PROJECT CONDITIONS

A. The above-grade features to be demolished are indicated on the Design Drawings and the Contractor will confirm structures to be demolished with National Grid and/or the Construction Manager prior to the start of Work.

B. The at-grade and subsurface structures to be demolished include asphalt pavement, concrete pads, former MGP-related structures, gas manifold surface and sub-surface piping, former railroad tracks spurs, subsurface electric and telecommunication utilities, and stormwater catch basin and stormwater pipe.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities be located and marked within and surrounding the Site.
   2. Retain Local Utility Line Ticket information and responses received from the various utility companies that perform the clearances.

B. Erect, and maintain temporary barriers and security devices for Site workers' protection.

C. Protect existing structures indicated to remain in accordance with these Technical Specifications.

D. Prevent movement or settlement of adjacent structures and/or Site features.
   1. Implement ISS activities near the existing building per the Design Drawings.
   2. Implement slope protection measure procedures in accordance with Section 31 40 00 (Slope Protection Measures), as required.

3.02 INSPECTION OF BELOW-GRADE STRUCTURES TO BE DEMOLISHED

A. As applicable, the interior of the structures shall be exposed to facilitate an inspection of the interior surfaces for integrity. Contractor shall notify the Construction Manager when a subsurface structure is ready for inspection.

B. During demolition activities, the soils around the exterior of the structure and associated piping shall be removed so that the adjacent soils can be visually inspected by the Construction Manager for indications of MGP-related source material.

C. For any at-grade or subsurface historical structures to be demolished which is within the ISS area and within the excavation area, the feature will be demolished, re-sized to a maximum of 1 foot in size or less, and incorporated into the ISS treatment.

3.03 DEMOLITION REQUIREMENTS

A. Use of explosives is not permitted.

B. Conduct demolition to minimize interference with adjacent structures, off-Site properties or other on-Site construction activities.

C. Cease operations immediately when adjacent structures appear to be in danger. Notify Construction Manager and the Village of Patchogue authorities. Do not resume operations until directed by National Grid and/or the Construction Manager.

D. Obtain written permission from National Grid if demolition equipment will traverse, infringe upon or limit access to off-Site properties or occupied adjacent structures.

E. Perform odor, vapor, dust and noise monitoring and control in accordance with Section 01 52 00.

3.04 DEMOLITION

A. Demolish and remove asphalt pavement, at-grade and subsurface structures depicted on the Design Drawings and those encountered during excavation and ISS within the limits as shown on the Design Drawings.

B. The structures will be demolished utilizing a hoe ram, hydraulic hammer or equivalent attachment mounted on an excavator, backhoe or other conventional excavation equipment.

C. For any at-grade or subsurface structure demolished which is outside of the Central/Core Area and outside of the ISS Area, the demolished debris shall be inspected by the Construction Manager for visible signs of MGP-related source material.

   1. If the debris is determined to not have visible signs of MGP-related source material, the debris shall be prepared and decontaminated, as necessary, to meet the acceptance criteria of the disposal or recycling facility. Preparation shall consist of demolishing the structures into manageable sized pieces and that meet the disposal facilities' acceptance criteria.

2. If required by the disposal facility, decontamination of concrete debris shall consist of pressure washing using a high pressure, low volume power washer. Physical/mechanical agitation (scraping with hand tools) of soil adhered to debris may be utilized to minimize wastewater generation.

D. For any at-grade or subsurface structure which is within the Central/Core Area or within the ISS Area, the demolished debris shall be demolished into maximum size 1-foot pieces and incorporated into the ISS treatment zone.

E. Remove and cap designated utilities in accordance with Section 33 05 17.

F. Protect and support utilities to remain in accordance with Section 33 05 18.

G. Backfill in accordance with Section 31 23 23.

H. Clean-up and remove demolished materials from the Site daily.

END OF SECTION

SECTION 02 61 00

MONITORING WELL DECOMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparation.
   2. Well decommissioning.
   3. Equipment decontamination.
   4. Waste management.

B. Related Sections and Documents:
   1. Construction Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's Standard General and Supplemental Conditions, apply to this Section.
   2. Section 01 10 56 – Protection of Work and Property.
   3. Section 01 33 00 – Submittal Requirements.
   4. Section 01 40 00 – Quality Requirements.
   5. Section 01 52 20 – Decontamination Requirements.
   6. Section 31 70 00 – Waste Management, Transportation, and Disposal.

1.02 SUBMITTALS

A. Drilling Contractor information including:
   1. Name and address of the drilling company.
   2. Name of proposed Driller.
   3. Copy of Driller's certification and company's New York registration.
   4. Certificate of insurance naming National Grid as additionally insured.

B. The driller's well decommissioning/sealing records for each well, including the type and amount of material removed from each well prior to decommissioning and the amount and type of material used to decommission each well.

1.03 REFERENCES

A. All applicable federal, state and local regulations.

B. Occupational Safety and Health Administration (OSHA) Regulations.

C. CP-43: "Groundwater Monitoring Well Decommissioning Policy" (New York State Department of Environmental Conservations [NYSDEC], latest version).

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with applicable local, state and federal regulations and standards.

1.05 QUALIFICATIONS

A. Drilling company and proposed driller: Specializing in performing the Work of this section with minimum of three years of documented experience.

B. Drilling company shall be on National Grid's approved Contractor list.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Grout mixture: A cement-bentonite slurry in the ratio of 7.8 gallons of water to 3.9 pounds of dry powdered bentonite to 94 pounds of dry Portland cement (Type I).

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that Site conditions will support equipment for performing decommissioning operations.

B. Protect structures and utilities near each well to be decommissioned from damage. Damage to existing structures shall be repaired and/or damaged structures shall be replaced at no cost to National Grid.

C. Call New York Dig Safely and local utilities not less than 3 working days before initiating work and request underground utilities to be located and marked within and surrounding construction areas.

3.02 WELL DECOMMISSIONING

A. Wells shall be decommissioned in accordance with "CP-43: Groundwater Monitoring Well Decommissioning Policy" (NYSDEC). Bedrock wells will be grouted in place in accordance with this policy. The wells at the Site do not penetrate a confining layer and the wells are intact (i.e., the wells are sealed above the sand pack), thus, the overburden wells and the overburden portion of the bedrock wells will be grouted in place. Over-drilling, well extraction, and bore-hole sealing is required only if decommissioning an overburden well that penetrates a confining layer.

B. Measure well depth and compare to well construction diagram to determine if there is sediment, debris or other materials (e.g., tubing, bailers, etc.) in the screen or riser casing of the well. If there is material in the screen or riser casing, an attempt shall be made to remove this material prior to decommissioning.

C. Perform gauging of NAPL in the wells and, if present, recover NAPL from the wells prior to decommissioning.

D. A tremie pipe (or tremie hose) hose shall be placed in the well; the bottom discharge end of the tremie pipe lowered to the bottom of the well. Cement/bentonite grout will be pumped into the well under pressure through the tremie pipe such that the grout discharges to the bottom of the well. During grouting, the tremie pipe may be raised from the bottom of the well, but is to be positioned such that the discharge end remains

submerged in the column of undiluted grout in the well while the grout is being pumped. Grout will be pumped into the well until grout appears at the ground surface at the top of the riser casing. Water or other fluids that were in the well that were displaced by the grout shall be contained for waste characterization and disposal.

E. Once the grout has reached the top of the riser casing, the rate of settling shall be observed. At the completion of decommissioning, after the grout has set, the final grout level should be within five feet of the ground surface. Additional grout may need to be added after the initial grouting activities if the grout has settled more than five feet below grade. If excessive settling occurs, alternative methods shall be used as appropriate for the location and the observations made during grouting, such as grouting in stages or using grout with a thicker mixture.

F. The grout level shall be re-inspected after a minimum of 24 hours has passed since the grouting was considered to be complete (i.e., since the set grout appeared to have stabilized with five feet of the ground surface). If the grout level is observed to be within five feet of the ground surface, the grouting is completed.

G. Following completion of grouting, the above-grade protective casing or flush-mounted protective cover will be removed, along with any portion of the polyvinyl chloride (PVC) casing that is above grade. The area where the protective cover/casing was removed will be backfilled with clean soil to grade.

H. Overburden wells scheduled for decommissioning that are to be completely removed by excavation (i.e. overburden wells where depth of excavation extends down to, or deeper than, the bottom of the well) shall not be grouted.

I. Wells located outside the in-situ solidification area are designated to remain and shall be protected by barriers, fencing and/or signage.

3.03 DECONTAMINATION

A. All equipment used for well decommissioning shall be steam cleaned prior to mobilizing to the Site and prior to demobilizing from the Site.

B. Well decommissioning equipment that comes in contact with subsurface materials shall be decontaminated by steam cleaning prior to use at each location.

C. Equipment decontamination shall be conducted in accordance with the Section 01 52 20 –Decontamination Requirements.

3.04 WASTE MANAGEMENT

A. Solids derived from well decommissioning activities shall be contained and disposed of in accordance with Section 31 70 00 – Waste Management, Transportation, and Disposal.

B. Water or liquids derived from well decommissioning activities shall be contained and disposed in accordance with Section 31 70 00.

3.05 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements.

B. Request inspection by Design Engineer, Construction Manager and NYSDEC representative after determining well to be decommissioned is free of debris/materials and/or after debris/materials, if present, have been removed.

C. At the completion of grouting to seal well, request visual inspection by Design Engineer, Construction Manager, and NYSDEC Representative.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Stormwater Swale

1.02 REFERENCES

A. American Concrete Institute:
   1. ACI 211.1 Proportioning Concrete Mixtures
   2. ACI 301 Specifications for Structural Concrete
   3. ACI 305 Hot Weather Concreting
   4. ACI 306 Specifications for Cold Weather Concreting
   5. ACI 308 Specifications for Curing Concrete
   6. ACI 309 Consolidation of Concrete

B. ASTM International:
   1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C33 - Standard Specification for Concrete Aggregates.
   3. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
   5. ASTM C150 - Standard Specification for Portland Cement.
   6. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   7. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   8. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
   9. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

1.03 SUBMITTALS

A. Identify sources for materials specified in this section.

B. Design Data:
   1. Submit proposed mix design showing:
      a. The expected strength at 28 days;
      b. Corresponding slump before and after the introduction of high-range water-reducing admixtures;
      c. Water/cement ratios;
      d. Weights and test results of the ingredients;
      e. Aggregate gradation;
      f. Test results of mix design prepared by an independent testing laboratory; and

g. Other physical properties necessary to review each mix design for conformance with these specifications.

C. Field Quality Control testing results.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. To demonstrate conformance with the specified requirements for concrete, provide the services of an independent testing laboratory for testing specified herein. Costs of testing laboratory services shall be borne by the Contractor.

C. Conform to ACI 305 when concreting during hot weather.

D. Conform to ACI 306.1 when concreting during cold weather.

E. Acquire cement and aggregate from one source for Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement:
1. Portland cement shall be ASTM C150, Type I or II, low alkali, containing less than 0.60 percent alkalis. In addition to standard requirements, cement shall satisfy optional chemical and physical requirements of ASTM C150, Tables 2 and 4, respectively.

B. Aggregates:
1. Fine and coarse aggregates shall conform to ASTM C33. Aggregates shall be non-reactive and shall be washed before use.
2. Aggregates shall be checked for alkali-silica reactive constituents per ASTM C1260. Aggregate shall have less than 0.1% expansion when tested in accordance with ASTM C1260. Aggregates having 0.1% or greater expansion when tested in accordance with ASTM C1260 may still be satisfactory provided ASTM C1567 concrete mix test results are submitted and show an expansion of less than 0.1% at 16 days. ASTM C1260 and ASTM C1567 test results shall be no older than 1 year.
3. Tests for size and grading of fine and coarse aggregates shall be in accordance with ASTM C136. Combined aggregates shall be well and uniformly graded from coarse to fine sizes to produce a concrete that has optimum workability and consolidation characteristics. The final combined aggregate gradation shall be established during the design mix.
4. Aggregates used in the concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by the submitted historical data or trial mixtures.
5. Fine Aggregate: Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33.

6. Coarse Aggregate: Coarse aggregate shall be hard, dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other deleterious substances shall not exceed the limits listed in ASTM C33, Table 3 for Class Designation 5S. Gradation of each coarse aggregate size specified in paragraph 03300-2.02 A shall conform to ASTM C33, Table 2.

C. Pozzolan:
   1. Pozzolan shall be Class F fly ash conforming to ASTM C618. Class C fly ash is not allowed. Pozzolan supplied during the life of the project shall have been formed at the same single source.
   2. Pozzolan color shall not substantially alter the resulting concrete from the normal gray color and appearance.
   3. Use pozzolan materials that are of the same brand and type and from the same plant of manufacture as the materials used in the concrete represented by the submitted field test records or used in the trial mixtures.

D. Chemical Admixtures:
   1. Admixtures shall be compatible with the concrete and with each other. Calcium chloride or admixtures containing calcium chloride are not acceptable. Admixtures shall be used in accordance with the manufacturer's recommendations and shall be added separately to the concrete mix. The water reducing retarders and admixtures shall reduce the water required by at least 11 percent for a given concrete consistency and shall comply with the water/cement ratio standards of ACI 211.1.
   2. Water reducing admixtures shall conform to ASTM C494, Type A.
   3. Water reducing and retarding admixtures shall conform to ASTM C494, Type D.
   4. High range water reducing (superplasticizing) admixtures shall conform to ASTM C494, Type F.
   5. High range water reducing and retarding admixtures shall conform to ASTM C494, Type G.
   6. Air entraining agent shall conform to ASTM C260.
   7. Select shrinkage reducing admixture, if used, for compatibility with air entrainment admixture and other ingredients of the concrete mix.

E. Water:
   1. Water for washing aggregate, for mixing and for curing shall be free from oil and deleterious amounts of acids, alkalis, and organic materials; and shall comply with the requirements of ASTM C1602. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete.

F. Membrane Curing Compound:
   1. Acceptable products include: BASF “MasterKure CC 250SB”; Dayton Superior “Cure & Seal 25% J22UV”; or approved equal, conforming to ASTM C309 and ASTM C1315.
   2. Compound shall be clear and applied in accordance with the manufacturer’s instructions.
   3. Curing and sealing compound shall be certified compliant with final finish system if applicable.

2.02 CONCRETE CHARACTERISTICS

A. Concrete shall be normal weight concrete composed of specified cement, pozzolan, admixtures, aggregates and water proportioned and mixed to produce a workable, strong, dense, and impermeable concrete. The Contractor may substitute interground Portland-pozzolan cement conforming to ASTM C595, containing the specified amount of pozzolan in lieu of Portland cement and pozzolan. Water-cementitious material (w/cm) ratio is based on the combined contents of cement and pozzolan in a given mix proportion.

B. Provide Class A concrete meeting the following criteria for the stormwater swale:

Material and Property	Measurement
Design Strength (28 day)	4000 psi
Cement Content (minimum)	611 pounds/cu yd
Course Aggregate Size	ASTM 57 or ASTM 61
Water-Cement Ratio (maximum)	0.443 w/cm
Air Content	4.5 - 7.5%
Slump	3-5 inches

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.02 PREPARATION

A. Remove debris from substrates.

B. Remove water from areas receiving concrete before concrete is placed.

3.03 READY-MIXED CONCRETE

A. Concrete shall be truck-mixed, ready-mixed concrete conforming to the applicable portions of ASTM C94. Materials shall be proportioned by weighing. Pozzolan shall be introduced into the mixer with cement and other components of the concrete mix; pozzolan shall not be introduced into a wet mixer ahead of other materials or with mixing water. Water shall be introduced at the time of charging the mixer; additional water may be introduced within 45 minutes from charging the mixer, provided the specified slump is not exceeded and the maximum total water per the approved mix design is not exceeded. Contractor shall arrange with the testing laboratory for inspection as required to comply with these specifications.

B. Concrete shall be delivered to the Site and discharge shall be completed within 90 minutes after introduction of water to the mixture.

3.04 FORMWORK ERECTION

A. Forms shall be of wood or metal and be straight and of sufficient strength to resist spring, tipping or other displacement during the process of positing and consolidating concrete.
   1. Wood or metal forms shall be securely staked and braced to the required line and grade.
   2. Wood or metal forms shall be sufficiently tight to prevent leakage of mortar.
   3. Wood or metal forms shall be cleaned thoroughly and oiled before concrete is placed against them.

B. Verify lines, levels, and measurement before proceeding with formwork.

C. Hand trim sides and bottom of earth forms and remove loose dirt.

3.05 CONVEYING AND PLACING CONCRETE

A. Concrete shall be conveyed from the mixer to the forms in accordance with ACI 301. Concrete which has segregated in conveying shall be removed from the site of the work.

B. Placing Concrete:
   1. Concrete shall be placed in accordance with ACI 301. Do not permit concrete to drop freely more than 4-feet.
   2. Place concrete in continuous operation.
   3. In hot weather (above 80 degrees F), concrete shall be placed in accordance with ACI 305.1.
   4. In cold weather (below 45 degrees F), concrete shall be placed in accordance with ACI 306.1.
   5. Concrete shall be consolidated in accordance with ACI 301. If proper consolidation is not occurring, then concrete placing shall be suspended until proper consolidation can be achieved.

3.06 STORMWATER SWALE

A. Reinforcement Items
   1. Place, support, and secure reinforcement items against displacement.

B. Provide light broom finish on surfaces which are exposed to weather.

3.07 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete through the use of a membrane curing compound, as specified above.

3.08 FIELD QUALITY CONTROL

A. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

B. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
   3. Sample concrete and make one set of three cylinders for every 100 cubic yards or less of each class of concrete placed each day.

C. Field Testing:
   1. Slump Test Method: ASTM C143/C143M.
   2. Temperature Test Method: ASTM C1064/C1064M.
   3. Measure slump and temperature for each compressive strength concrete sample.

D. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39/C39M.
   2. Test one cylinder at 7 days.
   3. Test two cylinders at 28 days.

E. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.09 DEFECTIVE CONCRETE

A. Repair or replacement of defective concrete will be determined by the Design Engineer.

B. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Design Engineer for each individual area.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Protection.
   2. Preparation.
   3. Site clearing.
   4. Waste management.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General and Supplementary Conditions, apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 10 56 – Protection of Work and Property.
   4. Section 01 50 00 – Temporary Facilities and Controls.
   5. Section 02 41 19 – Selective Demolition.
   6. Section 02 61 00 – Monitoring Well Decommissioning.
   7. Section 31 25 13 – Erosion and Sediment Control.
   8. Section 33 05 18 – Utility Support and Protection.

1.02 QUALITY ASSURANCE

A. Perform Work in accordance with Village of Patchogue and Town of Brookhaven codes and regulations.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verify existing conditions before starting Work.

B. Verify existing plant life designated to remain is tagged or identified.

3.02 PROTECTION

A. Verify utilities requiring protection and rerouting in accordance with Section 33 05 18 – Utility Support and Protection.

B. Locate, identify, and protect utilities indicated to remain, from damage.

C. Protect trees, plant growth, and features designated to remain, as final landscaping.

D. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.03 PREPARATION

A. Call Local Utility Line Information service not less than three (3) working days before performing Work. Request underground utilities to be located and marked within and surrounding work areas.

B. Implement erosion and sediment control measures in accordance with Section 31 25 13 – Erosion and Sediment Control.

C. Set up temporary facilities and controls in accordance with Section 01 50 00 – Temporary Facilities and Controls.

D. Decommission designated groundwater monitoring wells in accordance with Section 02 61 00 – Monitoring Well Decommissioning and protect existing monitoring wells to remain.

3.04 CLEARING

A. Clear all debris, rubble, and vegetation from the limits of work and in any other areas which will be used by the Contractor as approved by National Grid and/or the Construction Manager.

B. Coordinate with all applicable utility companies regarding managing utilities impacted by the Work.

C. Contractor shall meet all the requirements imposed by the utility companies including but not limited to: supporting and/or protecting existing utilities, coordinating with utility companies regarding disconnecting or relocating existing utilities, backfilling and compacting excavation areas as required, and conducting necessary vibration and settlement monitoring.

D. Remove trees and stumps and shrubs within work areas. Debris, stumps, roots and other vegetation that are generated during clearing operations will be stockpiled, characterized and disposed off-Site at an approved disposal facility.

E. Perform selective demolition, in accordance with Section 02 41 19 – Selective Demolition.

3.05 WASTE MANAGEMENT

A. The Contractor shall be responsible for handling, stockpiling, characterization, transportation and off-Site disposal of all generated wastes at properly licensed and permitted disposal facilities approved by National Grid.

B. Continuously clean-up and remove waste materials from Site. Do not allow waste materials to accumulate on-Site.

C. Do not burn or bury materials on Site. Leave Site in clean condition.

D. Segregate contaminated materials from non-contaminated materials.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Excavation of MGP-Source Impacted Soils.
   2. Excavation of ISS-Treated Soil.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 10 56 – Protection of Work and Property.
   4. Section 01 30 00 – Administrative Requirements.
   5. Section 01 33 00 – Submittal Requirements.
   6. Section 01 40 00 – Quality Requirements.
   7. Section 01 50 00 – Temporary Facilities and Controls.
   8. Section 01 52 00 – Work Zone and Community Air Monitoring and Control.
   9. Section 31 23 23 – Backfill.
   10. Section 31 25 13 – Erosion and Sediment Controls.
   11. Section 31 40 00 – Slope Protection Measures.
   12. Section 31 70 00 – Waste Management, Transportation and Disposal.
   13. Section 31 80 00 – In-Situ Solidification.

1.02 SUBMITTALS

A. Prepare and submit plans for excavation as part of the Construction Management Plan (CMP) for review and approval by National Grid and the Design Engineer within 10 days of the Notice to Proceed. Plan shall describe the proposed excavation method for excavation of impacted soil and solidified soil, identify ESC measures, and describe the schedule and sequencing of excavation activities with other Remedial Activities.

B. Submit copy of excavation permits if required by local and state regulatory agencies.

1.03 REFERENCES

A. Occupational Safety and Health Administration (OSHA) Regulations

B. Local utility standards and requirements when working near utility lines, as defined by each utility owner.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Design Drawings, Specifications, and approved Contractor Remediation Plan.

B. Perform Work in accordance with local and state regulations and standards.

C. The Design Engineer will implement the Construction Quality Assurance Project Plan (CQAPP) to provide quality assurance and assess the conformity of the work to the DEC-approved Remedial Design Report, Design Drawings, and Technical Specifications.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Approximate existing Site conditions are indicated on the Design Drawings. The Contractor shall examine and confirm existing Site conditions prior to the start of Work.

B. Protect active utilities indicated to remain from damage. Utilities affected by the construction activities shall be protected during the course of work or temporarily isolated and re-established at the completion of Work. Work near utilities shall be coordinated with the utility purveyor and performed in accordance with the utility purveyor requirements.

C. Call Local Utility Line Information service and Village of Patchogue and/or Town of Brookhaven not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and adjacent properties.
   2. Do not proceed with intrusive activities until the mark out is complete and confirmed.

D. Confirm that Site clearing and preparation activities have been completed in accordance with Section 31 10 00.

E. Patchogue River bank slope protection measures shall be designed, installed, maintained, and removed in accordance with Section 31 40 00.

F. Protect bench marks, survey control points, existing structures, and fences from equipment and vehicular traffic. Benchmarks and survey marks that are missing or damaged shall be replaced by the Contractor's Surveyor at no additional cost.

G. Inspect and repair, if necessary, erosion and sediment controls prior to the start of excavation activities in accordance with Section 31 25 13.

3.02 GENERAL REQUIREMENTS

A. All excavation work shall be performed in compliance with all appropriate Federal, State, and OSHA regulations.

B. All excavation outside the limits shown on the Design Drawings, which is not approved by National Grid or the Construction Manager, together with the removal and disposal of the excavated material, shall be at the Contractor's expense. The unauthorized excavation shall be filled and compacted with the specified backfill materials by the Contractor at no additional cost to the National Grid.

C. Notify National Grid and/or Construction Manager of unexpected subsurface conditions.

3.03 SOIL EXCAVATION

A. As specified in Section 31 80 00, the ISS-treated soil within the limits of the ISS area shall be excavated, if not removed concurrently with active ISS operations, to a depth of four feet below final grades to accommodate installation of the Site Covers.

B. Excavated ISS-treated material shall be placed in a temporary waste containment area for characterization and off-Site disposal in accordance with Section 31 70 00.

C. Impacted soil excavation shall be performed within the limits and depths indicated on the Design Drawings.

D. Excavated impacted soils may be stockpiled and staged on Site in designated temporary waste containment areas or direct-loaded into trucks for off-Site disposal. If direct-loading is selected, Contractor shall identify this in the CMP, along with the basis for using this method, and all required waste characterization and waste acceptance from the disposal facility shall be completed prior to initiating excavation.

E. Within the limits of the final Site Covers (outside the ISS areas and impacted excavation area), excavate soils to depth of 2 feet below final grade. Excavated soils shall be managed in accordance with Section 31 70 00.

F. Subsurface structures and debris encountered during excavation shall be managed in accordance with Section 31 70 00.

G. Contractor shall control dust emission and odors during all excavation activities.

3.04 PROTECTION

A. Protect excavation areas until backfilling and restoration is completed.

B. Prevent displacement or loose soil from falling into excavation; maintain excavation stability.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, vibration, and other hazards created by earth operations per Sections 01 10 56 and 31 40 00, and as shown on the Drawings.

D. Contractor shall protect all existing structures outside the limits of the excavation areas. If Contractor damages any structures, Contractor shall repair or replace the damaged structure to the original construction standards at Contractor’s own expense without reimbursement

E. Contractor shall notify all utility companies and locate all underground utilities prior to starting excavation work. Contractor shall be responsible for protection of utilities. If Contractor damages any utilities, Contractor shall repair or replace the damaged utility to the original construction standards at Contractor's own expense without reimbursement

3.05 QUALITY CONTROL

A. Contractors Land Surveyor shall stake excavation boundaries as indicated on the Drawings and perform initial survey.

B. Contractor shall employ all equipment necessary for control of excavation depths, lines, and grades.

C. Verification of final excavation horizontal lengths and depths shall be accomplished by survey provided by Contractors Land Surveyor and in a manner that mutually acceptable to the Contractor and Construction Manager.
   1. Horizontal limits of completed excavation in sufficient detail to determine limits of the material removed.
   2. Vertical limits of excavation consisting of top of final grade or excavation limit in sufficient detail to verify elevations.

END OF SECTION

SECTION 31 23 23

BACKFILL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. References.
   2. Submittals.
   3. Backfill Materials.
   4. Examination of Materials.
   5. Stockpiling of Backfill Materials.
   6. Backfilling.
   7. Tolerances.
   8. Field Quality Control.
   9. Protection of Finished Work.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General, apply to this Section.
   2. Section 01 10 00 –Summary of Work.
   3. Section 01 33 00 – Submittal Requirements.
   4. Section 01 40 00 – Quality Requirements.
   5. Section 31 23 16 – Excavation.
   6. Section 31 50 00 – Site Cover and Restoration.
   7. Section 33 05 17 – Perimeter Utility Cut and Cap.

1.02 REFERENCES

A. New York State Department of Transportation (NYSDOT) Standard Specifications (latest version).

B. New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation 6 NYCRR Part 375

C. ASTM International:
   1. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.
   2. ASTM D1577 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

1.03 SUBMITTALS

A. Provide fill material and geosynthetic submittals in accordance with Section 01 33 00.

B. Contractor shall submit a Backfill Plan for backfilling activities as identified in Section 01 10 00. Plan shall include a description of sequencing, backfill materials, material staging, and compaction methods.

C. Coarse Aggregate (Imported):
   1. Analytical Samples: Submit in laboratory prepared containers to the testing laboratory.
   2. At least two (2) weeks prior to the material being needed at the Site, provide documentation of the source of the fill including:
      a. The name of the person providing the documentation and the relationship to the source of the fill.
      b. The location where the fill was obtained.
      c. Identification of any state or local approvals as a fill.
      d. A brief history of the use of the property which is the source of the fill (if no prior approval is available for the source).
      e. Laboratory analytical results or certificates supporting that the source quality conforms to the requirements identified in Part 2.
   3. Bills of lading to document the source of the material and the imported quantity.
   4. No material shall be imported to the Site until NYSDEC approval is obtained for the source and the Contractor is authorized by the Construction Manager.

D. Rip-Rap (Imported):
   1. Analytical Samples: Submit in laboratory prepared containers to the testing laboratory.
   2. At least two (2) weeks prior to the material being needed at the Site, provide documentation of the source of the fill including:
      a. The name of the person providing the documentation and the relationship to the source of the fill.
      b. The location where the fill was obtained.
      c. Identification of any state or local approvals as a fill.
      d. A brief history of the use of the property which is the source of the fill (if no prior approval is available for the source).
      e. Laboratory analytical results or certificates supporting that the source quality conforms to the requirements identified in Part 2.
   3. Bills of lading to document the source of the material and the imported quantity.
   4. No material shall be imported to the Site until NYSDEC approval is obtained for the source and the Contractor is authorized by the Construction Manager.

E. Top Soil (Imported):
   1. Analytical Samples: Submit in laboratory prepared containers to the testing laboratory.
   2. At least two (2) weeks prior to the material being needed at the Site, provide documentation of the source of the fill including:
      a. The name of the person providing the documentation and the relationship to the source of the fill.
      b. The location where the fill was obtained.

c. Identification of any state or local approvals as a fill.
d. A brief history of the use of the property which is the source of the fill (if no prior approval is available for the source).
e. Laboratory analytical results or certificates supporting that the source quality conforms to the requirements identified in Part 2.

3. Bills of lading to document the source of the material and the imported quantity.
4. No material shall be imported to the Site until NYSDEC approval is obtained for the source and the Contractor is authorized by the Construction Manager.

F. Material Reuse:
1. Materials from Site activities may be re-used as backfill upon submission and approval of material re-use forms by the NYSDEC. No soil shall be re-used on Site prior to receiving this approval as well as the approval of National Grid and the Design Engineer.

G. Submit information and qualifications of proposed analytical laboratory.

H. Submit information and qualifications of proposed geotechnical laboratory.

PART 2 PRODUCTS

2.01 BACKFILL MATERIALS

A. Source Quality Control
1. Employ a NYSDOH ELAP-certified approved analytical testing laboratory to perform the analytical testing on each different source and/or material.
a. Parameters shall include Target Analyte List (TAL) volatile organic compounds (VOCs), TAL semi-volatile organic compounds (SVOCs), TAL metals, cyanide (total and amenable), and PCBs/Pesticides.
b. Analytical data shall demonstrate compliance with the lower of the protection of public health soil cleanup objectives in 6 NYCRR 375.6.7(d) for restricted-residential criteria.
c. Testing frequency shall be according to the following schedule:

Contaminant	VOCs	SVOCs, Inorganics & PCBs/Pesticides	
Soil Quantity (cubic yards)	Discrete Samples	Composite	Discrete Samples/Composite
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
> 1000	Add an additional 2 VOC discrete samples and 1 composite sample for each additional 1,000 cubic yards or consult with DER		

d. Grab samples shall be allowed for VOC analyses only.

e. Composite samples shall be prepared by collecting discrete samples from three to five random locations from the volume of soil to be tested which shall then be mixed and analyzed for SVOCs, inorganic, and PCB/pesticide constituents.

2. If results from analytical data indicate concentrations above specified criteria, the Contractor shall submit another proposed material source.

B. Coarse Aggregate, Size Designations 1, 2, and 3:

1. Certified clean imported NYSDOT Coarse Aggregate.
2. Free of extraneous debris or solid waste.
3. Conforming to NYSDOT Table 703-4 Sizes of Stone, Gravel and Slag, Size Designation 1 and 2 within the following limits:

	Percentage Passing by Weight		
U.S. Standard Sieve Size	Size 1	Size 2	Size 3
2 ½ inch	-	-	100
2 -inch	-	-	90-100
1 ½ inch	-	100	35-70
1 inch	100	90-100	0-15
½ inch	90-100	0-15	
¼ inch	0-15		

4. Consisting of virgin material from a permitted mine or quarry documented to not exceed the lower of the protection of public health soil cleanup objectives in 6 NYCRR 375.6.7(d) for unrestricted criteria.
5. Consisting of material documented to not exceed the lower of the protection of public health soil cleanup objectives in 6 NYCRR 375.6.7(d) for restricted-residential criteria.

C. Rip-Rap, 8-inch Median Diameter:

1. Free of extraneous debris or solid waste.
2. 50% by weight of stones have at least one dimension equal to or larger than 8-inches.
3. Well graded mixture of hard and angular stones with a maximum diameter of 2-inches and a minimum diameter of 1-inch.
4. Minimum individual stone specific gravity of 2.5.
5. Consisting of virgin material from a permitted mine or quarry documented to not exceed the lower of the protection of public health soil cleanup objectives in 6 NYCRR 375.6.7(d) for unrestricted criteria.
6. Consisting of material documented to not exceed the lower of the protection of public health soil cleanup objectives in 6 NYCRR 375.6.7(d) for restricted-residential criteria.

D. Top Soil:

1. Free of extraneous debris, solid waste, seeds or other viable propagules of invasive plants, woody vegetation, stones over 2-inches in size, hard clods, and materials deleterious to plant growth.

2. Top soil shall conform to NYSDOT Standard Specifications - Construction and Materials section 713-01B for manufactured lawn top soil with naturally occurring granular material within the following limits:

U.S. Standard Sieve Size	Percentage Passing by Weight
1 inch	100
No. 10	90 - 100
No. 40	45 – 80
No. 200	25 – 70
2 Micron	5 – 35

3. Top soil shall consist of friable natural loam with the addition of humus only. The addition of other soil types, such as sand or clay soil, shall not be accepted. Natural top soil shall be acquired from a verifiable source and must be free from subsoil.
4. pH between 5.5 and 7.6
5. Organic content between 6% and 12% on a dry weight basis.
6. Consisting of material documented to not exceed the lower of the protection of public health soil cleanup objectives in 6 NYCRR 375.6.7(d) for restricted-residential criteria.

PART 3 NEXECUTION

3.01 EXAMINATION OF MATERIALS

A. Prior to placing backfill materials, request materials inspection by the Construction Manager and/or Design Engineer.

B. If the physical and/or engineering properties of materials delivered to the Site differ significantly from the samples tested, perform additional testing to verify compliance with the specifications.

C. Any material placed that does not conform to these Specifications shall be removed and replaced with conforming material, at no cost to National Grid.

3.02 STOCKPILING OF BACKFILL MATERIALS

A. Stockpile materials on-Site at locations approved by the Construction Manager.

B. Stockpile in sufficient quantities to meet project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Direct surface water away from stockpiles on-Site to prevent erosion or deterioration of materials.

3.03 ISS AREA BACKFILL

A. Top of ISS Subgrade Preparation
   1. Prior to placement of backfill materials, the ISS top of subgrade will be graded and smoothed such that the final elevation of the grade surface of the ISS treated area is a minimum of 4 feet below final grade.

B. Backfill with Coarse Aggregate Type to achieve base grade (i.e., 2 feet below final grade).
   1. Coarse Aggregate Type 2 shall be placed in 12-inch thick lifts and mechanically compacted.
   2. Any ruts occurring during construction shall be filled with additional backfill material, and compacted as appropriate.

3.04 TOLERANCES

A. Subgrade and Final Grade: Plus or minus one inch from design final grades.

3.05 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements.

B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.06 PROTECTION OF FINISHED WORK

A. Section 01 70 00 – Execution Requirements

END OF SECTION

SECTION 31 25 13

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Installation, maintenance, and removal of measures related to erosion and sediment control.
   2. Installation of permanent outlet protection measures.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General and Supplementary Conditions, apply to this Section.
   2. National Grid's Health and Safety Requirements Specified in the Contract Documents.
   3. Section 01 10 00 – Summary of Work.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 30 65 – Health and Safety Requirements.
   6. Section 31 23 23 -- Backfill

1.02 REFERENCES

A. New York State Standards and Specifications for Erosion and Sediment Control.

B. New York State Stormwater Management Design Manual. Prepared by: Center for Watershed Protection. Prepared for: New York State Department of Environmental Conservation (NYSDEC).

C. United States Environmental Protection Agency (USEPA) –Office of Water; Storm Water Management for Construction Activities.

D. Occupational Safety and Health Administration (OSHA) Regulations.

1.03 SUBMITTALS

A. Submit an Erosion and Sediment Control (E&SC) Plan to the Design Engineer for review and approval. The E&SC Plan shall be developed as part of the Contractor's Construction Management Plan (CMP) in accordance with Section 01 10 00.

B. Submit product information on erosion control products for the review and approval by the Design Engineer.

1.04 SLOPE PROTECTION AND EROSION CONTROL

A. Silt barriers shall be constructed around all stormwater inlets and maintained throughout construction.

B. Sediment accumulated behind silt barriers shall be removed when the ponding capacity is reduced by one-half.

PART 2 PRODUCTS

2.01 TEMPORARY SILT FENCE

A. Silt fence fabric shall be inert to chemicals commonly found in soil and resistant to mildew, rot, insects, and rodent attack.

B. Silt fence fabric and fence posts shall be factory-assembled. Posts shall be attached to the silt fence at a maximum of 8-foot centers.

C. Silt fence cloth shall be Filter X, Mirafi 100X, Stabilinka T140N or approved equal.

D. Pre-fabricated silt fence shall be manufactured by Geofab, Envirofence, or approved equal.

2.02 HAY BALES

A. Hay bales shall consist of undecayed firmly-packed hay.

B. Hay bales shall be 14 inches by 18 inches by 36 inches as prepared by a standard bailing machine.

C. Hay bales shall be firmly bound by at least two separate circuits of rope or band material which will withstand weathering for a minimum of three months.

2.03 FILTER BAGS

A. Filter bags shall be utilized to filter sediment from water pumped from excavations and trenches. Filter bags shall be Dirtbag by ACF Environmental of Richmond, VA, Wetland Filter Bags by Environmental Protection Products, or approved equal.

B. Used filter bags shall managed as a contaminated material (miscellaneous debris/waste), and managed and disposed off-Site in accordance with Section 31 70 00.

2.04 STABILIZED CONSTRUCTION ENTRANCES

A. Temporary construction entrances shall be constructed of NYSDOT No. 3 coarse aggregate with an 8 oz./sy. non-woven geotextile fabric underlay, and as shown on the Design Drawings.

2.05 GABION MESH

A. Gabions shall be made of hexagonal triple twist mesh with heavily galvanized steel wire. The maximum linear dimension of the mesh opening shall not exceed 4.5-inches and the area of the mesh opening shall note exceed 10 square inches.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Comply with applicable requirements in the "New York State Standards and Specifications for Erosion and Stormwater Control".

B. Comply with all applicable regulatory requirements to obtain required permits or certifications prior to the start of Work.

C. The Contractor is responsible for the installation and maintenance of erosion and sediment control measures during the Work.

D. Implement any corrective actions identified by the Construction Manager or the Design Engineer during daily inspections.

E. Temporary erosion and sediment control measures shall be installed and maintained in accordance with the NYSSESC.

3.02 SILT FENCE AND HAY BALE INSTALLATION

A. Silt fence and hay bales shall be installed as shown on the Drawings. Additional silt fence/hay bales shall be installed to delineate the limit of the disturbance (installed on the down slope side), around the perimeter of any stockpile areas as well as in strategic locations based on visual observation of flow patterns and topography of work areas to control sediment entrained storm water from entering and exiting work areas.

B. Silt fence material shall be embedded at least 6 inches beneath ground surface and shall extend upward at least 20 inches above the ground surface. The top edge of the fabric shall be reinforced or shall have a 1-inch tuck. Silt fence posts shall be driven at minimum of 16 inches below ground surface as shown on the Drawings.

C. Where two ends of a silt fence join, the ends shall be overlapped a minimum of 6 inches.

D. Silt barriers shall be constructed around all stormwater inlets and maintained throughout construction.

E. Hay bales shall be embedded at least four inches beneath the ground surface and shall be securely anchored in place by either 2 stakes or rebars driven through the bale. The first stake in each bale shall be driven toward the previously laid bale at an angle to force the bales together. Stakes shall be driven flush with the bale.

3.03 STABILIZED CONSTRUCTION ENTRANCES

A. Clear the entrance/exit area of all vegetation, roots, and other objectionable material.

B. Grade the subgrade surface so that the entrance/exit will have a cross slope.

C. Place stone to the dimensions, grade, and locations shown on the Drawings.

3.04 PROVISIONS FOR EROSION CONTROL DURING WORK

A. Implement and maintain erosion and sediment control measures around all areas to be disturbed prior to disturbing ground, in accordance with the Drawings and Specifications, and to the complete satisfaction of the Construction Manager and/or the Design Engineer. The Construction Manager or Design Engineer will periodically observe erosion and sediment control structures to confirm that the Contractor is maintaining these features.

B. Take sufficient precautions during Work to prevent the erosion of materials such as soil, tar, non-aqueous phase liquids (NAPL), wastes, fuels, and oils into the surface waters of New York. Storm water catch basins or drains shall be protected from sediment materials run-off. Use all best management practices (BMPs) necessary to protect inlets from sediment and debris.

C. Disposal of collected waters from the Site shall be at a location approved by the National Grid. Drainage shall not be disposed of until silt and other sediment material have been removed. Particular care shall be taken to prevent the discharge of unsuitable drainage to a water supply or surface water body.

D. Accumulated soil, silt and debris shall be removed by the Contractor from behind the face of the silt fence or other BMPs as needed to maintain BMP effectiveness. At a minimum, soil and silt will be removed from behind the silt fence and filter socks when it accumulates to a depth 6 inches behind the barriers. Clogged or damaged BMPs shall be replaced immediately. The Contractor shall notify the Construction Manager of such checks and repairs so that the Work can be inspected and documented.

E. Removed soil and silt shall be treated as waste material, and shall be managed and disposed off-Site in accordance with Section 31 70 00.

F. Erosion and sediment control measures will be maintained at all times by the Contractor. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented.

G. Maintain stabilized construction entrances in a condition to prevent mud or soil from leaving the Site. This may require periodic topdressing with 2-inch stone. Immediately remove soil, mud and all objectionable materials spilled, washed, or tracked onto any road. Collected materials will be treated as waste materials, and managed and disposed off-Site disposal per Section 31 70 00.

H. Any erosion and sediment control measures impacted by implementation of the Work will be properly disposed off-Site by the Contractor.

3.05 STREET CLEANLINESS

A. Where construction vehicle access routes intersect public roads, Contractor shall make provisions to mitigate the transport of mud, spills, soil, or dust onto the public road. Contractor's haul roads shall be equipped with necessary controls to prevent soil transport to public streets. If soil, mud, spoils, and/or dust is transported onto public roads, Contractor shall immediately clean the road by shoveling, sweeping. Street washing may be necessary only after soil is removed.

3.06 PERMANENT OUTLET PROTECTION

A. Prepare the subgrade for the rip-rap and gabion outlet protections to the required lines and grades.

B. Install 8 oz./sy. non-woven geotextile fabric over the subgrade and protect geotextile from damage while placing rip-rap stone. Repair damaged sections of geotextile by overlapping another piece of geotextile or by completely replacing the damaged area. Overlap geotextile a minimum of 12-inches at seams or overlaps.

C. Gabions shall be fabricated in such a manner that the sides, ends, and lid can be assembled into a rectangular basket of the specified sizes. Gabions shall be of single unit construction and shall be installed according to manufactures recommendations.

END OF SECTION

SECTION 31 40 00

SLOPE PROTECTION MEASURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Installation, maintenance, and removal of slope protection measures.
   2. Performance requirements.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 40 10 – Protection of Work and Property.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 50 00 – Temporary Facilities and Controls.
   6. Section 31 23 16 – Excavation.
   7. Section 31 23 23 – Backfill.
   8. Section 31 80 00 – In-Situ Solidification.

1.02 PERFORMANCE REQUIREMENTS

A. Furnish, install, monitor, and maintain slope protection measures, capable of containing ISS-related swell within the ISS area (i.e., not allowing ISS-related swell to overtop or flow around the slope protection measures) and able to resist soil and hydrostatic and earth pressures at the adjacent Patchogue River bank.

B. Install slope protection measures without damaging existing work, Site features (e.g., existing building, existing fencing, etc.) and utilities on-Site.

1.03 SUBMITTALS

A. Submit a plan detailing the means and methods of slope protection measures as part of the Contractor Remediation Plan identified in Section 01 10 00. The plan shall detail the proposed ISS implementation sequence and slope protection measures to prevent ISS-related swell from leaving the ISS area and to protect the Patchogue River bank, active utilities, and existing structures. The plan shall incorporate slope protection measures specifically identified in the Construction Drawings and additional slope protection measures proposed by the Contractor. The plan shall provide or reference drawings that identify the methods, materials, dimensions, and elevations; identify sequencing of activities; and identify procedures for removal of measures.

B. Submit detailed product information for required materials, including manufacturer data sheets, dimensions, testing reports and certifications.

C. Submit detailed information for equipment proposed for installation of slope protection measures.

D. Photograph existing Site conditions prior to commencing Work. The photographs shall be of sufficient detail in the event damage to structures occurs, and shall include, at a minimum, structures, walls, fencing, and any other existing Site features.

1. The Contractor shall be liable for all damage and expense for direct or indirect damage caused to the Work and/or existing structures. Repair any damage to the Work and existing structuring during construction operations to the satisfaction National Grid.

1.04 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this Section with a minimum experience of five (5) similar projects with installation and operation of slope protection measures.

1.05 PROJECT CONDITIONS

A. Contractor shall not interrupt utilities unless permitted in writing by National Grid and utility owner and then only after arranging for temporary utility services, if required.

B. Survey adjacent structures and utilities, employing a qualified Professional Surveyor licensed in the State of New York to establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

C. During installation of slope protection measures, resurvey benchmarks daily until slope protection measures are completely installed, and weekly thereafter until complete removal of slope protection measures. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify (within 24 hours) the Design Engineer and/or the Construction Manager if changes in elevations or positions occur or if cracks, sags, or other damage is evident in nearby structures or Site features.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials that are either new or in serviceable condition. If the Design Engineer determines that materials are not in an acceptable condition, they shall be replaced at no additional cost.

B. Sheet piles shall be Arbed AZ-13, A328 steel or approved alternate.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect existing Work, Site features, utilities and Patchogue River bank from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during installation/removal of slope protection measures.

1. Shore, support, and protect Site features and utilities as necessary.

B. Promptly correct bulges, breakage, or other evidence of movement to ensure that slope protection measures remain stable.

C. Promptly repair damages to adjacent Site features and utilities caused by installing slope protection measures.

3.02 GENERAL REQUIREMENTS

A. Install slope protection measures at the locations identified on the Design Drawings. The Contractor may use other protection measures (e.g., berms, sequenced ISS) for the remaining ISS areas, with the exception for ISS near sensitive structures at locations identified on the Design Drawings, and shall be in accordance with Section 31 80 00.

B. Contractor shall have a Competent Person (as defined by OSHA regulations) inspect slope protection measures daily (or following a weather event) during ISS implementation.

3.03 SHEET PILING

A. Install and maintain sheet piling system in accordance with the approved design and Section 01 10 00.

B. Install and remove sheet piles by hydraulic pressing methods. Driving sheet piles with a vibratory or impact hammer will not be allowed.

C. Use installation method not capable of causing damage to nearby structures. Align top of sheet piling normal to the installation force of the press to minimize bowing of piling during installation. Maintain sheet piling vertical during installation. Jetting or pre-drilling of sheet piling is not permitted unless approved in writing by the Design Engineer. Do not damage sheet piling during installation/removal operations.

3.04 REMOVAL AND REPAIRS

A. As directed by the Construction Manager, remove and decontaminate slope protection measures when construction is complete and the ISS area has cured sufficiently to be self-supporting and bear the soil and hydrostatic pressures of the Patchogue River bank and as approved by the Contractor's Competent Person.

B. Remove systems in stages to avoid disturbing underlying soils, damaging pavements, Site features, and utilities.

C. Repair or replace, as directed by the Construction Manager, adjacent work damaged or displaced by removing slope protection measures at no additional cost.

END OF SECTION

SECTION 31 50 00

SITE COVERS AND RESTORATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. References.
   2. Submittals.
   3. Close-Out Submittals.
   4. Surveying and Construction Tolerances.
   5. Materials.
   6. Preparation.
   7. Stockpiling of Materials.
   8. Demarcation layer.
   9. Site Covers.
   10. Stormwater Swale and Wet Meadow.
   11. Site Restoration.
   12. Protection of Installed Work.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 30 65 – Health and Safety Requirements.
   4. Section 01 30 00 – Administrative Requirements.
   5. Section 01 33 00 – Submittal Requirements.
   6. Section 01 40 00 – Quality Requirements.
   7. Section 01 70 00 – Execution Requirements.
   8. Section 03 30 00 – Cast in Place Concrete.
   9. Section 31 23 23 – Backfill.
   10. Section 31 25 13 – Erosion and Sediment Control.
   11. Section 32 12 16 – Asphalt Pavement.
   12. Section 32 31 13 – Chain-Link Fences and Gates.

1.02 REFERENCES

A. New York State Department of Transportation (NYSDOT) Standard Specifications (latest version).

B. 6 NYCRR Part 375-6.7(d) (latest version).

C. Division of Environmental Remediation, Technical Guidance for Site Investigation and Remediation (DER-10) (latest version).

1.03 SUBMITTALS

A. Demarcation Layer – Nonwoven Geotextile.
   1. Manufacturer's product data sheet and installation instructions.
   2. Sample of the material: 12 in. x 12. in. (nominal).

1.04 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: As-built Survey: Record actual elevations and limits of the subgrade and completed Site covers.

1.05 SURVEYING AND CONSTRUCTION TOLERANCES

A. The Surveyor shall prepare final record-drawing documentation in accordance with Section 01 30 00 – Administrative Requirements.

B. Section 01 40 00 - Quality Requirements: Tolerances.
   1. Thickness of Site Cover: Plus or minus 1 inch.

PART 2 PRODUCTS

2.01 MATERIALS

A. Section 03 30 00 Cast in Place Concrete

B. Section 31 23 23 - Backfill.

C. Section 32 12 16 – Asphalt Pavement.

D. Wet meadow seeding mixture containing Deer Tongue or Switchgrass, Redtop and Birdsfoot Trefoil seed varieties.

2.02 DEMARCATION LAYER

A. Demarcation layer shall be a 4 oz./sy. non-woven geotextile: Mirafi 140NL/O (orange color) or equivalent approved by the Design Engineer.

B. Manufacturing Quality Control:
   1. Geosynthetics shall be manufactured with quality control procedures that meet or exceed generally accepted industry standards.
   2. Contractor shall obtain from the geosynthetics manufacturer(s) sample and test results for the geosynthetics to demonstrate that the materials and fabrication practices comply with the specifications. This quality control (QC) sampling and testing shall be performed at the Contractor's expense.
   3. The Contractor shall not accept or install any geosynthetics which exhibit defects.
   4. In the event that any geosynthetic sample does not comply with these specifications, it will result in rejection of the roll from which that sample was obtained. The Contractor shall replace any rejected rolls at no additional cost.

5. If a geosynthetic sample fails to meet the quality control requirements of this Section, Design Engineer will require sampling and testing of each roll manufactured in the same lot, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until the Contractor verifies, in writing, that each and every QC problem has been identified and corrected, and that all affected rolls have been replaced; all at no additional expense.
6. Additional sampling and testing may be performed, at the Contractor's discretion and expense, to more rapidly identify any non-complying rolls and/or to qualify individual rolls.
7. Comply with all certification and submittal requirements specified herein.

C. Transportation:
1. Transportation of the geosynthetic materials shall be the responsibility of the Contractor. The Contractor shall be liable for all damages to these materials prior to and/or during transportation to the Site.

PART 3 EXECUTION

3.01 PREPARATION

A. Backfilling shall be sequenced and performed in accordance Section 31 23 23 and the Construction Management Plan (Section 01 10 00).

B. Grade and smooth subgrade surface in preparation for the placement of the demarcation layer.

C. Verify subgrade condition has been approved by the Construction Manager.

3.02 STOCKPILING OF MATERIALS

A. Stockpile materials on-Site at locations approved by the Construction Manager.

B. Stockpile in sufficient quantities to meet project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile to a maximum height of 8 feet.

E. Direct surface water away from stockpile areas to prevent erosion or deterioration of materials.

3.03 DEMARCATION LAYER - NONWOVEN GEOTEXTILE INSTALLATION

A. Base Grade Preparation:
1. Prior to placement of the geotextile of the Site Covers, the subgrade will be graded and smoothed such that base grade is maintained at a minimum of 2 feet below final grades, as shown on the Design Drawings.
2. Surface shall be free of sharp objects.

B. Installation:
    1. The geotextile shall be laid smooth without wrinkles or folds. Adjacent geotextile rolls shall be overlapped a minimum of twelve inches.
        a. If the standing water is present, the demarcation layer shall be installed and weighted down with crushed stone aggregate placed by excavator bucket or by hand to ensure overlap lengths.
    2. The installed geotextile shall be inspected by the Construction Manager to ensure that the geotextile has not been damaged during installation. Damaged geotextiles, as identified by the Construction Manager, shall be repaired immediately. Cover the damaged area with a geotextile patch which extends an amount equal to the required overlap beyond the damaged area.
    3. Subsequently placed backfill materials shall be placed by end dumping onto the demarcation from the edge, or over previously placed backfill. Construction vehicles shall not be allowed directly on the geotextile.
    4. If placement of the backfill material causes damage to the geotextile, the damaged area shall be cleared of backfill material and repaired as previously described above. The placement procedure shall then be modified to eliminate further damage from taking place.

3.04 CENTRAL/CORE AREA: SITE COVER

A. The Site Cover shall be installed within the Central/Core Area where shown on the Design Drawings.

B. Crushed Stone Site Cover: The Site Cover within the National Grid-owned property in the areas specified on the Design Drawings.
    1. The stone cover will be constructed as follows (in descending order):
        a. From the final grade at surface to six-inches below grade shall be a coarse stone with a NYSDOT Standard Specifications for Coarse Aggregate size designation Type 2 (or approved equivalent);
        b. 18 inches of NYSDOT Standard Specifications for Coarse Aggregate size designation Type 1 (or approved equal); and
        c. Nonwoven geotextile demarcation layer.

C. Compaction: Within the water table, backfill will be placed in loose layers and tamped in-place using excavation equipment. Above the groundwater table, all backfill will be placed in 12-inch thick lifts and mechanically compacted.

D. Do not backfill with frozen materials.

E. Employ placement method that does not disturb or damage other work.

F. Remove surplus backfill materials from Site.

3.05 OFF-SITE PROPERTY: SITE COVER

A. The Site Cover on the Off-Site Property shall be installed where shown on the Design Drawings.

B. Install Asphalt Pavement Site Cover as shown on the Design Drawings and in accordance with Section 32 12 16 (Asphalt Pavement).

3.06 STORMWATER SWALE AND WET MEADOW

A. Install stormwater swale and wet meadow at locations and elevations shown on the Design Drawings

B. Stormwater Swale:
   1. Construct stormwater swale as follows (in descending order):
      a. From the final grade surface, 6 inches of 4,000 pounds per square inch concrete;
      b. 6 inches of compacted subbase course conforming to Section 304 of NYSDOT, Type 2 Subbase Course;
      c. 12 inches of NYSDOT Standard Specifications for Coarse Aggregate size designation Type 1 (or approved equal); and
      d. Nonwoven geotextile demarcation layer.
   2. Extend asphalt pavement Site cover, crushed stone Site cover, asphalt restoration surface, and stone restoration surface up to limit of swale and flush with swale sidewall.
   3. Install concrete surface as specified in Section 03 30 00.

C. Wet Meadow:
   1. Construct wet meadow as follows (in descending order):
      a. From the final grade surface, 6 inches of vegetated top soil;
      b. 8 oz./sy. nonwoven geotextile layer;
      c. 18 inches of NYSDOT Standard Specifications for Coarse Aggregate size designation Type 1 (or approved equal); and
      d. Nonwoven geotextile demarcation layer.
   2. Construct wet meadow sidewalls at one-to-one slope.
   3. Construct swale outlet protection, gabion outlet weir, and gabion outlet protection as specified in the Design Drawings and Section 31 25 13.
   4. Spread top soil evenly across wet basin bottom and sidewalls and lightly compact with a dozer or backhoe bucket. Avoid excessive compaction of top soil.
   5. Seed top soil.
      a. Apply seed mixture at specified rates.
         1) Deer Tongue: 0.35 lbs/1,000 sq. ft; or Switchgrass: 0.45 lbs/1,000 sq. ft.
         2) Redtop: 0.1 lbs/1,000 sq. ft
         3) Birdsfoot Trefoil: 0.23 lbs/1,000 sq. ft
      b. Ensure adequate soil moisture is present prior to seeding. Postpone seeding if wet meadow surface is powder dry.
      c. Spread design seed mixture through broadcasting or hydroseeding.
      d. Apply 100 lbs per 1,000 sq. ft. of small grain straw mulch after seeding and anchor with netting or tackifier.

3.07 SITE RESTORATION

A. Off-Site Asphalt Pavement Restoration:
   1. Remove remaining existing asphalt pavement outside remedial area to the limits shown on the Design Drawings. The full depth of asphalt pavement shall be removed via milling or saw-cutting and removal.
   2. Re-grade and compact subgrade surface.
   3. Install new asphalt pavement surface (without demarcation layer) as specified in Section 32 12 16.
   4. Final grades of asphalt surface shall meet the grades depicted on the Design Drawings.

B. Crushed Stone Surface Restoration:
   1. Where indicated on the Design Drawings, existing area with crushed stone surfaces that have been disturbed during Work, shall be restored with 6 inches of Coarse Aggregate Type 1.

C. Install new fencing and gates as shown on the Design Drawings and in accordance with Section 32 31 13 (Chain Link Fences and Gates).

D. Disturbed areas outside Limit of Work shall be restored to pre-existing conditions.

3.08 PROTECTION OF INSTALLED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

END OF SECTION

SECTION 31 70 00

WASTE MANAGEMENT, TRANSPORTATION, AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. References.
   2. Submittals.
   3. Permits and Regulations.
   4. Quality Assurance.
   5. Materials and Products.
   6. Preparation.
   7. Management of Waste materials.
   8. Waste characterization.
   9. Waste transportation, treatment, disposal and recycling.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Construction Quality Assurance Project Plan (CQAPP).
   3. Section 01 10 00 – Summary of Work.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 50 00 – Temporary Facilities and Controls.
   6. Section 31 23 16 – Excavation.
   7. Section 31 23 23 – Backfill.
   8. Section 31 80 00 – In-Situ Solidification.

1.02 REFERENCES

A. State of New York Rules and Regulations, including Title 6 of the Official Compilation of Codes, Rules, and Regulations (6 NYCRR) Parts 360, 364, and 370 regarding treatment/disposal, transportation, and management of hazardous waste.

B. New York State Department of Environmental Conservation (NYSDEC) Technical Administrative Guidance Memorandum (TAGM) 4061 – Management of Coal Tar Wastes and Coal Tar Contaminated Soil and Sediment from Former Manufactured Gas Plants (MGPs).

C. Transportation regulations, including U.S. Department of Transportation (USDOT) regulations, including Title 29 Part 171 and 172 and New York Department of Transportation (NYDOT) rules and regulations.

D. Waste Management Plan, Patchogue Former Manufactured Gas Plant (MGP) Site.

1.03 SUBMITTALS

A. Submit a Waste Management Plan (WMP) to National Grid and/or the Design Engineer, for incorporation into the design and subsequent design submittals to the NYSDEC (i.e., 100% RDR). The WMP shall describe the Contractor's proposed method and procedures for staging, handling, and transporting each generated waste. For each waste stream, describe waste characterization sampling procedures and requirements, and identify the National Grid pre-approved treatment facilities, disposal facilities and waste haulers to be utilized (name, address, contact person, hours of operation, USEPA/NYSDEC permit/registration numbers and copies of permits, and any incidents reported in the past 5 years).

B. Contractor shall provide a list of proposed waste haulers and disposal/recycling facilities for all waste streams for review by the Construction Manager and approval by National Grid.

C. Contractor shall provide signature sheets for all truck drivers indicating that truck driver orientation requirements have been completed.

D. Submit information of the proposed laboratory to be used for waste characterization analyses no later than two weeks prior to the start of sampling activities. Laboratory shall be a certified New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) laboratory.

E. Provide electronic copies of the waste characterization analytical data to National Grid and Construction Manager within 24 hours of receipt from the laboratory.

F. Contactor shall only utilize routes designated in the Contractor's Traffic Plan. It is the responsibility of the Contractor to utilize equipment and personnel capable of navigating the local traffic patterns while maintaining minimum daily production required to meet the project milestones. The Contractor shall be responsible for all delays caused as a result of trucks not following approved traffic routes due to inadequate scheduling of trucks or due to any other traffic or trucking delays.

G. Daily Construction Report shall include detailed documentation of all loading and transport activities.

H. Manifests and Bill of Lading
   1. Provide and complete all required manifest forms and Bill of Lading forms for National Grid for proper transportation and disposal of materials off-Site. The Contractor shall be responsible and will be held accountable for assuring that all sampling, analysis, transportation, and disposal requirements of the disposal facilities, Federal, State, and local governments are compiled with and properly documented. All manifests and/or Bills of Lading must be signed by National Grid (or authorized representative) and the truck driver.
   2. Prepare and submit a summary sheet daily that provides at a minimum, the following information regarding each truck load:
      a. Date.
      b. Load Number.
      c. Uniform Hazardous Waste Number or Bill of Lading Number.

d. Truck ID Number (license plate number of truck used).
e. Estimated gross weight.
f. Estimated tare weight.
g. Estimated net load weight.
h. Actual load weight.
i. Material type (non-hazardous, hazardous, debris, etc.).
j. Disposal method.
k. Disposal facility.

I. Contractor shall submit the completed waste manifests, certificates of disposal/destruction, and weight tickets.

J. Product data and manufacturer specifications on materials used to construct the Temporary Waste Containment Areas (TWCA).

1.04 PERMITS AND REGULATIONS

A. Comply with all Federal, State, and local regulations regarding transportation and disposal of non-hazardous special wastes. These include, but are not limited to:
   1. Trucks used for transportation of non-hazardous special wastes shall be permitted for such use;
   2. Vehicle operator possession of a commercial driver's license with non-hazardous special waste materials endorsement (if applicable);
   3. Registration of vehicle as a special non-hazardous waste carrier (if applicable);
   4. Utilization of shipping papers and/or special non-hazardous waste manifest;
   5. Proper marking and placarding of vehicles;
   6. Placement of emergency response procedures and emergency telephone numbers in vehicle, and operator familiarity with emergency response procedures; and
   7. Compliance with all load height and weight regulations.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Design Drawings, Technical Specifications, approved Contractor Remediation Plan, and approved Contractor Waste Handling and Contingency Plan.

B. Perform Work in accordance with local and state regulations and standards.

C. The Construction Manager will implement the Construction Quality Assurance Project Plan (CQAPP) to provide quality assurance and assess the conformity of the work to the DEC-approved Remedial Design Report, Design Drawings, and Technical Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Provide waste containers (e.g., roll-offs, holding tanks, drums, etc.), as appropriate, which meet applicable regulations.

B. All equipment delivered to the Site supplied shall be in good working conditions. Equipment and machinery including haul trucks that have visible oil or hydraulic fluid leaks will not be allowed on Site until satisfactorily repaired. The Contractor is responsible for the cleanup of any hydraulic fluid spill at the Contractor's expense.

C. Trucks used for transportation of material for off-Site disposal shall be water-tight. The transport containers shall be equipped with solid covers (e.g., tightly woven fabric, not mesh covers) that shall be utilized during the transportation of wastes from the Site to the disposal facility. All trucks shall be covered prior to leaving the Site.

D. Construct TWCAs in accordance with the details presented on the Design Drawings.

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor shall construct TWCA(s) as detailed in Drawings. The location of TWCA shall be as shown on the Drawings or as pre-approved by the Construction Manager.

3.02 MANAGEMENT OF WASTE MATERIALS

A. Contractor shall perform Work such that no waste material is spilled during transfer of materials to the TWCA and/or loading into disposal trucks. If spills occur, the waste shall be immediately collected and the spill area shall be appropriately cleaned. Polyethylene sheeting shall be placed on the ground surface beneath and adjacent to the disposal truck (i.e., beneath the swing area) to catch potential droppings in active waste loading areas (excluding the TWCA).

B. Cover and secure the TWCA with plastic sheeting during inactive periods.

C. Direct surface water away from the TWCA.

D. Stockpiled materials shall be removed from the Site within 7 days of placement, unless a longer duration is approved by National Grid.

E. Excavated Soils:
   1. Excavated soils shall be temporarily staged in a TWCA (prior to characterization and waste acceptance) or direct loaded into trucks (after in-situ characterization and waste acceptance) for off-Site disposal.

F. ISS-Related Swell:
   1. ISS-related swell (i.e., swell removed at the ground surface and/or material removed from the ISS area to accommodate the surface cover/cap) shall be disposed at a National Grid-approved disposal facility.
   2. ISS-related swell shall be crushed, broken, cut, or otherwise processed into manageable pieces to facilitate handling, transportation, and off-Site disposal and to satisfy any size requirements of the National Grid-approved disposal facility.
   3. Management of ISS-related swell shall be coordinated and sequenced with ISS activities.
   4. ISS-related swell shall be temporarily staged in the TWCA for characterization prior to off-Site disposal.

G. Obstructions such as boulders, bedrock, former MGP structures and other debris may be encountered during the Work. Oversized material (i.e., greater than 2 feet in maximum dimension) will be removed in its entirety.
   1. Concrete, brick, and boulders shall be reduced in size to less than 2 feet in maximum dimension will be placed into the ISS mix.
   2. Wood, metal, piping, or other debris will be decontaminated and prepared as necessary, and recycled or disposed of off-Site as appropriate at a National Grid-approved facility.

H. Wastewater generated from remedial activities (including dewatering waste generated from ISS-related swell excavation and/or curing, decontamination, and other sources) shall be collected, containerized, and sent off-Site to a National Grid-approved disposal facility.

I. Asphalt Pavement: Debris generated during removal of the existing asphalt pavement shall be staged separately for off-Site recycling.

J. Non-Aqueous Phase Liquids (NAPL): NAPL will generally be managed and handled as a commingled waste along with the media it is associated with, such as debris (e.g., NAPL commingled with former MGP-related debris will be placed into the ISS area and incorporated into the ISS).

K. Miscellaneous Waste: Other miscellaneous waste streams shall be managed in accordance with applicable State and Federal regulations and shall be coordinated with the Construction Manager. Local recycling requirements shall be met and recycling containers for paper, plastic, glass, and metals shall be available on-Site.

L. After waste materials are removed from the Site, the Contractor shall decontaminate, decommission, remove, and/or demobilize (as appropriate) TWCA and any other waste management components. Management of materials requiring off-Site treatment, disposal, and/or recycling shall be coordinated with the Construction Manager and performed in accordance with this Section.

3.03 WASTE CHARACTERIZATION

A. Perform all waste characterization sampling of waste materials indicated for off-Site disposal. Perform sampling in conformance with the applicable regulatory requirements (e.g., RCRA regulations) and the requirements of National Grid and approved off-Site treatment/disposal facilities.

B. Laboratory analyses shall be performed at a laboratory approved by National Grid.

C. Waste Characterization requirements shall be outline in the Contractor Waste Handling and Contingency Plan.

D. ISS-Related Swell: Unless otherwise approved by the disposal facility and National Grid, at a minimum, waste characterization of this waste category shall consist of the following:
   1. One sample composite sample (3-5 grab samples composited) initially analyzed for RCRA hazardous characteristics (EPA SW-846 analytical methods) and total PCBs.

2. One (1) composite sample (3-5 grab samples composited) analyzed for TPH (EPA Method 8015 GRO/DRO), Total VOCs (EPA Method 8260B), Total SVOCs (EPA Method 8270C), PCBs (EPA Method 8082), Total Metals (EPA Method 6010 B), Total Cyanide (EPA Method 9010), percent Sulfur (EPA Method D129-64), and BTU (ASTM Method D 240-87) at the following frequency:
    a. First Composite Sample for the first 150 Tons.
    b. Second Composite Sample for the first 300 Tons.
    c. Third Composite Sample for the first 750 Tons.
    d. One (1) Additional Composite per every additional 750 Tons.

E. Unless otherwise approved by the National Grid authorized representative, ISS-related swell Waste Characterization shall be performed as follows:
    1. General:
        a. Waste characterization samples shall be collected before the ISS spoils set up.
        b. Samples shall be cured on-Site and conveyed to the laboratory for testing.

3.04 WASTE TRANSPORTATION AND DISPOSAL

A. Contractor will employ 2 dedicated flaggers to stop and direct all traffic at the locations where trucks will enter and exit from the Site at ALL times during transportation activities. Waste materials shall be transported only at the times and by the routes indicated in the approved waste management and traffic plans, unless approved by National Grid and/or the Construction Manager.

B. Confirm acceptance of waste types and forms with the disposal facility and notify the Construction Manager as to restrictions imposed by the disposal facility. Use off-Site treatment/disposal facilities pre-approved by National Grid. Prior to waste shipment, Contractor shall receive written communication from the facility confirming that the waste is acceptable for treatment/disposal at their facility, treatment/disposal capacity is available, and the treatment/disposal method.

C. Contractor shall not transport waste off-Site prior to receipt of characterization sample results for review/acknowledgement by National Grid and/or the Construction Manager and approval by the Construction Manager.

D. Do not track soil off-Site at any time during the project. Visible soil tracks on streets will be cleaned up immediately at no additional cost. Take sufficient precautions to prevent loose soils from adhering to tired treads, wheel wells, etc.

E. Waste Transportation:
    1. Prior to waste shipment, obtain written confirmation from transporter that they are authorized to deliver manifested waste to the identified treatment/disposal facility.
    2. All truck drivers shall be required to sign the orientation form. All truck drivers shall be provided with hard copies of the orientation packager including the Transportation Plan and Traffic Plan.
    3. All truck drivers will be required to follow incident reporting requirements detailed in the Traffic Plan. Contractor shall verbally inform the Construction Manager of any trucking related incident as soon as possible.

4. Trucks shall only enter and exit the Site at locations shown on the Drawings unless approved by the owner through the Construction Manager.
5. Contract NYSDEC-permitted (Part 364 Permit) and National Grid-approved waste transportation companies to transport waste materials to approved disposal facilities.
6. Ensure that transportation vehicles are properly loaded and securely covered with solid linings/covers, equipped with tailgate locks, and do not exceed permitted weights. All vehicles shall be properly covered, secured, and decontaminated prior to leaving the Site.
7. Prepare and supply waste manifests which will be signed by National Grid or by National Grid's authorized representative.
8. Manage all disposal documentation including, but not limited to manifests, bills-of lading, weigh tickets, and Certificates of Destruction/Disposal.
9. The Contractor will not be paid for shipments with unsigned shipping documentation.

F. Daily Trucking Log:
1. The Contractor shall provide a Daily Trucking Log to the Construction Manager for approval providing information on each of the off-Site shipment from the project Site, including trucking company, truck and trailer registration number, date, pre-characterization source ID, destination facility, estimated quantity, verification of decontamination, verification of 364 permit and Contractor personnel's initials.
2. Contractor shall fill in the Daily Trucking Log for each shipment at the time it leaves the project Site.
3. The contractor shall electronically submit the completed Daily Trucking Log to the Construction Manager.
4. Contractor shall submit Certificates of Destruction for each load shipped for disposal. Certificates shall be provided for review in advance of Contractor invoice for disposal quantities, any discrepancies of load identification may delay quantity verification.

G. Manifests:
1. Contractor will prepare manifests and necessary paperwork for transportation and disposal of impacted material and debris
2. A non-hazardous/hazardous waste manifest or other tracking documents shall be provided by the Contractor for each individual load depending on material classification. Each manifest should be signed by the designated authorized agent of the Owner, the truck driver as a transporter, and by the disposal facility operator.
3. The Contractor will not be paid for shipments with unsigned manifests.

H. National Grid, Construction Manager and/or the CQA Representative will not be held responsible for delays or stoppages associated with the transportation of waste materials from the Site.

END OF SECTION

SECTION 31 80 00

IN-SITU SOLIDIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. ISS Implementation using bucket-mixing method.
   2. ISS Implementation in the vicinity of sensitive structures using bucket mixing methods.
   3. Pilot-Scale ISS Implementation.
   4. Full-Scale ISS implementation.
   5. Performance monitoring and reporting.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 10 56 – Protection of Work and Property.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 40 00 – Quality Requirements.
   6. Section 31 23 16 – Excavation.
   7. Section 31 40 00 – Slope Protection Measures.
   8. Section 31 70 00 – Waste Management, Transportation and Disposal.
   9. NYSDEC Guidance for Quality Control Coring on In-Situ Solidification Projects (latest version).

1.02 REFERENCE STANDARDS

A. Following is a list of standards, which will be referenced in this Section. Such referenced standards shall be considered part of these specifications as if fully repeated herein.
   1. API RP 13B-1 for Viscosity and Density;
   2. API 13A: Specification for Oil-Well Drilling Fluid Materials (i.e., specification for Bentonite);
   3. ASTM C143: Standard Test Method for Slump of Hydraulic-Cement Concrete;
   4. ASTM C150: Standard Specification for Portland Cement;
   5. ASTM C192: Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory;
   6. ASTM D422: Particle-Size Analysis of Soils;
   7. ASTM C684: Standard Test Method for Making, Accelerated Curing, and Testing Concrete Compression Test Specimens;
   8. ASTM C989: Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars;
   9. ASTM D1632: Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory;

10. ASTM D1633: Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders;
11. ASTM D2166: Standard Specification for Unconfined Compressive Strength of Cohesive Soil;
12. ASTM D4380: Standard Test Method for Density of Bentonitic Slurries;
13. ASTM D4972: Standard Test Method for pH of Soils;
14. ASTM D4832: Preparation and Testing of Controlled Low Strength Material Test Cylinders; and
15. ASTM D5084: Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

1.03 ABBREVIATIONS AND DEFINITIONS

A. API - American Petroleum Institute

B. ASTM - American Society for Testing and Materials

C. Bucket-Mixing Method (BMM) - Soil mixing that is performed with the use of an excavator bucket.

D. Grout - A stable colloidal suspension of powdered cement, bentonite, additives and/or other similar materials in water.

E. Addition Ratio - A volumetric ratio of grout to soils (e.g., 100 gal/cubic yard) to be mixed in an ISS cell. The grout addition ratio is determined for each cell based on the cell dimensions, soil density, pattern of treatment, and desired application rate.

F. ISS Cell – A discrete area where grout is added to the soil and mixed with an excavator bucket to the design depth. This creates a rectangular prism of treated soil. The footprint and depth of the cell are located by survey or GPS-based equipment mounted on the excavator.

G. Working Platform - The working platform is the leveled surface of stable soils from which the SM equipment operates.

H. Mixing Pass – Operation of the mixing bucket from the top of the cell to the bottom and back. Generally, a number of passes are required to completely mix an ISS cell.

I. Sampler – A tool and ancillary equipment capable of obtaining samples of the freshly mixed soil and grout from discrete depth intervals. The sampler should be capable of retrieving a 2-gallon sample or as approved by the Design Engineer.

J. Swell – The excess material resulting from adding grout to the in-situ soils. The swell is typically a mixture of soil and grout similar to the materials in the ISS cell.

K. Soil Mixing (SM) – The process of mixing soil with grout and other reagents to solidify and stabilize soil.

L. In-Situ Solidification (ISS) – The process of soil mixing in-situ (as opposed to ex-situ).

1.04 QUALIFICATIONS

A. The ISS Contractor shall be pre-qualified before bidding on this work. Contractors shall meet the following experience criteria:
   1. Project Experience: The ISS Contractor shall have at least five (5) years of experience over the last ten years; and have completed at least five (5) ISS projects, with at least two (2) projects having objectives similar to those of this project.
   2. Personnel Experience: The ISS Contractor's Supervisor shall have at least three (3) years on-Site experience managing field operations of similar size and scope, and shall have supervised at least two (2) projects within the past five (5) years employing the technique proposed for this project. The Supervisor shall have experience and knowledge of all aspects of ISS as required for the project and shall be present at the work Site at all times during SS operations.
   3. The Contractor's other personnel shall have a minimum of two (2) years of experience with projects of similar scope. Other personnel include equipment operators, batch plant operator, ISS rig operator, supervisory engineering staff, and technical staff involved with the ISS system operation.
   4. Provide project staff resumes and project specific ISS experience over the last 5 years. At a minimum, the project staff shall include a project manager, Site supervisor, quality control technicians, and other associated key staff. Project descriptions shall include Site description, size of the stabilization areas, type of grout and equipment used.
   5. Submit the qualifications of the Contractor's proposed laboratory for QC testing. The laboratory shall have previous experience with soil mixed materials, experienced laboratory technicians, and modern laboratory testing equipment.

1.05 SUBMITTALS

A. ISS Pilot-Scale Study Work Plan:
   1. Name and experience of the various persons, their role and primary responsibilities.
   2. Equipment set-up and Site use layout: including storage areas, grout mixing plant location, haul roads, and work platform.
   3. Soil mixing equipment specifications, including maximum depth capability of mixing machine, dimensions of the mixing bucket and capacity of grout mixing plant.
   4. Construction means and methods: Listing of equipment and capabilities, construction steps, handling of excess grout and swell, layout, overlap control, control of drainage, spills, wastes, etc.
   5. Description of how additives will be mixed with the soil and how the desired mix design will be achieved.
   6. Calculations of quantity of components needed for each batch, number of cells, mix ratio, and volume of soil to be mixed.
   7. Methods to protect existing Site features including, but not limited to, underground utilities and existing structures.
   8. Material Safety Data Sheets for mix materials.

B. ISS Work Plan:
   1. Name and experience of the various persons, their role and primary responsibilities.

2. Equipment set-up and Site use layout: including storage areas, grout mixing plant location, haul roads, and work platform.
3. Soil mixing equipment specifications, including maximum depth capability of SM machine, dimensions of the mixing bucket and capacity of grout mixing plant.
4. Construction means and methods: Listing of equipment and capabilities, construction steps, handling of excess grout and swell, layout, overlap control, control of drainage, spills, wastes, etc.
5. Description of how additives will be mixed with the soil and how the desired mix design will be achieved.
6. Calculations of quantity of components needed for each batch, number of cells, mix ratio, and volume of soil to be mixed per cell.
7. A layout drawing showing the geometry, overlaps, and dimensions of the cell overlapping pattern.
8. Schedule: A bar chart schedule showing all major activities and durations.
9. Methods to protect existing Site features including, but not limited to, underground utilities and existing structures.
10. Material Safety Data Sheets for mix materials.

C. Quality Control (QC) Plan: Prepare and submit a plan that describes the methods for ensuring the requirements established in the Specifications are achieved, including but not limited to:
   1. Method for collection of representative samples from a single mixed cell at discrete depths.
   2. Method(s) for controlling and measuring mix depth.
   3. Method(s) for controlling and monitoring overlap.
   4. Method(s) for controlling and monitoring reagent quality.
   5. Method(s) for controlling and monitoring addition rates.
   6. QC monitoring and testing requirements.
   7. Approach to re-work areas failing performance criteria.

D. ISS Daily Records: Provide (electronically, on a form acceptable to Design Engineer) a daily report summarizing the work activities including daily totals and running totals for volume of soil mixed and grout components used. Contractor shall attach daily grout mixing forms. ISS daily reports shall be submitted daily no later than 10:00 AM the following day to the Design Engineer and shall include at a minimum the following information:
   1. Description of the work completed with a sketch identifying which cells are completed.
   2. Cell Identification Number.
   3. Date and time of beginning and completion of each cell, including interruptions to the mixing process or material supply.
   4. Grout batch mix records.
   5. Daily totals and running totals for volume of soil mixed and grout components used.
   6. Issues identified and how they have been resolved.

E. Completion Report: Prepare and submit a report documenting the ISS implementation.

1. Grout Quantities: Quantities of grout constituents delivered to the Site and used during the project with backup in the form of weigh receipts, bills of lading, flow meter records, or equivalent.
2. Certificates of Analysis: Certificates of Analysis for each load of grout component imported to the Site. If the grout is delivered pre-blended, then a certificate of analysis shall be required for each component (e.g., Portland cement) of the grout blend. All testing conducted for the Certificates of Analysis shall be performed by a laboratory that has been accredited by the American Association of State Highway and Transportation Officials (AASHTO). Provide one (1) certificate of analysis for each type of material and one (1) for each and every source. This shall be required once during the project, prior to delivery of materials to the Site. The analysis shall ensure compliance with ASTM C150 for Portland Cement, ASTM C989 for Ground Granulated Blast Furnace Slag, and API 13A for bentonite.
3. Results of all quality control and quality assurance testing.
4. Project Modifications: Any modification to the project schedule and any modifications or deviations from the Contract Documents.
5. Spoil Disposal/Handling Methods: Description of spoil disposal and handling methods, as well as quantities managed.
6. Unforeseen Issues: Any unforeseen Site conditions or equipment problems that affected solidification efforts and how they were resolved.
7. Record Survey Drawings: Record survey drawings of the as-built lateral extent and top and bottom elevations of the ISS and QC sampling locations including any cells relocated during construction.

PART 2 PRODUCTS

2.01 GROUT

A. Grout shall consist of a stable colloidal suspension of cement, bentonite or other additives in water. The purpose of the grout is to assist in loosening the soils for mixing and to modify the soils for reduced contaminant generation, etc. The grout shall be pumpable and workable with the SM grout addition equipment.

2.02 BENTONITE

A. The purpose of the bentonite is to reduce the permeability and/or unconfined compressive strength (UCS) of the treated soil after remediation. Bentonite used in preparing the grout mixture shall meet API Specification 13A. The bentonite shall be adequately protected from moisture and contamination in storage at the jobsite. Reclaimed bentonite or bentonite containing deleterious matter shall not be used.

2.03 CEMENT

A. Cement used in preparing grout shall conform to ASTM C150 and/or C989. The cement shall be adequately protected from moisture and contamination in storage on the jobsite. Reclaimed cement or cement containing lumps or deleterious matter shall not be used.

2.04 WATER

A. Fresh potable water, free of excessive amounts of deleterious substances that adversely affect the properties of the grout shall be used to manufacturer grout. It is the responsibility of the Contractor that the grout resulting from the water shall always meet the standards of this specification.

2.05 ADDITIVES

A. Ad-mixtures may be used to enhance the workability or final properties of the treated soil. Additives may be added to the water or the grout. Propriety chemicals may be approved by the Design Engineer based on the results of the pilot-scale study.

PART 3 EXECUTION

3.01 PREPARATION

A. The ISS limits, as shown on the Drawings, shall be surveyed and staked out by a NY licensed surveyor prior to commencing ISS activities.

B. BMM cells shall be laid-out with 1-foot minimum overlap along the perimeter of adjacent completed cells unless otherwise shown on the Construction Drawings.

C. Sensitive structures shall be protected during remedial action construction using the special procedures for ISS near sensitive structures as shown on the Construction Drawings. Pre- and post- construction building inspections, vibration and settlement monitoring will be performed per Section 01 10 56.

D. Patchogue River bank slope protection measures shall be designed, installed, maintained, and removed in accordance with Section 31 40 00. These shall be implemented prior to performing ISS.

E. ISS near sensitive structures shall be performed before ISS is performed adjacent to these areas.

3.02 PERFORMANCE STANDARDS

A. Create a homogenous block of solidified soil extending from the top surface down to the target depth, as determined by the Design Engineer through visual observations during mixing and core sampling.

B. Provide a minimum addition rate of Portland cement of 5% and a maximum addition rate of 12.5% by weight of wet soil (as per results of treatability study), unless otherwise approved by the Design Engineer. The preliminary optimal additional rate is 8 to 10% by weight of wet soil.

C. Provide an addition rate of bentonite of up to 1.5% by weight of wet soil (as per the results of the treatability study), unless otherwise approved by the Design Engineer. The preliminary optimal addition rate is 1.5% by weight of wet soil.

D. Achieve target geometric mean hydraulic conductivity of all individual samples as well as the maximum hydraulic conductivity for the individual samples, as specified by the

Design Engineer following the completion of the pilot-scale study (see Part 3.03). The goals for the mean and maximum values are $1x10^{-6}$ cm/s or less and 1×10^{-5} cm/s, respectively, as feasible.

E. Achieve an unconfined compressive strength of the solidified/stabilized mass that conforms to the following requirements:
   1. 50 psi average (28-day UCS test), 30 psi minimum for individual samples; and
   2. 25 psi minimum UCS within areas designated as ISS near sensitive structures as shown on the Construction Drawings before proceeding with the installation of secondary or tertiary cells. The UCS for this requirement shall be measured in the field using a Pocket Penetrometer.
   3. If the measured UCS approaches 500 psi, adjust the grout mixture to reduce the UCS while continuing to meet the hydraulic conductivity requirement, as approved by the Design Engineer.
   4. The average for the UCS shall be calculated using the arithmetic mean.

F. The test result with the longest cure time for a given sample set (refer to Part 3.07 B. 2. of this Section) shall be used for the average calculations.

3.03 PILOT-SCALE STUDY

A. A pilot-scale study shall be performed as the first part of the ISS implementation at a location approved by the Design Engineer.

B. The pilot study shall use the same equipment proposed for the full-scale ISS implementation. The cell construction shall conform to the requirements of Part 3.4 of this Section.

C. A mix design is defined as variations of the cement addition, bentonite addition and/or water addition rates. For each proposed mix design to be used for the full-scale implementation:
   1. : A minimum of two (2) ISS cells totaling approximately 500 cubic yards (i.e., approximately 250 cubic yards per cell) shall be mixed.
   2. Mix the test cells at the locations designated by the Design Engineer.

D. Each cell and overlap shall be sampled as described in Part 3.07.

E. A minimum of 3 full depth mixing passes shall be performed for each cell. Additional mixing passes shall be performed if visual inspection of samples indicates incomplete or non-uniform mixing of the grout and soil.

F. Full-scale implementation shall not begin until the results from the pilot study demonstrate that one or more of the proposed mix designs meets the project requirements in this specification as approved by the Design Engineer.

3.04 FULL-SCALE IMPLEMENTATION

A. Top of the ISS interval shall be the surface soil immediately below the existing surface cover materials (e.g., grass, asphalt or concrete).

B. Bottom of the ISS interval shall be to the depths indicated on the Design Drawings.

C. ISS near sensitive structures: ISS near sensitive structures shall be conducted according to the methods, and in the areas, shown on the Construction Drawings. The ISS cells shall be constructed in the alternating pattern shown on the Construction Drawings. The initially installed ISS cells (primary cells) shall be allowed to set up to the strength specified in Part 3.02 before the secondary cells are installed. Similarly, the secondary cells shall be allowed to set up before the tertiary cells are installed. Soil mixing near the existing structures shall only be performed after installations away from the structures have demonstrated consistent achievement of the project UCS and permeability requirements in Part 3.02. Refer to Part 3.01 above regarding protection of property and excavation support.

D. Each soil cell shall be advanced while simultaneously adding grout and then mixed by repeated passes of the mixing bucket. A minimum of 3 full depth passes (up and down) shall be performed unless the results of the pilot test indicate that a greater minimum number of passes is necessary. Additional mixing or passes may be required to evenly distribute the grout throughout the cell based on the inspection of samples taken from the cell.

E. The grout addition rate shall be monitored and recorded for each cell and adjusted as necessary for minimum drilling/digging resistance and to accommodate the design mix. The minimum addition rate shall be calculated based on the volume of unmixed soil in the cell, the density of the soil, and the volume of grout required to achieve the design mix proportions.

F. The outer portions of the ISS area shall be completed last in the event that the outer cells need to surround interior areas that do not comply with the performance standards. This sequencing will allow for the outermost cells to be completed with the benefit of potential refinements to the mix design and implementation process that are made as a result of completing the interior cells first. Sequencing the installation in this manner would be expected to reduce the potential for one of the outermost cells to be out of compliance with the established performance standards.

G. After completion of ISS or performed in sequence with the ISS implementation, the ISS area shall be excavated to the depth of 4 feet bgs specified in Section 31 23 16, to allow for the installation of the backfill and Site Cover, as specified in Section 31 23 23 and 31 50 00.

H. Contractor shall retain a NY licensed surveyor to survey the final ISS limits.

I. Backfilling and restoration may not proceed until written authorization is provided by the Design Engineer to the Contractor authorizing a backfilling of the ISS area.

J. Contractor shall protect the ISS area until backfilling and restoration is completed.

3.05 OBSTRUCTIONS

A. If obstructions including former MGP structure, debris, boulders, bedrock or other potentially damaging materials are encountered the operator shall stop mixing until the nature of the obstruction is known.

B. Over-sized material (i.e., greater than 1 foot in maximum dimension) will be removed in its entirety.
   1. Concrete, brick, and boulders shall be reduced in size to less than 1 feet in maximum dimension and placed into the ISS mix.
   2. Wood, metal, piping, or other debris will be removed and recycled or disposed of off-Site as appropriate and in accordance with Section 31 70 00.

C. Obstructions which cannot be removed and reduce the advancement rate to less than one foot of penetration per minute for at least five minutes may be accepted as refusal upon approval of the Design Engineer.

3.06 PROTECTION

A. Protect ISS areas until backfilling and restoration is completed.

B. Prevent displacement or loose soil from falling into ISS areas; maintain excavation stability.

C. Protect structures, utilities, the Patchogue River bank and other facilities from damage caused by settlement, lateral movement, undermining, washout, vibration and other hazards created by earth operations per Sections 01 10 56 and 31 40 00, and as shown on the Drawings.

3.07 TOLERANCES

A. The following tolerances shall apply to the ISS dimensions and construction:
   1. The depth of the cell shall be measured or surveyed to within six inches of the desired elevation. The depth shall be measured from the surface to the bottom of the mixing bucket.
   2. The pattern of overlaps shall be surveyed and staked to ensure that the overlap or overlap ratio is constructed as designed.
   3. Construction will not be permitted when the air temperature is below 20 deg. F or when severe weather conditions may compromise the quality of the work.
   4. The addition ratio shall be calculated and checked for each cell. The addition ratio may be corrected for previous overlaps in the same cell. In all cases, the minimum addition ratio shall be observed.

3.08 PERFORMANCE MONITORING

A. Conduct performance monitoring to document that the ISS implementation achieves the established performance criteria specified in this Section.

B. ISS Mix Samples: ISS Mix Samples shall be collected from the ISS mass at depths determined by the Design Engineer immediately after the mixing of reagents into the subsurface and before the ISS cell sets. Sampling frequency shall consist of the following:
   1. Visual Inspection Samples: Samples for visual inspection shall be collected from each day's ISS cells at a rate of one (1) location per 100 cubic yards of mixed soil, to be selected by the Design Engineer. At each location, two (2) depths selected by the

Design Engineer shall be sampled. Additional samples may be required based on observations of the cell construction and the visual inspection samples.

2. UCS and Hydraulic Conductivity Samples: Sets of samples shall be collected for UCS and hydraulic conductivity testing, as follows:
   a. A set of samples shall consist of two (2) samples obtained from different locations of the day's cells, one primary sample and one secondary sample (to be saved for additional testing, if necessary). From each sample in the set, six (6) cylinders shall be formed and cured according to ASTM D1632 and D1633, Method B. No cylinders shall be formed from the visual inspection samples unless the Contractor is directed to do so by the Design Engineer.
   b. A set of samples shall be collected from the cells at the following rate:
      1) One (1) set per day (first 500 cubic yards).
      2) Additional sets during each week, as needed, to provide one (1) set per 500 cubic yards on a weekly average.
      3) Additional sets if significant changes to the solidified/stabilized material are observed.
   c. Samples shall be taken at the locations and depths selected by the Design Engineer.
   d. After curing for 14 days, the primary sample will be submitted to the laboratory by the Contractor, where they will be tested for hydraulic conductivity (ASTM D5084) and UCS (ASTM D1633).
   e. If results of the hydraulic conductivity and UCS tests do not comply with the performance standards, the Contractor shall take corrective actions, as directed by the Design Engineer (refer to Part 3.08 of this Section).

C. Core Samples: Core samples shall be collected from the ISS mass for quality control purposes, in accordance with the NYSDEC Guidance for Quality Control Coring on In-Situ Solidification Projects:
   1. Cores shall be completed using direct push sampling methods, HQ wireline coring methods or an equivalent method approved by the Design Engineer. Rotosonic or compressed air-drilling methods will not be allowed.
   2. One core borehole shall be completed for every 5,000 square feet of ISS area, but not less than two (2) bore holes per ISS area.
   3. Cores runs must be no longer than five (5) feet.
   4. If less than 60% of the core material is recovered from any of the cores, one (1) new core hole must be drilled adjacent to the previous location. If the recovery from the adjacent core hole continues to be less than 60%, the Contractor shall await further direction from the Design Engineer in consultation with the NYSDEC.
   5. The first coring location shall be completed when each ISS area is no more than 5% complete.
   6. As applicable, core borehole locations shall be biased towards areas with the greatest soil contamination, areas where contamination is in direct contact with the bedrock surface, and/or locations where difficulties in the ISS process were encountered (e.g., difficult soil conditions, excessive grout loss). Core boreholes shall be placed in locations where individual cells overlap, to the extent possible. The core locations shall be proposed by the Contractor and approved by the Design Engineer prior to conducting corning.
   7. The Contractor shall survey the location of each core.

8. Cores shall be archived following coring activities and staged at a location approved by the National Grid and Design Engineer.
9. Core samples and related equipment used during sampling activities will be visually inspected by the Design Engineer for the following criteria, and results recorded:
    a. Visible NAPL
    b. Non-mechanical induced cracking within the core
    c. Percent of core sample recovered
    d. NAPL coating on drilling tools
    e. NAPL in drill wash tub
10. If one or more of the above conditions is noted:
    a. The Design Engineer will notify the National Grid and NYSDEC.
    b. The Contractor shall implement corrective actions (refer to Part 3.09 of this Section) if deemed necessary by the Design Engineer, in consultation with the NYSDEC.
11. When a core has been drilled from the top to the bottom elevation of the ISS area depth, and samples collected, it will be considered complete. When the ISS area depth extends to bedrock, the core should be advanced at least three (3) feet into bedrock.
12. Following completion of each coring location, the borings will be filled with grout.

3.09 CORRECTIVE ACTION

A. If performance monitoring indicates that the performance standards are not met for an area, the Contractor shall implement corrective actions at their own expense. Corrective actions may include:
    1. For ISS Mix Samples:
        a. Reanalyzing another cylinder from the same sample after further of curing.
        b. Analyzing the secondary sample from the sample set to determine if the failing sample is considered anomalous and isolated.
    2. For Core Samples:
        a. Complete additional cores borings around the area of concern to determine if the identified NAPL within the ISS mass is encapsulated.
    3. If subsequent sampling and testing indicate performance standards are still not met for an area, the Contractor shall implement one or more of the following, as approved by the Design Engineer:
        a. Modification to the mix design.
        b. Re-work (e.g., re-mix) the cell(s) represented by the failing sample. Collect additional samples and cores for performance monitoring.
        c. Install new cells to surround the cell(s) represented by the failing sample. Collect additional samples and cores for performance monitoring.
        d. Repair the cell(s) represented by the failing sample using alternative methods approved by the Design Engineer. Collect additional samples and cores for performance monitoring.
        e. Excavate and dispose of the cell(s) represented by the failing sample in accordance with Section 31 23 16, Section 31 70 00, and other applicable sections.

3.10 SPOILS MANAGEMENT

A. ISS swell material shall be managed at the surface and a perimeter berm shall be constructed to control potential waste migration from the ISS area.

B. Excess swell material plus an additional four feet of material below existing grade shall be removed from the ISS area and staged in the waste staging pad for management in accordance with Section 31 70 00. The spoils shall be staged in blocks or piles of manageable size so that cutting or hammering is not necessary to reduce their size for transportation to the disposal facility.

C. Supplemental ex-situ mixing may be conducted at the waste staging pad or within the footprint of the ISS area, as directed by the Design Engineer, and then followed by additional waste characterization sampling.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Subbase Course.
   2. Asphalt Pavement Courses.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General and Supplementary Conditions, apply to this Section.
   2. Section 01 30 00 – Administrative Requirements.
   3. Section 01 70 00 – Construction Closeout.
   4. Section 31 50 00 – Site Cover and Restoration.

1.02 REFERENCES

A. ASTM International:
   1. ASTM D2950 - Density of Bituminous Concrete by Nuclear Method.

B. New York State Department of Transportation (NYSDOT).
   1. 2008 Standard Specifications.
   2. Materials Method 5.16 Superpave Hot Mix Asphalt Mixture Design and Mixture Verification Procedures.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Requirements: Requirements for submittals.

B. Product Data: Submit product information and asphalt mix designs a minimum of 5 working days before use of the material, to Design Engineer for approval.

C. Test results of asphalt thickness and density testing, performed in accordance with Section 3.6.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with NYSDOT Standard Specifications.

B. Mixing Plant: Conform to NYSDOT Standard Specifications.

C. Obtain materials from same source throughout.

1.05 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 10 years experience.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS

A. Subbase course shall conform to Section 304 of NYSDOT, Type 2 Subbase Course.

B. Base course shall be plant mix bituminous concrete conforming to Section 400 of the NYSDOT specification and as follows:
   1. Thickness: 4 inches
   2. Item: 25 F9 Base Course HMA, 70 Series Compaction
   3. PG Binder Type: PG 64-22

C. Surface course shall be plant mix bituminous concrete conforming to Section 400 NYSDOT specifications and as follows:
   1. Thickness: 2 inches
   2. Item: 12.5 F3 Top Course HMA, 70 Series Compaction
   3. PG Binder Type: PG 64-22

D. All materials shall be as specified in NYSDOT § 402-2 and Materials Method 5.16. Aggregate shall conform to Subsection 401-2.02. Mixture shall conform to Section 402.

E. Tack Coat: Material and application shall conform to the requirements set forth in NYSDOT Sections 407 and 702-6.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade is dry and inspected by Design Engineer.

3.02 SUBBASE COURSE

A. Install 4 inches of compacted subbase course.

B. After subbase placement, the subbase surface shall be inspected and approved by the Design Engineer prior to continuation of work activities.

3.03 PREPARATION - TACK COAT

A. Apply tack coat in accordance with NYSDOT Standard Specifications.

B. Apply tack coat to contact surfaces of curbs and vertical surfaces.

3.04 ASPHALT PAVEMENT (BASE AND SURFACE COURSE)

A. Placement, finishing, compaction and construction of the asphalt pavement shall be performed in accordance with NYSDOT Standard Specifications.

B. Place asphalt base course within 12 hours of applying prime coat.

C. Place asphalt base course to 4 inches compacted thickness. The bituminous base course must be applied and compacted within the temperature range of 250-325ºF.

D. Place asphalt surface course within 24 hours of placing and compacting binder course. When surface course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

E. Place surface course to 2 inches compacted thickness. The bituminous surface course must be applied and compacted within the temperature range of 250-325ºF.

F. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

G. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

H. Place asphalt finished surface flush with existing manholes, catch basins and any other existing subgrade feature and finished asphalt surface shall be flush when adjoining existing asphalt.

3.05 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

3.06 FIELD QUALITY CONTROL

A. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D2922
   2. NYSDOT Standard Specifications §402-C
   3. Frequency of Tests: Every 2,500 square feet, unless more frequent testing is requested by the Design Engineer.

B. The subbase course and asphalt base and surface courses shall be compacted to 95% of the maximum density. If the test results indicate compaction to less than 95% of the maximum density, the Contractor shall recompact the area and area shall be retested.

C. Thickness - Thickness measurements shall be conducted at a minimum frequency of one location per 2,500 square feet, unless more frequent testing is requested by the Design Engineer.

D. Where cold joints are necessary, cut back the placed and compacted asphalt a minimum of 3 inches with a concrete power saw, so that the vertical face of compacted full thickness material is exposed. Treat this surface with tack coat before proceeding with placement of new asphalt course.

E. Smoothness (Surface Course Only) - The final surface shall be a smooth, level surface suitable for truck traffic and parking. The surface must also provide positive drainage off-Site and a smooth transition to the surrounding areas.

F. As directed by the Construction Manager, remove and replace all defective areas. Cut-out such areas and fill with fresh bituminous asphalt. Compact to the required density.

3.07 PROTECTION OF FINISHED WORK

A. Section 01 70 00 – Construction Closeout: Protecting finished work.

B. Immediately after placement, protect pavement for 24 hours (minimum) or until it has become properly hardened.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fence material and products for replacement of chain-link fence and gates.

B. Related Sections and Documents:
   1. Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions apply to this Section.
   2. Section 01 10 00 – Summary of Work.

1.02 REFERENCES

A. ASTM International:
   1. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   2. ASTM A817 - Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
   3. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   4. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
   5. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
   6. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
   7. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
   8. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Chain Link Fence Manufacturers Institute (CLFMI):
   1. CLFMI - Product Manual.

1.03 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing fencing products specified in this section with a minimum of five (5) years documented experience.

1.04 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

C. Perform Work in accordance with Village of Patchogue and/or Town of Brookhaven codes and regulations.

1.05 SUBMITTALS

A. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

B. Submit schedule of values for quantities of materials.

C. Submit Manufacturer company information and Statement of Qualifications.

1.06 PERFORMANCE CRITERIA

A. Structural Performance: Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Minimum Post Size and Maximum Spacing for Wind Velocity Pressure: Determine based on mesh size and pattern specified, and on the following minimum design wind pressures and according to CLFMI WLG 2445:
      a. Wind Speed: 80 mph.
      b. Fence Height: 6 feet.
      c. Line Post Group: IA, ASTM F 1043, Schedule 40 steel pipe.
   2. Determine minimum post size, group, and section according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet.

B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

B. Identify each package with manufacturer's name.

C. Store fence fabric and accessories in secure and dry place.

PART 2 PRODUCTS

2.01 MATERIALS

A. Framing (Steel): ASTM F1083 Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 25ksi; coating conforming to ASTM F1043 Type A on pipe exterior and interior.

B. Fabric Wire (Steel): ASTM A392 Class 1 zinc coated steel wire.

C. Concrete: ASTM C94/C94M, Option A; Normal Portland Cement, 2,500 psi strength at 28 days.

2.02 COMPONENTS

A. Line Posts: 1.9-inch diameter.

B. Corner and Terminal Posts: 2.38-inch diameter.

C. Gate Posts: 3.5-inch diameter.

D. Top and Brace Rail: 1.66-inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66-inch diameter for welded fabrication.

F. Fabric: 2.0-inch diamond mesh interwoven wire, nine (9) gage thick, top salvage knuckle end closed, bottom selvage twisted tight.

G. Tension Wire: six (6) gage thick steel, single strand, marcelled, spiraled or crimped, aluminum-coated tension wire conforming to ASTM A817.

H. Tension Band: six (6) gage thick steel.

I. Tension Strap: six (6) gage thick steel.

J. Tie Wire: Aluminum alloy steel wire.

2.03 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Gate Hardware:
   1. Fork latch with gravity drop; two 180- degree, non-lift off, gate hinges for each leaf and hardware for padlock.
   2. Provide weather-proof, keyed alike padlocks, with two keys per lock.

2.04 GATES

A. General:
   1. Factory assembled gates.
   2. Gates should be designed for operation by one person.

B. Swing Gates:
   1. Fabricate gates to permit 180-degree swing.
   2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

C. Sliding Gates:
   1. Framing and Posts: ASTM F1184, Class 2 for internal rollers.

2. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.
3. Secure rollers to post or frame without welding.

2.05 FINISHES

A. Components and Fabric: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 1.8 oz./sq. ft coating.

PART 3 EXECUTION

3.01 FENCE DEMOLITION AND REMOVAL

A. Remove fence where indicated on the Drawings. Fence removal shall include fabric, posts, and accessories.

B. Dispose of removed fence and debris off-Site at a licensed disposal or recycling facility.

3.02 INSTALLATION OF NEW FENCE

A. Install new fence where indicated on the Drawings.

B. Excavate holes for posts to diameter and spacing in accordance with manufacturer's instructions. The excavated soils shall be managed in accordance with Section 31 70 00. will be sampled and managed by National Grid.

C. Install posts with six (6) inches maximum clear opening from end posts to buildings, fences and other structures.

D. Install framework, fabric, accessories and gates in accordance with this Section.

E. Set intermediate, terminal, corner and gate posts plumb, in concrete footings with top of footing two (2) inches above finish grade. Trowel top of concrete forming crown to shed water.

F. Line Post Footing Depth Below Finish Grade: ASTM F567.

G. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

H. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

I. Install top rail through line post tops and splice with six (6) inch long rail sleeves.

J. Install center and bottom brace rail on corner gate leaves.

K. Refer to Paragraph 3.3 for installation of fence fabric.

3.03 INSTALLATION OF FENCE FABRIC

A. Install fence fabric in accordance with ASTM F567. Place fabric on inside of post and rails.

B. Do not stretch fabric until concrete foundation has cured for 7 days.

C. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

D. Position bottom of fabric 2 inches above finished grade.

E. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

F. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

G. Install bottom tension wire stretched taut between terminal posts.

3.04 INSTALLATION OF FENCE GATES

A. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

B. Support gates from gate posts. Do not attach hinged side of gate from building wall.

C. Install gate with fabric to match fence. Install three hinges on each gate leaf, latch, catches, and drop bolt.

D. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

3.05 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch.

B. Maximum Offset from Indicated Position: one (1) inch.

C. Minimum distance from property line: As specified by town codes and regulations.

END OF SECTION

SECTION 33 05 17

PERIMETER UTILITY CUT AND CAP

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Qualifications.
   3. Quality Assurance.
   4. References.
   5. Preparation.
   6. Trenching.
   7. Utility cutting and capping.
   8. Soil and waste management.
   9. Backfilling.
   10. Field Quality Control.
   11. Protection.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 30 65 – Health and Safety Requirements.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 50 00 – Temporary Facilities and Controls.
   6. Section 31 23 23 – Backfill.
   7. Section 33 05 18 – Utility Support and Protection.

1.02 SUBMITTALS

A. Submit information and statement of qualifications of proposed asbestos Contractor.

1.03 QUALIFICATIONS

A. Asbestos Contractor: Company specializing in performing work of this Section with a minimum experience of five years.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with the approved Construction Quality Control Project Plan (CQCPP) as specified in Section 01 40 00.

B. Perform Work in accordance with the Village of Patchogue and/or Town of Brookhaven codes and regulations and local utilities' codes and requirements.

1.05 REFERENCES

A. All applicable federal, state and local regulations.

B. Occupational Safety and Health Administration (OSHA) Regulations.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Locations of existing Site conditions indicated on the Design Drawings are approximate. The Contractor shall examine and confirm existing Site conditions prior to the start of Work.

B. Call Local Utility Line Information service, Village of Patchogue, and Suffolk County not less than three (3) working days before performing Work.
   1. Request underground utilities to be located and marked within the Site and adjacent properties.
   2. Do not proceed with intrusive activities until the mark out is complete and confirmed.

C. Coordinate with the utility companies during the work to determine which utilities, presented on the Design Drawings, reference drawings, and utility mark-ups and encountered in the field, are active or inactive and which may be abandoned.

D. Protect Site structures and features indicated to remain.

E. Protect bench marks, survey control points, existing structures, fences. Benchmarks and survey marks that are missing or damaged shall be replaced by the Contractor's Surveyor.

F. Furnish and install temporary construction fencing surrounding the trenching and work areas in accordance with Section 01 50 00, as needed for worker safety.

3.02 TRENCHING

A. All excavation work shall be performed in compliance with all appropriate Federal, State, and OSHA regulations.

B. Excavate a two to three-foot-wide and a two-foot-deep bgs trench, in accordance with Section 01 10 00, along the perimeter of the remedial areas. Excavation of overburden material from the trench will involve hand digging and heavy equipment, as necessary.

C. Hand excavate and probe the surface of the excavation prior to soils being removed with equipment. The depth of the manual probe shall be a minimum of 10 inches.

D. In order to minimize the risk to potential buried piping/lines, the amount of soil excavated from the trench with the construction equipment shall not exceed the depth of the previous manual probe. After completion of the next probe, the soils may be excavated with construction equipment.

E. Soft dig techniques (i.e., soil vacuum equipment) may be used to excavate the trench and expose subsurface utilities. Upon discovery of subsurface features, hand excavation methods or soft dig techniques will be employed to identify the feature.

F. The final depth of the trench will be limited to the deepest utility/piping or as directed by the Construction Manager.

G. Excavation shall be benched and/or sloped as required per OSHA regulations. Excavation stability and actual sloping and benching shall be determined by a Competent Person as defined in OSHA 1926.650(b) and in accordance with 1926 Subpart P (Excavations).

3.03 UTILITY CUTTING AND CAPPING

A. When a utility line or piping is located, the Contractor (in consultation with National Grid), shall identify the utility/line. If the utility/line appears to be active, a representative from the pertinent utility company will be contacted to evaluate the line and terminate the service, if required.

   1. If the utility line or piping is not owned by the pertinent utility companies, the utility line or piping shall be considered part of the former MGP. The extents of the former MGP utility line or piping shall be exposed in-place to locate both ends (i.e., the line or piping shall remain intact until determined to be inactive). If the utility line or piping is observed to be connected to utilities beyond the Site limits, the Contractor shall coordinate with the pertinent utility company to evaluate and disconnect the former MGP utility. The former MGP utility line or piping within the Site limits shall be removed in accordance with these Specifications.

B. For utilities/lines that are determined to be inactive, initial penetration of the utility/pipe will involve use of spark-proof drilling tools to create a small hole in the utility/pipe. Access to the interior of the line will allow initial screening of the internal atmosphere with field screening instruments to determine the potential for explosion. Once screening has identified acceptable conditions within the line, a non-sparking saw, such as a "Nibbler", or similar, shall be utilized to cut and remove a section of pipe to the existing property line, or as close as is practical.

C. Utility/piping sections that will be cut and removed for purposes of line breaking and capping shall be visually examined for presence of asbestos or asbestos containing material. If asbestos is encountered, the Contractor will subcontract an asbestos Subcontractor meeting Federal and New York State asbestos licensing and permitting requirements to address the utility/pipe. The asbestos abatement shall be performed in accordance with local, state, and federal regulations.

D. Any residual material which drains from the line shall be collected and segregated for characterization and off-Site transportation and disposal in accordance with Section 31 70 00.

E. Plugging of the line will require the mixing and placing of grout (hydraulic cement) into the open end of the cut line. Bentonite will be mixed with the soils being placed as backfill adjacent to the plugged lines.

3.04 SOIL AND WASTE MANAGEMENT

A. Excavated soil shall be stockpiled adjacent to the trench on top of plastic sheeting, tarps, or other similar barrier. The barrier will be laid over the existing grade for temporary placement of excavated soil.

B. Stockpiled soils shall conform to OSHA set-back requirements for trenches/excavations.

C. Stockpiled soils and debris will be visually inspected for the presence of NAPL and/or NAPL indicators by the Design Engineer and/or the Construction Manager.

D. Within the targeted excavation areas only, soil and debris observed to contain NAPL or NAPL indicators (based on visual observation and field screening techniques) shall be reused to backfill to the trench. The location of such soils will be documented for subsequent excavation and off-Site disposal.

E. Outside the targeted excavation areas, the excavated soils containing NAPL and/or NAPL indicators shall be staged separately and covered for off-Site disposal.

F. Excavated soils and generated waste shall be managed, transported and disposed of in accordance with Section 31 70 00.

3.05 BACKFILLING

A. Sequence trenching and backfilling so that trench is backfilled at end of working day.

B. Backfill trenches to pre-existing grade with unfrozen fill materials.

C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Additional soils required to backfill the trench outside of the targeted excavation areas will consist of certified clean imported fill, in accordance with Section 31 23 23.

E. Place fill material in continuous layers of 8 inches and compact.

3.06 FIELD QUALITY CONTROL

A. Request visual inspection of excavated soils prior to staging on-Site or loading for off-Site disposal.

3.07 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain excavation stability.

B. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 33 05 18

UTILITY SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittals.
   2. Project Conditions and Coordination.
   3. Materials.
   4. Preparation.
   5. Utility Support and Protection.

B. Related Sections and Documents:
   1. Design Drawings and general provisions of the Contract Documents, including Technical Specification Sections and National Grid's General Conditions, apply to this Section.
   2. Section 01 10 00 – Summary of Work.
   3. Section 01 30 65 – Health and Safety Requirements.
   4. Section 01 33 00 – Submittal Requirements.
   5. Section 01 50 00 – Temporary Facilities and Controls.
   6. Section 02 41 19 – Selective Demolition.
   7. Section 31 23 16 – Excavation.
   8. Section 31 23 23 – Backfill.
   9. Section 31 70 00 – Waste Management, Transportation, and Disposal.

1.02 SUBMITTALS

A. Submit a Utility Protection and Rerouting Plan to National Grid and/or the Design Engineer, for incorporation into the design and subsequent design submittals to the NYSDEC (i.e., 100% RDR). The Plan shall detail the proposed methods for protecting and supporting the existing utilities during excavation, ISS, and backfilling, sequencing for the proposed rerouting, temporary by-passes, and/or reconnecting of active utilities, and proposed methods and materials for reconnections and rerouting.

B. Provide copies of permits/approvals obtained from local authorities for working on utilities and within utility easements.

C. As-built drawings showing final configuration of all functional utilities requiring reconnection.

1.03 PROJECT CONDITIONS AND COORDINATION

A. Perform Work in accordance with the Village of Patchogue and/or Town of Brookhaven Codes.

B. Underground utilities are defined to be, but are not limited to: sanitary sewer, water, storm water, gas, telecommunication, cable, other piping, electrical conduits, etc. Underground structures known to National Grid and the Design Engineer are shown on the Design Drawings. This information is shown to assist the Contractor in accordance with the best information available, but is not guaranteed to be correct or complete. The Contractor shall field verify all underground utilities and structures indicated on Design Drawings. The Contractor shall verify the location of underground utilities with the appropriate agencies.

C. At-grade (i.e., surface) structures are defined as all existing structures and other facilities at or above the ground surface. Surface structures include, but are not limited to, monitoring wells, piezometers, utility poles (including anchors and support cables), fire hydrants, electrical panels, curbs, piles, fencing, foundations, former MGP-related structures, and all other facilities that are visible above the ground surface.

D. Necessary changes in the location of the proposed remedial activities may be made by National Grid, the Construction Manager and/or the Design Engineer to avoid unanticipated underground structures. If permanent relocation of an underground structure or other subsurface facility is required and is not otherwise provided for in the Contract Documents, National Grid or the Construction Manager will direct the Contractor in writing to perform the necessary work.

E. The Contractor shall not interrupt utilities unless permitted in writing by National Grid and/or the Construction Manager and utility owner, and then only after arranging for temporary utility services, if required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials and construction methods used for the capping and re-routing or reconnecting of the utilities shall comply with the respective utility company's requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. The Contractor shall coordinate with the utility company who owns the utility during the performance of the work to determine which utilities, presented on the Design Drawings, reference drawings, and utility mark-ups and encountered in the field, are active and which may be abandoned.

B. Contractor shall coordinate work and schedules with utility owners and shall provide the utility owners, National Grid and/or the Construction Manager written notice at least 48 hours before utility shutdowns.

C. Before proceeding with the work, the Contractor shall provide written permit/approval from the utility owner to National Grid, the Construction Manager and the Design Engineer indicating that the methods and procedures to be used have been reviewed and approved by the utility owner. Contractor shall be responsible for all damage and expense for direct or indirect damage caused during the remedial construction activities. The Contractor shall immediately repair all damage caused by their work to the satisfaction of National Grid, the Construction Manager and/or the Design Engineer.

3.02 UTILITY PROTECTION AND REROUTING

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop as a result of the Work including excavation, ISS, containment/slope protection measure installation/removal, backfilling, or restoration.
   1. Shore, support, and protect active utilities encountered.
   2. Support and protect all structures to remain.

B. Underground utilities (active or inactive) within or adjacent to the areas where remedial activities will be performed shall be sustained in place and protected from direct or indirect damage. Such sustaining and supporting shall be done carefully and as directed by the party owning the structure or utility.

C. The Contractor shall perform hand excavation to expose all utilities. If it is an active utility, the Contractor shall support and protect the utility to prevent damage and to prevent interruption to the services that the utility provides. The Contractor shall be liable for damages to an active utility and is responsible to have it repaired promptly.

D. Perform construction necessary to complete rerouting connections or reconnections to existing utilities, including test pits to locate existing utilities and structures that may be encountered.
   1. Contractor shall place demarcation flags on all on-Site and off-Site telecommunication lines and place signs on all utility poles stating “OH LINES ABOVE.

E. Keep existing active utilities in operation, unless otherwise specifically permitted, in writing, by National Grid and/or the Construction Manager and utility company, if applicable.

F. Contractor shall perform all rerouting and capping activities so as to avoid interference with other construction activities.

G. Contractor shall complete all necessary preparatory work and shall keep shutdown periods to a minimum. Contractor shall obtain approval of shutdown periods, in writing, prior to starting work.

H. Contractor is responsible for the design of the rerouted active utilities, if proposed. Any damage resulting from the failure of the rerouted utilities shall be repaired or replaced, to the satisfaction of the National Grid and the utility company.

I. The Contractor will protect and support existing utilities and on-Site utility poles that are to remain in place during the performance of the work in accordance with the requirements of the utility company.

J. Any residual material which drains from utility lines/pipes removed as part of the Work shall be collected and segregated for characterization and off-Site transportation and disposal in accordance with Section 31 70 00.

END OF SECTION

Appendix L: Maintenance and Protection of Traffic Plan (MPTP)

Maintenance and Protection of Traffic Plan
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 153021

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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Section 1

Introduction

This Maintenance and Protection of Traffic Plan (MPTP) has been prepared by Brown and Caldwell Associates on behalf of National Grid to support the proposed remedial design and implementation of the remedy at the Patchogue Former Manufactured Gas Plant (MGP) Site located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (the Site) and the Off-Site property, owned by Above all Storefronts, located immediately adjacent to (east of) the Site located at 212 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (Off-Site Property). This MPTP describes the Site and Off-Site Property location and surroundings, the need for traffic control during the implementation of the proposed remedial work and the procedures that will be used to maintain vehicular and pedestrian traffic. The safety of motorists, road workers and pedestrians was among the chief concerns when preparing this MPTP. This plan has been prepared in conformance with the "Federal Highway Administration Manual on Uniform Traffic Control Devices" (MUTCD); United States Department of Transportation (USDOT) [USDOT, 2009].

1.1 Site Description

The remedy will be implemented within the property owned by National Grid, herein referred to as the Site and at the adjacent property, hereafter referred to as the Off-Site Property. The Off-Site Property is currently leased to National Grid during implementation of the remedial activities. 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 location and Site Plan are shown on Figures 1-1 and 1-2, respectively.

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.

1.2 Overview of Proposed Remedial Action

The proposed remedial action will be performed on the Site and the Off-Site property. The remedial action is anticipated to include:

1. Mobilization/Site Preparation Activities
    - Construction of staging area
    - Installation of soil erosion and sediment control measures
    - Construction of decontamination pad

2. Pre-remedial activities
   - Protection/abandonment of existing monitoring wells and piezometers
   - Establish air monitoring program and collect baseline data
3. Remedial Activities
   - ISS of designated soils

     Excavation of designated soils
   - Backfilling above the solidified mass
   - Waste handling/characterization/treatment/disposal
   - Construction of site cover
   - Removal of MGP related structures (i.e. former tanks, foundations, or piping) encountered during excavation activities
4. Demobilization
   - Complete punch list items
   - Site restoration/demobilization
5. Ongoing Activities
   - Groundwater monitoring
   - Implementation of Site Management Plan

1.3 Potential Impacts to Pedestrian and Vehicular Traffic

Some of the remedial activities to be implemented at the Patchogue Former MGP have the potential to impact vehicular and/or pedestrian traffic along West Main Street. Temporary traffic control measures will be required at certain times during the implementation of the remedial action to facilitate the delivery and pickup of construction materials and equipment, the management and transportation of remediation-derived wastes to be subject to off-Site disposal and for the delivery of clean fill materials to the Site during backfill and restoration activities. These activities will result in additional, temporary traffic associated with the remedy implementation activities that will generally occur within daylight hours. Traffic along West Main Street and the Site entrance will be regulated to ensure the safety of all involved vehicular and pedestrian traffic throughout the duration of the implementation of the remedial action.

Section 2

Traffic Control

This MPTP establishes the minimum requirements for the maintenance and protection of vehicular and pedestrian traffic during the implementation of the proposed remedial action including traffic and pedestrian control measures.

2.1 General

All temporary traffic control measures, lane/sidewalk closures, flaggers, and necessary permits and approvals will be obtained by the Remedial Contractor selected to implement the work prior to the start of the construction activities. Each of these measures shall be performed in accordance with:

- The Manual on Uniform Traffic Control Devices (MUTCD);
- A Vehicular and Pedestrian Traffic Control Plan to be prepared by the Remedial Contractor and submitted and reviewed by National Grid, Brown and Caldwell (National Grid's Design Engineer) and/or other National Grid designees (i.e., Construction Manager, etc.) prior to mobilization; and
- Any applicable Town of Brookhaven or Village of Patchogue code(s).

The Remedial Contractor will notify the City Engineer or a designated representative and obtain the proper permits prior to any scheduled temporary lane or sidewalk closures.

2.2 Parking

As a safety measure, mandatory back-in parking rule will be in effect within the entire work area. Appropriate signage will be posted to inform all Site personnel and visitors about this requirement.

2.3 Truck Traffic

There is one mandatory access/egress route that truck-related construction vehicles will have to take while remedial work is being performed. This route will provide access/egress to both the Site and the adjacent Off-Site Property where the remedial activities will be performed. The mandatory traffic routes for all construction related vehicles accessing and regressing from these two areas is depicted on Figure 2-1. The mandatory designated routes to and from the Site for truck-related traffic are as follows:

To the Patchogue Former MGP Site:

From the Long Island Expressway

- Take Exit 62 towards Nicolls Road/ Blue Point/ Stony Brook (0.2 miles);
- Merge onto Expressway Drive South (0.1 miles);
- Take County Road 97/ Nicolls Road South Ramp to Blue Point (0.2 miles);
- Merge onto County Road 97/ Nicolls Road South (4.7 miles);
- Turn left onto County Road 85 (1.5 miles);
- After 1.5 miles on County Road 85/ West Main Street, the Site will be on the right (234 West Main Street).

Leaving the Patchogue Former MGP Site:

For truck-related traffic leaving the Site, the directions from the Site to the nearest highway (Long Island Expressway) are as follows:

- From the Site exit/entrance, turn right onto County Road 85/ West Main Street (0.2 miles);
- Turn left onto County Road 19/ Holbrook Road (0.4 miles);
- At the traffic circle, continue straight onto County Road 19/ Waverly Avenue (0.8 miles);
- Turn left onto Sunrise Highway North Service Road (0.3 miles);
- Continue onto NY454 West (0.4 miles);
- Take ramp onto County Road 97 North/ Nicolls Road (3.4 miles);
- Take the exit toward I-495 West/ New York (0.2 miles);
- Merge onto Expressway Drive North (0.4 miles);
- Merge onto I-495 (Long Island Expressway) West via ramp on left to New York.

2.4 Traffic Control Measures

Traffic control measures will be required on West Main Street at various times throughout the duration remedial action construction work. Lane/sidewalk closures and regulated traffic may be required at different times to maintain a safe work environment. To regulate these traffic changes, flag persons, cones, signs, and barricades may be used. Appropriate traffic devices will be used in order to appear visible to both pedestrian and vehicular traffic at all times, including evening or low-light times.

No excavation is proposed within West Main Street. West Main Street contains sidewalks in close proximity to the entrance/exit to the Site that will need to be regulated. Lane closures are not expected for an extended period of time. The Off-Site building may be utilized as a temporary facility during construction activities. The existing access road which provides access both the Site and the Off-Site building will require periodic traffic control into and out of the parking lot area.

As recommended in the MUTCD, appropriate warning and guidance devices will be installed and maintained by the Remedial Contractor throughout the implementation of the remedial action. All applicable devices will conform to the MUTCD regulations. Anticipated traffic and safety control devices, at a minimum, include:

- Cones, tubular markers, drums, and/or barricades will be installed as needed on West Main Street to temporarily divert vehicular and pedestrian traffic and warn travelers of nearby work activities and work vehicles accessing/regressing from Site roadways.
- Two (2) flag persons with flagger symbols will be deployed on West Main Street near the Site exit/entrance to monitor and regulate the flow of traffic from within and nearby the Site. This includes ensuring all parties' safety while construction or remedial action related vehicles are entering and exiting the Site.
- An existing chain link fence around the Site will serve as a physical barrier between remedial action construction activity work area and adjacent roadways and properties. This fence will also serve as a Site security fence and prevent unwarranted access to the Site. Temporary fencing will also be installed around the perimeter of the construction area on the Off-Site property.
- "Road Work Ahead" signs will be installed on roadways adjacent or nearby the Site and the additional work area on the adjacent property. The signs will be installed at a minimum of 100 feet from the work area extents in areas of low speed limits.

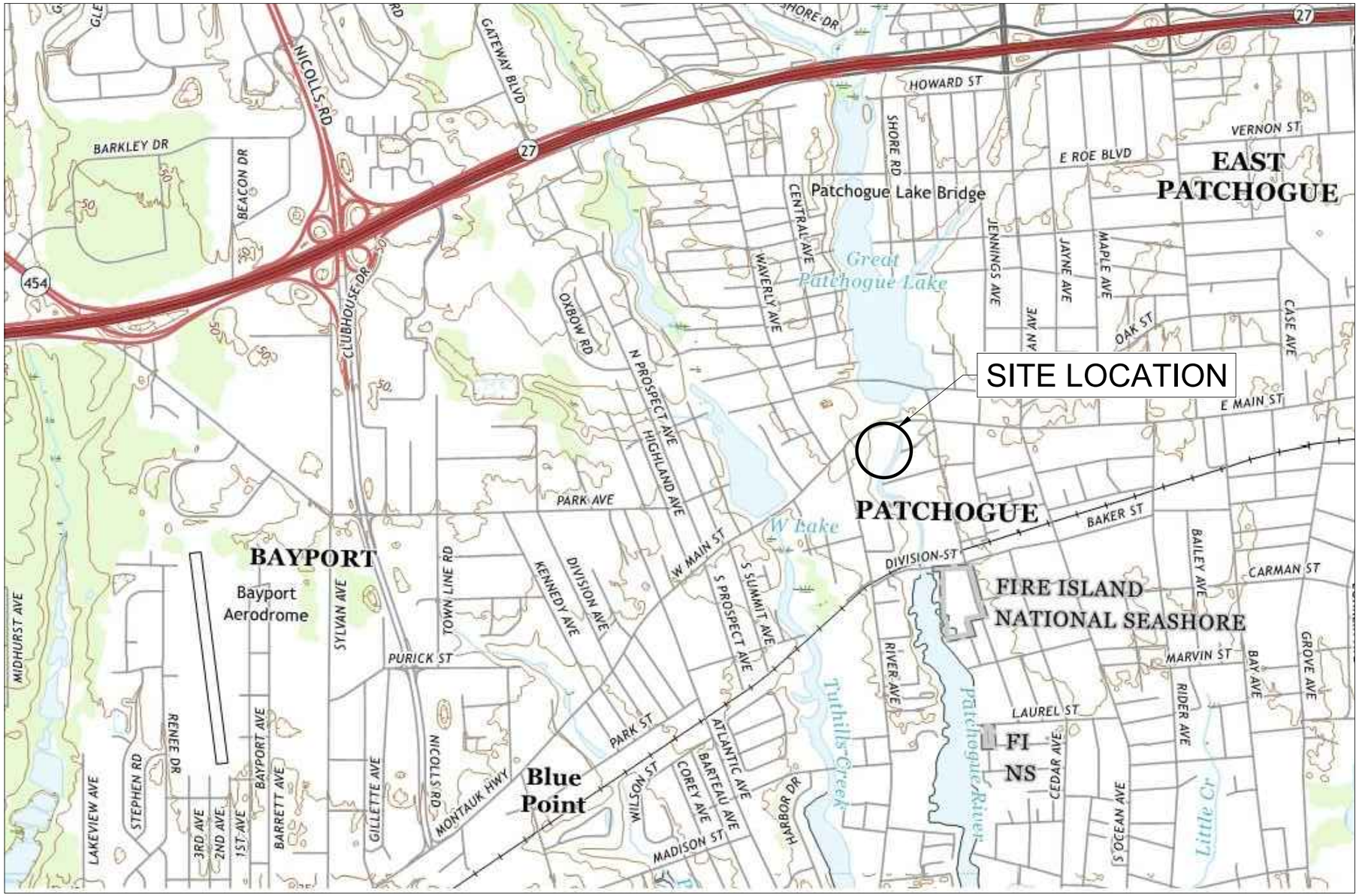
The approximate locations of the aforementioned traffic and safety control devices are shown on Figure 2-2. The Remedial Contractor will establish the locations of these devices once work is underway, with the approval of the Village of Patchogue, Town of Brookhaven, National Grid, BC and/or any other National Grid-appointed designees. The location of traffic devices may change due to changes in work activities or access points.

Section 3

References

USDOT, 2009. Federal Highway Administration Manual on Uniform Traffic Control Devices, United States Department of Transportation, Federal Highway Administration, December 2009.

Figures



SOURCE:
USGS 7.5 MINUTE TOPOGRAPHIC MAPS
PATCHOGUE □UADRANGLE
NEW YORK-SUFFOLK CO.
PATCHOGUE, NY 2016

0 750 1500
SCALE IN FEET

Brown AND Caldwell	SCALE: 1" = 1500' 149322 DATE: March 30, 2017	PATCHOGUE (212 and 234 WEST MAIN STREET) FORMER MGP SITE PATCHOGUE, NEW YORK	SITE LOCATION FIGURE 1-1

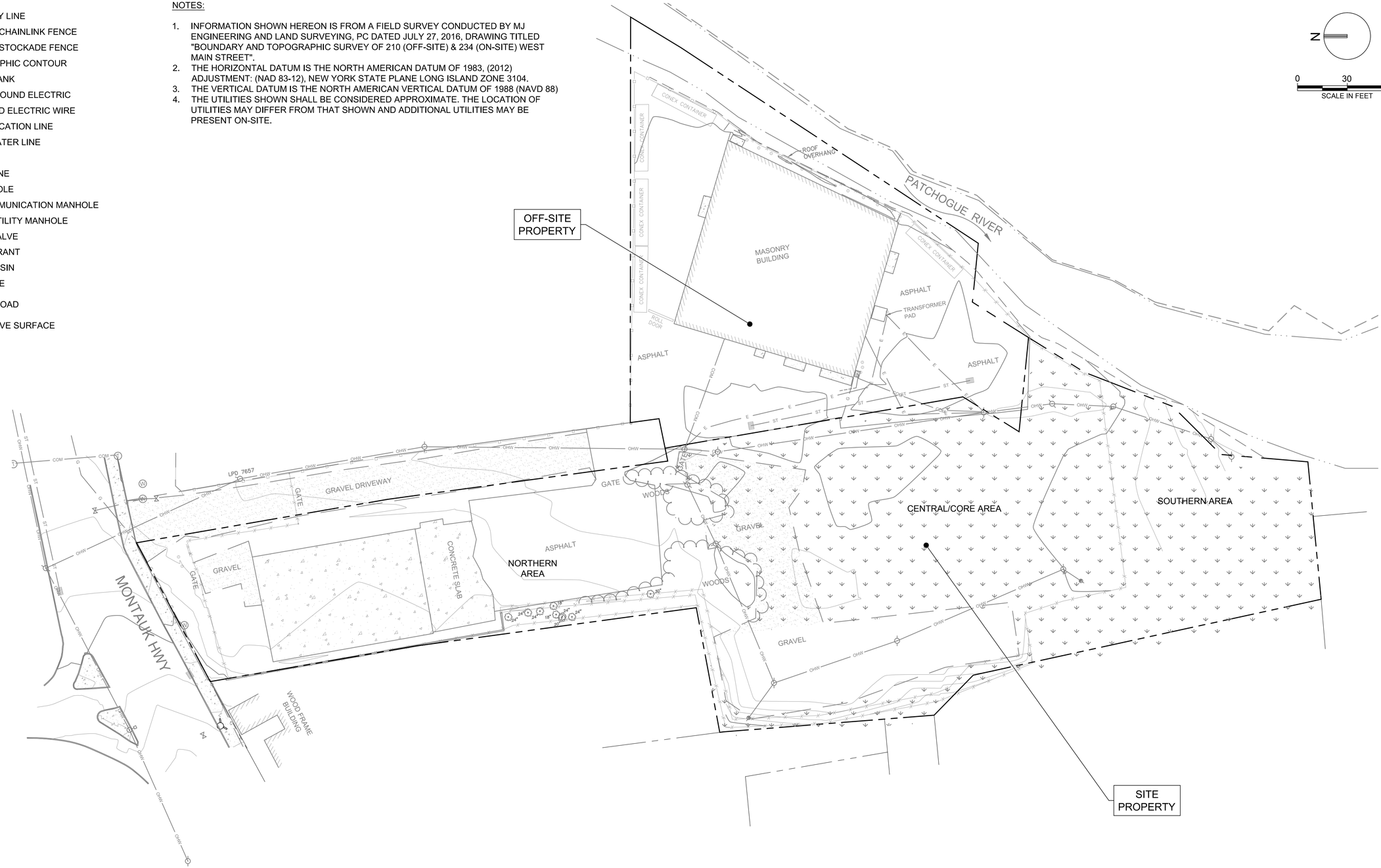
Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\60-95_RDR\2-Sheets\C-Ci□il File Name: FIGURE-1_ESD Plot Date: March 30, 2017 3:09 PM Cadd User: Eleanor Beck□ith

LEGEND:

- PROPERTY LINE
- EXISTING CHAINLINK FENCE
- EXISTING STOCKADE FENCE
- TOPOGRAPHIC CONTOUR
- TOP OF BANK
- UNDERGROUND ELECTRIC
- OVERHEAD ELECTRIC WIRE
- COMMUNICATION LINE
- STORMWATER LINE
- GAS LINE
- WATER LINE
- UTILITY POLE
- TELECOMMUNICATION MANHOLE
- WATER UTILITY MANHOLE
- WATER VALVE
- FIRE HYDRANT
- CATCH BASIN
- CONCRETE
- GRAVEL ROAD
- VEGETATIVE SURFACE

NOTES:

1. INFORMATION SHOWN HEREON IS FROM A FIELD SURVEY CONDUCTED BY MJ ENGINEERING AND LAND SURVEYING, PC DATED JULY 27, 2016, DRAWING TITLED "BOUNDARY AND TOPOGRAPHIC SURVEY OF 210 (OFF-SITE) & 234 (ON-SITE) WEST MAIN STREET".
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983, (2012) ADJUSTMENT: (NAD 83-12), NEW YORK STATE PLANE LONG ISLAND ZONE 3104.
3. THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
4. THE UTILITIES SHOWN SHALL BE CONSIDERED APPROXIMATE. THE LOCATION OF UTILITIES MAY DIFFER FROM THAT SHOWN AND ADDITIONAL UTILITIES MAY BE PRESENT ON-SITE.



Brown AND Caldwell	SCALE: 1" = 30' 147663 DATE: October 4, 2017	NATIONAL GRID PATCHOGUE FORMER MGP SITE 234 WESTMAIN STREET, VILLAGE OF PATCHOGUE, NY SITE PLAN	FIGURE 1-2

Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\2-SHEETS\C-CIVIL File Name: FIG_1-2 Plot Date: October 4, 2017 10:28 AM Cadd User: Robert Near

Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\2-SHEETS\C-CIVIL File Name: FIG 2-1 Plot Date: October 6, 2017 3:51 PM Cadd User: Radhika Patel

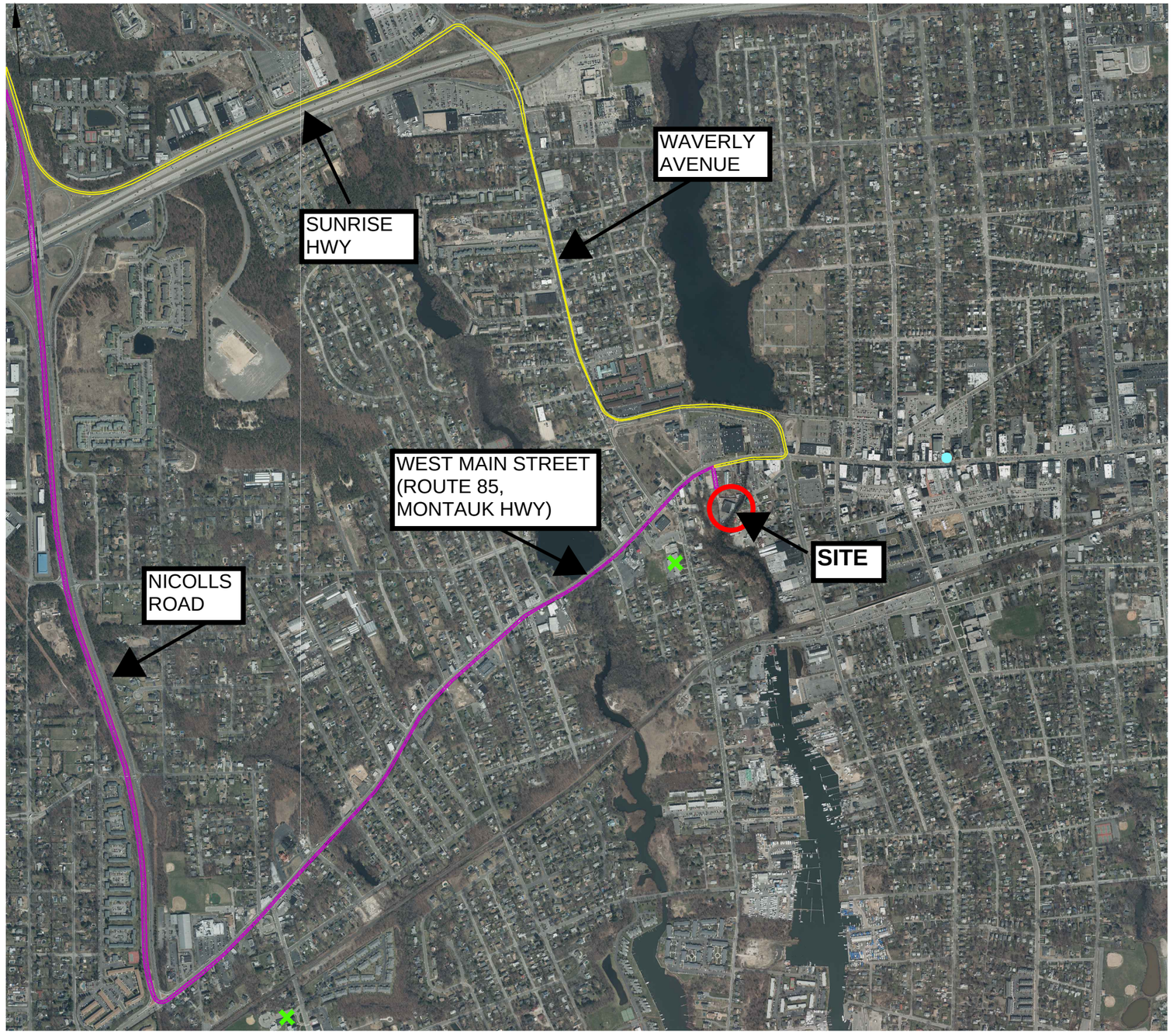
N

0 1200 2400

SCALE IN FEET

LEGEND:

- TRUCK ROUTE (ENTERING SITE)
- TRUCK ROUTE (LEAVING SITE)
- PUBLIC LIBRARY
- SCHOOL



FOR VEHICLES ENTERING THE SITE, THE DIRECTIONS FROM THE LONG ISLAND EXPRESSWAY ARE AS FOLLOWS:

- TAKE EXIT 62 TOWARDS NICOLLS RD/BLUE POINT/STONY BROOK (0.2 MI.)
- MERGE ONTO EXPRESSWAY DR SOUTH (0.1 MI.)
- TAKE COUNTY RD 97/NICOLLS RD SOUTH RAMP TO BLUE POINT (0.2 MI.)
- MERGE ONTO COUNTY RD 97/NICOLLS RD SOUTH (4.7 MI.)
- TURN LEFT ONTO COUNTY RD 85 (1.5 MI.)
- AFTER 1.5 MILES ON COUNTY RD 85/WEST MAIN ST, THE SITE WILL BE ON THE RIGHT (234 WEST MAIN ST)

FOR VEHICLES LEAVING THE SITE, THE DIRECTIONS ARE:

- FROM THE SITE EXIT, TURN RIGHT ONTO COUNTY RD 85/WEST MAIN ST (0.2 MI.)
- TURN LEFT ONTO COUNTY RD 19/HOLBROOK RD (0.4 MI.)
- AT THE TRAFFIC CIRCLE, CONTINUE STRAIGHT ONTO COUNTY RD 19/ WAVERLY AVE (0.8 MI.)
- TURN LEFT ONTO SUNRISE HIGHWAY NORTH SERVICE RD (0.3 MI.)
- CONTINUE ONTO NY-454 W (0.4 MI.)
- TAKE RAMP ONTO COUNTY RD 97 N/ NICOLLS RD (3.4 MI.)
- TAKE THE EXIT TOWARD I-495 W/ NEW YORK (0.2 MI.)
- MERGE ONTO EXPRESSWAY DR N (0.4 MI.)
- MERGE ONTO I-495 W VIA RAMP ON LEFT TO NEW YORK.

Brown AND Caldwell

SCALE: 1" = 1,200'

149322

DATE: OCTOBER 2017

PATCHOGUE (WEST MAIN STREET)
FORMER MGP SITE
PATCHOGUE, NEW YORK

TRUCK TRAFFIC ROUTE

FIGURE

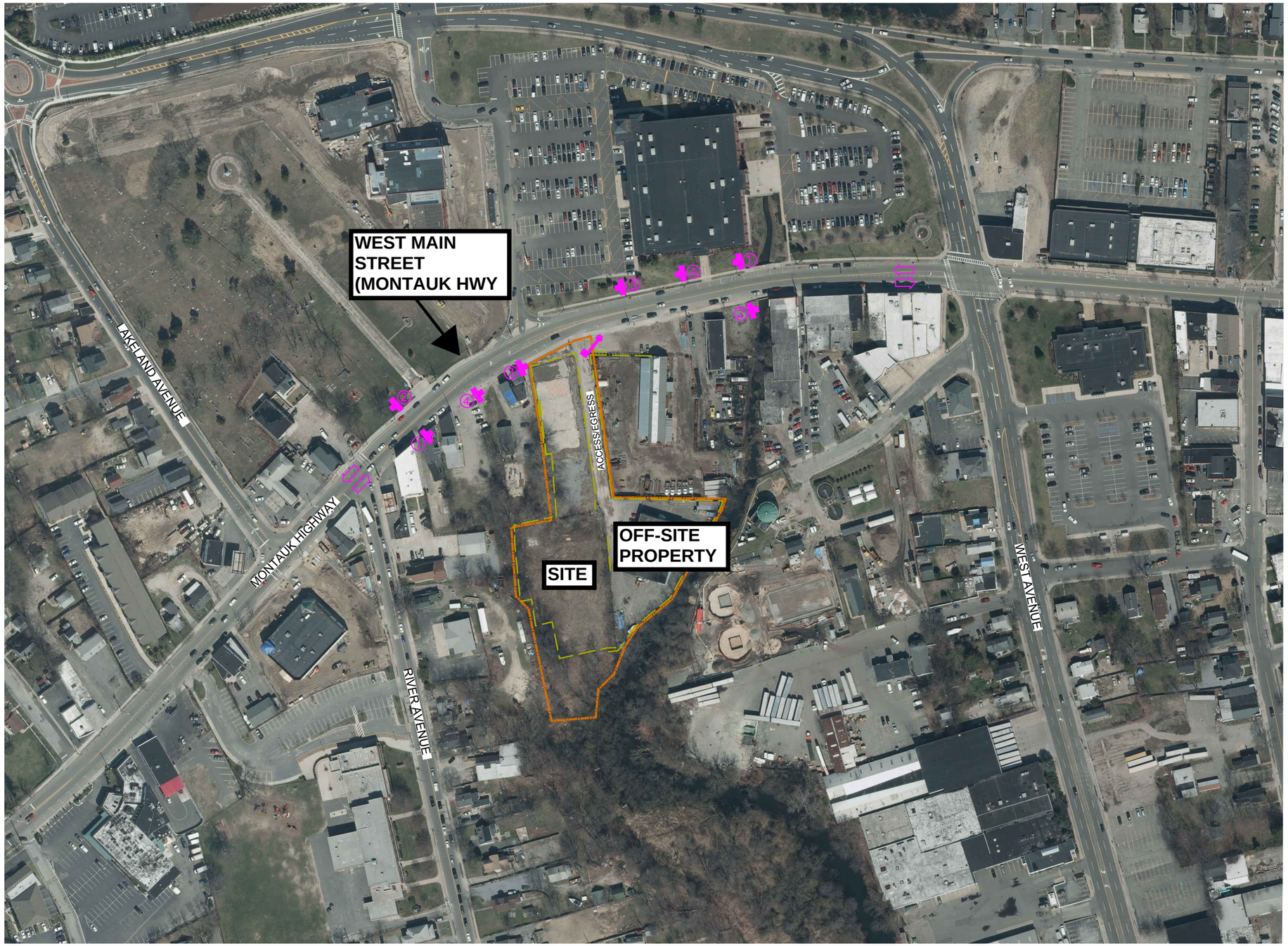
2-1

Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\2-SHEETS\C-CIVIL File Name: FIG 2-2 Plot Date: October 6, 2017 3:53 PM Cadd User: Radhika Patel

N

0 200 400

SCALE IN FEET



SIGN LEGEND:

1 ROAD WORK AHEAD

2 END ROAD WORK

3 CONSTRUCTION VEHICLE ENTRANCE EXIT

4

LEGEND:

- SITE BOUNDARY
- FLAGGER AS NEEDED
- TWO WAY TRAFFIC
- 1 SIGN (SHOWN FACING LEFT) AND ID
- APPROXIMATE FENCING BOUNDARY

SCALE: 1" = 200'

149322

DATE: OCTOBER 2017

PATCHOGUE (WEST MAIN STREET)
FORMER MGP SITE
PATCHOGUE, NEW YORK

TRAFFIC CONTROL PLAN

FIGURE 2-2

Appendix A: National Grid's Work Zone Traffic Control Safety Procedure

FOREWORD

National Grid's vision is to be a world-class safety organization, with zero injuries every day. A critical component of achieving this vision is the careful development, implementation and maintenance of safety procedures. This document, **Work Zone Traffic Control**, provides the minimum standards and specifications for work zone traffic control associated with the utility maintenance, repair and construction on or near roadways or on construction sites.

The procedure is designed to promote uniform and consistent application of these basic principals here at National Grid.

By following this guidelines set forth in Work Zone Traffic Control personnel can reduce their risk of injury and comply with applicable laws and regulations.

Questions regarding this procedure should be referred to National Grid's Safety Department.

Record Of Change

Date of Review/ Revision:

Revision	Date	Description
1	06/01/09	Response to audit item

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13.3 29 CFR 1926.201 - Signaling, ... 15
13.4 29 CFR 1926.202- Barricades, ... 15
13.5 29 CFR 1926.203- Definitions, ... 15
13.6 29 CFR 1910.269, Electrical Power Generation, Transmission and Distribution. 15
13.7 Utility Work Zone Traffic Control, Wayne State University, August 2008 15
13.8 ANSI 107-2004 15

1.0 INTRODUCTION

1.1 Purpose

This procedure will provide the minimum standards and specifications for work zone traffic control associated with the utility maintenance, repair and construction on or near roadways or on construction sites. The procedure is designed to promote uniform and consistent application of these basic principals.

The purpose of traffic control devices and reasons for their use is to help ensure roadway safety by providing for the orderly and predictable movement of all traffic and provide safety to both the public and employees.

1.2 Applicability

Equally as important as the safety of road users traveling through temporary traffic work zones is the safety of workers. This procedure applies to National Grid employees whose work exposes them to the risks of moving roadway traffic or construction equipment or interfere with the orderly flow of traffic. This includes maintenance or construction work performed within the highway boundary or on construction sites, either public or private.

Minimum standards of application are prescribed for typical situations. A number of typical scenarios are illustrated in the Utility Work Zone Traffic Control Field Guide, showing proper application of these standards and principles.

1.3 Reviews and Revisions

This procedure shall be reviewed periodically and revised as required. Revisions of this procedure should be made as a result of regulatory changes, management review, change in safety management guidance, or company policies. The dates of reviews and revisions will appear on the front of the page of the procedure titled “Record of Change”.

The Safety Programs and Regulatory Compliance Group shall have primary responsibility for maintaining this document, soliciting comment from stakeholders, and revising as necessary. The requirements of this procedure or any future revision thereof, shall be effective the date of its issue unless otherwise noted.

1.4 Documentation

Documentation related to this procedure and subsequent reviews and revisions will be maintained in the Safety Department. This procedure will be accessible to field operations both in paper and electronic formats. The paper versions of the procedure will not be document controlled. The official, current version of this procedure and all other procedures prepared under this guidance will be on the National Grid internal intranet website.

1.5 Quality Assurance and Audit

Internal self-assessment and quality assurance activities are performed at several levels. Local management is responsible for complying with this procedure and with associated work

methods that may be developed. The Safety Department shall be responsible for reviewing and revising this procedure based on feedback from these stakeholders.

The use of this procedure is subject to audit and it is anticipated that the Company' Legal Department and/or Internal Audit will periodically review its implementation.

2.0 RESPONSIBILITIES

2.1 Line of Business (LOB)

- Ensure that all employees are trained in Work Zone Traffic Control
- Monitor compliance with this procedure and note conditions where application of this procedure does not provide adequate worker protection.

2.2 Safety Department

- Provide on-going technical assistance to LOB as requested

2.3 Learning and Development

- Develop Work Zone Traffic Control training for LOB's.
- Conduct training for all workers exposed to the risks of moving roadway traffic or construction equipment.
- Conduct refresher training as needed to address needs and changes in regulatory requirements.
- Maintain training records in training database

2.4 Employees

- Adhere to the requirements of this procedure
- Attend all required training
- Request additional information when necessary

3.0 APPLICATION

It is not possible to prescribe detailed standards of the application for all situations that may conceivably arise. Therefore, typical illustrations are presented in the *Utility Work Zone Traffic Control Field Guide* for the most common situations with the understanding that additional protection may be required where special complexities and hazards prevail. Although each situation must be dealt with individually, conformity with the provisions established herein is required. The protection described for each situation shall be based on the **speed and volume of traffic, duration of work, and exposure to hazards**.

These standards are basically applicable to both rural and urban situations. High speed highways and streets require more thorough treatment than the minimum requirements, whereas low speed may be treated satisfactorily with a minimum of devices.

3.1 Standardization

3.1.1 All traffic control devices used on maintenance and construction projects shall conform to the applicable specifications of this manual.

3.1.2 Signs shall be kept in proper position, clean and legible at all times. Damaged, defaced or dirty signs shall be cleaned, repaired or replaced.

3.1.3 Barricades and signs supports shall be neatly constructed and shall not appear makeshift. They shall be repaired, cleaned or replaced as needed to keep up their appearance.

4.0 FUNDAMENTAL PRINCIPLES OF WORKZONE TRAFFIC CONTROL

4.1 Plan for Safety

Workers should plan ahead for the safety of the motorist, pedestrian and worker.

4.2 Keep it Moving

Normal traffic movement should be disrupted as little as possible.

4.3 Communicate

Motorists and pedestrians should be warned, informed and guided in a clear and positive manner while approaching and traveling through the work zone.

4.4 Plan for the Worst

Workers should plan for the possibility of errant vehicles leaving the roadway and impacting the work zone.

4.5 Train

Each person whose actions affect temporary traffic control zone safety should receive training appropriate to the job decisions each is required to make. Only those who are trained in safe traffic control practices and have a basic understanding of the principles and National Grid's procedures should supervise the selection, placement and maintenance of traffic control devices in work zones.

5.0 THE WORK AREA MUST BE PLANNED

Traffic congestion makes it necessary to plan protection for our work areas. Planned protection is necessary to avoid vehicle and pedestrian traffic hazards for the safety of the public and our own employees.

The vital nature of our services makes it necessary to provide them with a minimum of interruption. We must gain access, to our facilities and equipment, as repair and maintenance is required, providing a work area that is safe for all concerned.

It is National Grid's goal to maintain good relations with the general public. Employees in the field can create public goodwill by the way they conduct themselves and the way they arrange and maintain the traffic work zone.

You can help to maintain a reputation as a good neighbor by making it your standard work practice to use these principles of work zone traffic control.

5.1 Planning Considerations

5.1.1 Maintain street work areas for only as long as is absolutely necessary to quickly and safely move in, do the job, and move out, minimizing obstructions to traffic and exposure to accidents.

5.1.2 Plan according to the work area and duration of work.

5.1.3 Consider the character of the area around the work zone.

5.1.4 Install and securely anchor approved bridging over excavations where pedestrian and vehicular traffic must be maintained during the job.

5.1.5 Take special care to provide suitable boundary definitions and/or barricades to make pedestrians and drivers of vehicles aware of work area boundaries.

5.1.6 Plan in advance for:

- Speed of traffic
- Volume of traffic
- Any changes in the above which may occur during the work operation
- Duration of work
- Traffic approaches
- Pedestrian traffic
- Work vehicle movements above work zone

5.1.7 Maintain the smallest work area consistent with safe operations being guided by the following limitations:

a. Width of work area. The width of a work area, generally, should not exceed the width of one traffic lane. The job should be worked in steps; or in congested areas with unusual traffic conditions, notify appropriate police agency and/or DOT officials.

b. Length of work area. Whenever possible, place tools, equipment, vehicle, or other suitable barriers between the working point and oncoming traffic. Additional area required for essential equipment may be obtained by increasing the work area in the direction of the flow of traffic.

5.1.8 Day or night, warning lights on vehicles and barricades should be operating before moving out into traffic lanes.

5.1.9 Planned consideration should be given for a flagger when the work area extends into traffic lanes. The flagger shall be equipped with a stop and slow paddle and Class 2 or higher high visibility/reflective outer clothing. Channelization is preferred to flagging operations, when two-way traffic can be maintained.

5.1.10 Determine in advance the need for specific traffic control devices including additional special equipment which may be necessary. Consider who will install, maintain and remove the devices. For proper procedure concerning installation and removal of these devices, refer to Section 7.0.

5.1.11 Plan where work material and equipment will be stored.

5.1.12 Consideration should be given to preparation of an emergency traffic plan for unexpected incidents which cause complete closure of a roadway.

5.1.13 Refer to the Typical Control Plan diagrams (TCP's) in the Utility Work Zone Traffic Control Field Guide and select the setup which most closely meets your requirements, adapting it where necessary to meet local conditions.

5.1.14 For night operations or work areas left with traffic restrictions at night, illumination may be required in addition to flashing and steady lights on warning and guide devices.

6.0 SELECTING THE TYPICAL APPLICATION

Selecting the most appropriate typical application for a temporary traffic control zone requires knowledge and understanding of that zone. Three factors are used to characterize the typical applications: speed and volume (roadway type), duration of work and exposure to hazards.

Work duration is a major factor in determining the number or types of devices used in temporary traffic control zones. The five categories of work duration and their time at a location are as follows:

6.1 Duration of Work

6.1.1 Long-Term Stationary

Work that occupies a location more than three days.

At long-term stationary temporary traffic control zones, there is ample time to install and realize benefits from the full range of traffic control procedures and devices that are available for use. Generally, larger channelizing devices are used, as they have more retro- reflective material and offer better nighttime visibility. The larger devices are also less likely to be displaced or tipped over-an important consideration during those periods when the work crew is not present. Furthermore, as long-term operations extend into nighttime, retro-reflective and/or illuminated devices are required.

6.1.2 Intermediate-Term Stationary

Work that occupies a work location for more than one daylight period up to three days, or nighttime lasting more than one hour.

Typically, the work zone is occupied by excavations, materials, and/or equipment at times when workers are not present. At least one advance warning sign should face each direction of traffic approaching a long duration stationary work area. When such an area uses a portion of the roadway, channelizing devices should be used. For long duration work areas, larger signs and more conspicuous channelizing devices are usually warranted to control traffic. Conditions normally require attention by the person responsible for traffic control during work of long duration. Warning, delineation and channelization devices should be effective under varying conditions of light and weather. Devices should be kept current and flagger signs should be covered or turned from view when the flagger is not on duty.

6.1.3 Short-Term Stationary

Work that occupies a work location for more than 1 hour, within a single daylight period.

Most utility operations are short-term stationary work. The work crew is present to maintain and monitor the temporary traffic control zone. The use of a flagger is an option depending on road speed and volume. Lighting and/or retro-reflective devices should be chosen to accommodate varying seasonal, climatic, and visibility situations.

This would be work of a type that at the conclusion of the work day or emergency period, the area is returned to its original state in regard to traffic restrictions. It includes operations such as overhead utility repair, and work on underground utilities at manholes. At least one advance warning sign shall face each direction of traffic approaching the work area. When such an area occupies a portion of the roadway, channelizing devices should be used. As the size of a work area that occupies a travel lane increase, the number of traffic control devices should be increased. For short duration stationary work areas, portable signs, consistent with the need for advance warning and adequate notice, supplemented with cones and barricades are generally sufficient to control traffic.

6.1.4 Short Duration

Work that occupies a location up to one hour.

During short duration work, there are hazards involved for the crew in setting up and taking down the traffic controls. Also, since the work time is short, the time during which motorists are affected is significantly increased as the traffic control is expanded. Considering these factors, it is generally held that simplified control procedures may be warranted for short duration work. Such shortcomings may be offset by the use of other, more dominant devices such as special lighting units on work vehicles, such as arrow displays and flashing beacon lights.

It includes operations such as tree-trimming, overhead utility repairs and work at underground utilities at manholes lasting more than 15 minutes at one location.

6.1.5 Mobile Work

Work that moves intermittently or continuously.

Mobile operations often involve frequent short stops, each as much as 15 minutes long, for activities such as removal of debris from the roadway, operating a power distribution switch, changing a street light lamp, operating a gas valve, gas leak detection operations, surveying, inspections and other utility operations that are similar to stationary operations. Warning signs, flashing beacon lights, flags, and/or channelizing devices should be used. Each worker shall be highly visible to approaching traffic.

Mobile operations also include work activities in which workers and equipment move along the road without stopping, usually at slow speeds. The advance warning area moves with the work area. Traffic should be directed to pass safely. For some continuously moving operations-where volumes are light and visibility is good, a well marked and well signed vehicle may suffice. If volumes and/or speeds are higher, a shadow or backup vehicle equipped as a sign truck, preferable supplied with a flashing arrow display, should follow the work vehicle. Where feasible, warning signs should be placed along the roadway and moved periodically as the work progresses. In addition, vehicles may be equipped with such devices as flags, flashing vehicle lights, truck-mounted attenuators, and appropriate signs. These devices may be required individually or in various combinations, including all of them, as determined necessary.

Safety should not be compromised by using fewer devices simply because the operation will frequently change its location. Portable devices should be used. Flaggers may be used, but caution must be exercised so they are not exposed to unnecessary hazards. The control devices should be moved periodically to keep them near the work area. If mobile operations are in effect on a high-speed travel lane of a multilane divided highway, flashing arrow displays should be used.

6.2 Location of Work

The choice of traffic control needed for a temporary traffic control zone depends upon where the work is located. As a general rule, the closer the work is to traffic, the more control devices are needed.

6.2.1 Outside of the shoulder edge

Devices may not be needed if work is confined to an area 15 or more feet from the edge of the shoulder. Consideration should be given to roadway characteristics, roadway geometrics, and vehicle speed.

A general warning sign shall used if workers and equipment are within 15 feet or less of an uncurbed roadway or 2 feet or less of a curbed roadway.

6.2.2 On or near the shoulder edge

The shoulder should be signed as if work were on the road itself, since it is part of the driver's recovery area. Advance warning signs are needed. Channelizing devices are used to close

the shoulder, direct traffic, and keep the work space visible to the motorist. Portable barriers may be needed to prevent encroachment of errant vehicles into the work space and to protect workers.

6.2.3 On the median of a divided highway

Work in the median may require traffic control for both directions of traffic, through the use of advance warning signs and channelization devices. If the median is narrow, with a significant chance for vehicle intrusion into long-term work sites and/or crossover accidents, portable barriers should be used.

6.2.4 On the traveled way

Work on the traveled way demands optimum protection for workers and maximum advance warning for drivers. Advance warning must provide a general message that work is taking place, information about specific hazards, and actions the driver must take to drive through the temporary traffic control zone.

6.3 Roadway Type

Roadway type is also a primary factor in the use of temporary traffic control zone traffic control devices.

6.3.1 Rural two lane roadways

Characterized by relatively low volumes and high speeds.

6.3.2 Urban arterial roads

Often have lower speeds, but they may require significant controls because of higher traffic volumes and closer spacing of such design features as intersections.

6.3.3 Other urban streets

Characterized with light traffic volumes will generally require fewer more closely spaced devices.

6.3.4 Rural or urban multilane divided and undivided highways

6.3.5 Intersections

6.3.6 Freeways

Major arterials and freeways need the highest type of traffic control, primarily because of high speeds and often high volumes of traffic.

7.0 SIGNS

7.1 Location of Signs

7.1.1 Signs shall be placed where they convey their messages effectively and placement must therefore be accommodated to highway characteristics. Signs shall be so placed that the driver will have adequate time for response.

7.1.2 As a general rule signs shall be located on the right side of the roadway. Where special emphasis is deemed necessary, dual installations may be made which consist of duplicate signs opposite each other on the left and right sides of the roadway. Within a construction or maintenance zone, however, it is often necessary and/or desirable to place signs on portable supports placed within the roadway itself. It is also permissible to mount appropriate signs on barricades.

7.1.3 All signs should be mounted at approximately right angles to the direction of, and facing, traffic which they are to serve. Signs mounted on barricades, or temporary supports may be at lower heights but the bottom of the sign shall be not less than one foot above the pavement elevation. However, higher mounting heights are desirable.

7.2 Regulatory Signs

Regulatory signs (for example, speed limit reductions) impose legal compulsions or restrictions on motorists. Therefore, their use must be officially authorized by the agency having responsible jurisdiction.

7.3 Warning Signs

Warning signs are the most important type of signs used in connection with the maintenance and construction operations. Motorists, properly alerted to the physical conditions ahead, should be able to adjust the operation of their vehicles to safely negotiate the maintenance, construction or detour zone.

Warning signs are normally placed in advance of the condition for which they are intended. The advance posting distance for these signs will vary with the approach speed of traffic, the type of maintenance or construction activity, the roadway conditions, and the number and type of signs and other devices used.

Visibility of each sign should be examined with respect to grade, alignment, road curvature and other possible obstructions on the approach to the sign.

For maximum mobility and safety on certain types of maintenance operations, a large sign may be effectively mounted on a vehicle stationed in advance of the work or moving along with it. This may be the working vehicle itself, as in the case of gas leak mobile and street light work, or a vehicle provided expressly for this purpose. These mobile sign displays may be mounted on a trailer, may be provided with self-contained electric power units for flashing beacons and lights, or may be mounted on a regular maintenance vehicle.

7.4 Guide Signs

Guide signs are used to direct traffic through and around maintenance and construction operations where temporary route changes are necessitated by highway closures and detours.

8.0 BARRIERS AND CHANNELIZATION

8.1 Function

Barriers and channelizing devices, when properly used, are often essential to properly control and direct the movement of traffic through or around maintenance and construction projects.

- 8.1.1These devices are used to mark a limited channel of traffic or to close off sections of highways.
- The work vehicles themselves may be used to protect the work area, particularly in low speed urban districts.
- Consideration should always be given to the need for lighting devices at night.

8.2 Channelization

A very important element, within the system of traffic control devices commonly used in construction or maintenance areas (where a reduction in pavement width is involved), is the taper that is provided for channelization.

8.3 Barricades

Barricades are used to physically block off all or part of a roadway.

- If barricades extend across a roadway and shoulder as a fence, availability of access for maintenance or construction forces must be considered.
- Roadways should be narrowed gradually. This gradual narrowing may be accomplished by means of the barricades themselves or by placing cones, drums, or vertical panels in advance of the barricades. An alternate method is to install the barricades at intervals with each successive barricade extending further into the roadway. At night, consideration should be given to the use of delineators or steady-burning lighting devices to indicate the path to be followed and/or of obstructions within the roadway.
- Barricades may also be used to confine traffic to certain lanes or paths of travel for certain distances. These may be placed longitudinally or transversely to the path of travel. Cones, drums, or vertical panels may be used longitudinally or diagonally.

8.4 Auxiliary Devices

When used to require a change in direction or reduction in the number of lanes available, the change should be made gradually.

8.4.1 Cones

a. Cones shall be predominantly orange in color and may be supplemented with warning flags.

b. Cones should be kept clean and bright for maximum target value.

c. For night time use, they shall be reflectorized or equipped with lighting devices for maximum visibility.

8.4.2 Drums

Drums are less portable than cones but provide greater emphasis. They may be used to surround a work area. Drums shall not be placed in the roadway without advance warning signs.

8.4.3 Warning Lights

Warning lights are used to illuminate and emphasize the existence of obstructions and hazards at night. They may be used as necessary as a supplement to reflectorized signs, barricades and other channelizing devices. Warning lights used in series to supplement channelizing devices should be steady-burning, except that the first two lights in series may flash.

Warning lights consist of steady-burning lights, flashing lights and flashing arrow boards.

a. Steady burning lights include all single-unit, steady-burning, low-intensity lamps which emit yellow light.

b. Flashing yellow lights. They are used for advance warning or for marking a severe or unexpected obstruction or hazard in or near the roadway.

c. Flashing arrow boards. A portable unit, consisting of flashing indications arranged to form an arrow symbol, may be used with standard warning devices on highway obstructing maintenance and construction projects.

   1. A unit may be trailer mounted or it may be mounted on a vehicle and arranged so that it can be displayed or turned from view as necessary.

   2. When these units are used on a moving vehicle, controls and pilot lights should be located so that the message display can be monitored and changed from within the driving compartment of the vehicle.

8.4.4 Work Zone Enhancement Devices

Includes; telescoping bars, portable crowd control barriers, such as Color-cade barriers and other protective devices are used to provide additional measures for keeping pedestrians,

bicyclists, etc. from entering into the work area. Traffic control devices must meet the criteria for NCHRP Report 350 standards. However, common devices such as telescoping bars between cones and Color-cade barriers that are typically used within the work zone are not intended for vehicle protection but to prevent pedestrian incursion into the work zone.

9.0 INSTALLATION AND REMOVAL OF DEVICES

9.1 Protection

Installation and removal of devices, in itself, constitutes highway work that should be protected by means appropriate to the situation, such as hazard vehicle lights and vehicle emergency flashers. Establishing a work area within an intersection, or at a freeway interchange, may warrant greater protection.

9.2 Order of Work

1 Device installation normally proceeds from the beginning of the work zone to the far end. On a two-way road, the less affected direction should be set up before the more affected one. The work vehicle used should move in the same direction as traffic in the roadway half being set up.

2 On a one-way roadway, device removal is normally started at the downstream end with removal of the last work area protection device. Channelizing devices are then removed, from downstream to upstream, with those in advance of the workers continuing to provide protection, until the roadway is cleared. Removal of advance warning signs on the shoulder is normally accomplished with a work vehicle traveling in the direction of traffic flow.

10.0 EMPLOYEES EXPOSED TO VEHICULAR TRAFFIC

10.1 Clothing Requirements

a. High visibility safety apparel is required to maximize employee protection when exposed to the risks of moving roadway traffic or construction equipment.

b. Employees must wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Safety Apparel" or equivalent revisions, and labeled as ANSI 107-2004 standard performance for Class 2 or 3 exposure.

c. High-visibility safety apparel is defined as company approved:

   1. Safety vests
   2. Rain gear (jacket or jacket and pants ensemble), or
   3. Garments worn over the outer layer of clothing

d. Flaggers - safety apparel meeting ANSI 107-2004 standard performance Class 3 risk exposure should be considered for:

   - Flagging at night
   - Flagging in inclement weather and similar lowlight conditions
   - Flagging in high speed/volume traffic areas
   - When determined by the competent person in charge

e. Any exception for not wearing high-visibility safety apparel must be valid and must be documented on the job brief by the individual exposed to the risks of moving roadway traffic or construction equipment and by the responsible person in charge.

11.0 FLAGGERS

11.1 Application

Consideration should always be given to the need for flaggers to control traffic on a maintenance or construction project where traffic is permitted to travel through or adjacent to the work area. However, the decision to use or not to use a flagger in a particular situation rests with the person in charge of the operation.

1 STOP/SLOW Paddles. Paddles are the preferred tool to use when performing flagging duties.

2 Flags. A 24" x 24" Red Flag may be used for flagging in emergencies when STOP/SLOW paddles are not available. Red Flags are also acceptable when flagging at four-way intersections.

11.2 Flagger Stations

11.2.1 Flagger stations should be located far enough from the work site so that vehicles will have sufficient distance to slow down before entering the project but not so far that vehicles will tend to speed up into the work site.

11.2.2 Normally the flagger will be positioned adjacent to the traffic lanes being controlled either on the shoulder or in the barricaded lane. At a spot obstruction the flagger should stand on the shoulder opposite the barricaded section.

11.2.3 The flagger should stand alone, never permitting a group of workers to congregate around him or her. The flagger should be stationed sufficiently in advance of the work area to warn workers of approaching danger, such as out-of-control vehicles.

11.2.4A flagger warning sign shall be used facing each direction of traffic. These advance warning signs are optional for very brief periods or emergency traffic control.

11.2.5 Flagger Stations at night time shall be illuminated, except in emergency situations.

11.3 One-Lane Control

Where traffic in both directions must, for a limited distance, use a single lane, provisions should be made for alternate one-way movement to pass traffic, through the constricted section. However, where the one-lane section is of any significant length, there should be some means of coordinating movements (for example, walkie-talkies, hand signals, etc.) at each end so that vehicles are not simultaneously moving in opposite directions in the section and so that delays are not excessive at either end. Control points at each end of the route should be chosen so as to permit easy passing of opposing lines of vehicles.

12.0 VEHICLES IN THE WORK AREA

1 All vehicles in the work area shall activate their vehicle hazard warning flashers in addition to their beacon/flashing lights for the duration of the work.

2 As vehicles approach the work area they should activate their vehicle hazard warning lights along with the beacon/flashing to indicate to traffic that they are slowing down and preparing to enter the work zone.

3 Drivers of vehicles with portable beacon lights shall not attempt to activate or affix the lights to the vehicle while driving.

4 Beacon/Flashing lights are intended as hazard warning lights. These lights are not considered “Emergency Response Lights” and should not be used as such. It is, however permissible to use the Beacon/Flashing light while performing patrol or shadow vehicle activities when the vehicle speed is below the normal speed limit creating a potential traffic hazard.

5 All vehicle lights shall be approved for use by Fleet and only used in accordance with manufacturers’ instructions, local, state and federal law.

13.0 REFERENCES

13.1 49 CFR, Manual of Uniform Traffic Control Devices. 2003, rev 1 & rev2

13.2 NYCRR, Title 17, Volume (b), Chapter V, Uniform Traffic Control Devices.

13.3 29 CFR 1926.201 - Signaling,

13.4 29 CFR 1926.202- Barricades,

13.5 29 CFR 1926.203- Definitions,

13.6 29 CFR 1910.269, Electrical Power Generation, Transmission and Distribution.

13.7 Utility Work Zone Traffic Control, Wayne State University, August 2008

13.8 ANSI 107-2004

Appendix M: Storm Water Pollution Prevention Plan (SWPPP)

Stormwater Pollution Prevention Plan
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 149322.570

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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List of Abbreviations

BC	Brown and Caldwell Associates
CQA	Construction Quality Assurance
ESC	Erosion and Sediment Control
MGP	Manufactured Gas Plant
NYSDOT	New York State Department of Transportation
NYSSSESC	New York State Standards and Specifications for Erosion and Sediment Control
PPE	Personal Protective Equipment
RDR	Remedial Design Report
ROD	Record of Decision
SWPPP	Stormwater Pollution Prevention Plan

Section 1

Introduction

1.1 Purpose and Scope

This Storm Water Pollution Prevention Plan (SWPPP) has been prepared by Brown and Caldwell Associates (BC), on behalf of National Grid, for the Patchogue (W. Main Street) Former Manufactured Gas Plant (MGP) Site (referred to as the "Site"). This SWPPP has been prepared to identify the storm water management practices to be implemented during remedial action construction activities to 1) control potential impacts (i.e., erosion and sediment loading) to Site-related storm water runoff and 2) achieve the following objectives:

- Minimize potential erosion of existing soil/sediments within active work areas;
- Minimize the potential for the conveyance of sediment-laden storm water beyond the project work limits; and
- Minimize accumulation of water within active work areas.

1.2 Site Background

Site background is presented in the Remedial Design Report "Remedial Design Report (90-95% Submission), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" (RDR) prepared by Brown and Caldwell Associates, dated October 2017. A Site Plan is shown on Design Drawing C-101 (Appendix A of the RDR).

1.3 Summary of Remedial Activities

The remedial activities will include the following:

- Selective Demolition;
- Installation of Embankment Protection Measures;
- In-Situ Solidification;
- Excavation;
- Backfilling and Compaction;
- Construction of Environmental Cap; and
- Site Restoration.

These activities are further described in the RDR.

Section 2

Erosion and Sediment Control Plan

Prior to commencement of land disturbance and demolition activities, temporary erosion and sediment control (ESC) measures will be installed. The elements of the proposed ESC measures will be installed in accordance with the New York State Standards and Specifications for Erosion and Sediment Control (NYSSSESC, also referred to as the "Bluebook").

ESC measures will be employed including silt fencing, hay bale dikes, storm drain inlet protection, stabilized construction entrance/exit and dust control measures. The ESC measures will be installed as shown on Design Drawing C-500 and C-800 (Appendix A of the RDR) and in strategic locations based on visual observation of flow patterns and the topography of work areas to control sediment entrained stormwater from exiting work areas. During remedial construction, ESC measures will be inspected and maintained on a daily basis and following precipitation events. Accumulated sediment will be removed from the erosion and sediment controls, as needed. Sediment that originates from excavated areas and removed from ESC measures will be added to the stockpile for off-Site disposal. Sediment will be removed from behind the silt fence and hay bales when it accumulates to a depth greater than 0.5 feet behind the barrier.

2.1 Erosion and Sediment Control Measures

The following subsections of this SWPPP discuss the various types of ESC measures that may be utilized at the Site during the implementation of the remedial action.

2.1.1 Temporary Stabilized Construction Entrance

Stabilized construction entrances consisting of smoothly graded areas large enough to accommodate equipment and truck traffic will be constructed. The stabilized construction entrance will consist of crushed coarse aggregate stone underlain by non-woven geotextile fabric and will be maintained and redressed while in use. Stabilized construction entrance will be used by trucks leaving the Site to reduce the transport of dust and Site soils off-Site.

Access to the Site will be from West Main Street. The proposed access location is indicated on the Design Drawings. The necessary municipal permits, if any, to maintain a construction entrance will be obtained for the duration of the project by the Remedial Contractor, prior to mobilization to the Site.

2.1.2 Decontamination Area

During the implementation of the remedial construction activities, the Site will be divided into three primary zones: the exclusion zone, the contamination reduction zone, and the support zone. These locations will be identified by the Remedial Contractor in the field during the implementation of the remedial activities. The decontamination area will be located within the contamination reduction zone and will include the personnel decontamination station and the equipment decontamination pads. The purpose of the pad will be to provide an area where dirt, debris and any other contaminated material can be removed from vehicles, equipment, and/or personnel, if necessary, prior to departure from the work zones and the Site. The pad will be in an area with a bermed perimeter and consist of a crushed stone layer underlain by a geotextile layer and two plastic liners, with a collection sump. The trucks will be cleaned via mechanical means to remove dirt and debris, and, if needed, water sprayers will be used. A

personnel decontamination station will be designed and established by the Remedial Contractor as necessary. Heavy machinery, trucks, equipment and personnel exiting the exclusion zone will be subject to the decontamination procedures. A construction detail for the decontamination pad is included on Drawing C-500.

2.1.3 Silt Fence/Hay Bale Dikes

At a minimum, silt fence/hay bale dikes will be installed to delineate the limit of the remedial work area (installed on the down slope side) and around the perimeter of any stockpile areas. The ESC measures will be installed as shown on Drawing C-800 (Appendix A of the RDR) and in strategic locations based on visual observation of flow patterns and the topography of work areas to control sediment entrained storm water from existing and entering work areas.

2.1.4 Material Staging Areas

The construction equipment required to implement the remedial construction activities will be mobilized to the Site, as necessary based on the construction schedule. Equipment staging areas will be located to facilitate equipment ingress and egress and allow for proper sequencing of the remedial construction work.

Material staging areas will be established for the excavated materials, debris, clean backfill, and liquid wastes generated by decontamination activities. Staging areas will be underlain by plastic sheeting with perimeter berms to contain run-on and run-off. Liners beneath the stockpiles, as well as plastic sheeting used to cover stockpiles, will be of sufficient thickness to minimize rips caused by debris and/or the movement of materials and to be protective from the elements. Damaged or ripped liners/sheeting will be repaired or replaced, as necessary. The staging areas will be physically segregated to prevent cross contamination or commingling of materials. To the extent feasible, materials intended for off-Site transportation and disposal will be staged in areas of the Site that are not proximate to existing off-Site roadways to minimize the potential for off-Site impacts. Staging areas for excavated soils and impacted debris destined for off-Site disposal will be principally located in the remaining areas of the Site subject to excavation.

Excavated soils and impacted debris will be covered with plastic to minimize odors as well as the effects of weather. A construction detail for the stockpile area is included on Drawing C-500 of the RDR. Odor suppressing foam will be applied to stockpiles, as necessary, to minimize the potential for odors generated by the impacted soils. The locations of the staging areas are shown on Drawing C-111 of the RDR.

2.1.5 Dust and Odor Control Measures

Dust and odor control measures will include water spraying, covering stockpiles and open excavations with sheeting and/or tarps and odor suppressant foams. As part of the removal of former MGP features, dust control measures will include the spraying of water or misting the work areas to ensure the concrete and brick is moist.

Dust control measures will be implemented to minimize the potential for dust generation during soil excavation and handling, stockpiling and placement of fill. The primary method of dust control will be the application of water spray using water trucks and/or flat hose(s) connected to a water supply. Heavily traveled truck routes will be wet down by the water truck to minimize dust emissions. Truck routes on-Site will be continuously monitored for excessive build-up of Site soils or dust. In the event of excessive build-up of Site soils, the Remedial Contractor shall remove the excess soils and add them to the stockpile for off-Site disposal. In the case of excessive build-up of dust, response procedures in

accordance with the CAMP will be implemented. During freezing temperatures, calcium chloride will be spread in lieu of water to minimize the potential for ice at the Site. Additional dust control measures will include covering open excavations and stockpiles of soil, as required, to minimize erosion and dust generation.

Proper cleaning of trucks exiting the Site will aid in minimizing potential off-Site impacts from dust. Stabilized construction entrances consisting of smoothly graded areas large enough to accommodate equipment and truck traffic will be constructed at Site access point to clean tires of transport trucks exiting the Site. The base will be covered with non-woven geotextile and coarse aggregate and will be maintained and redressed while in use.

Truck routes on- and off-Site will be inspected continuously during high truck traffic periods for accumulation of excessive soil or dust. Proper cleaning of trucks exiting the Site will eliminate dusty conditions on adjacent roadways. Transport trucks exiting the Site will be inspected to ensure tires and undercarriages are clean and that tarps are secured. Excessive mud and loose soil observed on the trucks will be manually removed with brooms and brushes, as necessary.

Odor will be monitored during excavation, in situ solidification, and handling of impacted soils from the Site. If excessive odors are detected in the opinion of National Grid or the Construction Manager, controls will be implemented. Odor controls will include the use of odor suppressing foam and foaming devices or tarps to cover open excavations or stockpiles. Odors will also be controlled by sequencing Work activities to minimize the amount of Work areas open at a time. Odors will be mitigated, if necessary, by placing a layer of non-odorous soils or polyethylene sheeting over the Work area and stockpile when those areas are not in use (overnight and off-hours). In addition, foam application equipment and an adequate supply of odor reducing foaming agent will be available for application to the excavation area, during waste handling and management activities or stockpiles, as needed. Odor control may also be performed by odor-suppressing sprays such as BioSolve® sprayed during remedial construction and waste handling activities.

2.1.6 Good Housekeeping Practices

Good housekeeping practices will be implemented to reduce the potential for construction materials becoming entrained in storm water discharges from the Site. Throughout construction, the Remedial Contractor will be responsible for maintaining the Site in a neat and orderly condition. This will include, but not be limited to: routine waste management activities (e.g., the collection and disposal of trash, rubbish, construction waste, and sanitary wastes); prompt cleanup of any spills of impacted materials (liquid or dry); and prompt cleanup of any materials tracked by construction vehicles.

2.2 Inspection and Maintenance of ESC Measures

ESC measures at the Site will be inspected and maintained daily and following precipitation events to confirm that the ESC plan is being properly implemented and to assess whether any maintenance or improvements are necessary to optimize the ESC measures for current Site conditions. Inspections of the ESC measures will be performed by the Remedial Contractor. In addition, the Remedial Contractor will prepare a weekly inspection report summarizing the results of the inspections performed during the weekly period. The minimum requirements for weekly inspection reports are presented in Section 31 25 13 of the Technical Specifications of the RDR.

If it is determined during the inspection that any maintenance to the existing ESC measures or installation of additional ESC measures are necessary, maintenance/installation activities will be initiated as soon as possible and completed prior to completion of the next inspection report. If Site conditions (e.g., weather, ground conditions, etc.) prevent maintenance/installation activities from being

completed prior to submittal of the subsequent inspection report, Site conditions will be noted in the inspection report and maintenance/installation activities will be completed as soon as Site conditions permit.

ESC measures throughout the Site will be maintained for the duration of the remedial construction until all soil disturbing activities and Site restoration activities have been completed.

2.3 Site Restoration

Restoration activities will consist of Site grading and construction of a Site-wide environmental cap; re-establishing current pavement types Off-Site; and re-establishing chain-link fencing and restoring any other Site features removed to accommodate remedial construction. A final Site inspection will be performed by the Construction Manager and Construction Quality Assurance (CQA) Representative to verify that all Site restoration activities have been completed properly. Once it is confirmed that the Site has been restored in conformance with the design drawings and specifications, the Remedial Contractor will remove any ESC measures which are no longer needed.

2.4 Construction Sequence

The following sections detail the components of the remedy selected to address the impacts at the Site in accordance with the requirements of the Record of Decision) ROD. In general, the work will be implemented in the following sequence of events:

1. Submittals
2. Mobilization
3. Site Preparation Activities
4. Remedial Activities
5. Post-Remedial Action Activities

In addition, this section presents a detailed discussion of specific activities that will occur during the implementation of the Remedial Activities as follows:

- Air Monitoring;
- Odor Control and Vapor Management;
- Decontamination; and
- Waste Management.

Section 3

Pollution Prevention Plan

In addition to the Erosion and Sediment Control Plan described in Section 2.0, the Remedial Contractor will be required to prepare and implement a Pollution Prevention Plan, as part of the Contingency Plan for the Site, in accordance with the minimum requirements identified in this section. The Contractor's Pollution Prevention Plan will include a Spill Prevention Plan identifying measures to be taken to prevent spills from occurring and a Spill Response Plan identifying measures to be implemented in the event of a spill or spill-related emergency. Both the Spill Prevention Plan and Spill Response Plan are further described below.

3.1 Spill Prevention Plan

The Remedial Contractor will inspect all equipment prior to their mobilization for potential sources of spills by inspecting the condition of hydraulic cylinders, hoses, gaskets, fuel tanks, etc. If a potential spill source is identified, the Remedial Contractor will conduct the necessary repairs or replace the piece of equipment prior to mobilizing equipment to the Site.

At a minimum, the preventative measures listed below will be implemented by the Remedial Contractor to minimize potential spills of fuel during the remedial construction:

- Conduct refueling activities in a designated area on level ground away from steep slopes and utilize a drip rag or container to catch any potential spills during refueling;
- Do not leave equipment unattended during refueling;
- Do not refill internal combustion engine fuel tanks with a flammable liquid while the engine is running;
- Replace fuel caps before starting the engine;
- Secure (i.e., lock) fuel pump dispensers when not in use to avoid accidental fuel release;
- Keep fuel storage tanks within secondary containment (i.e., bermed containment);
- Conduct visual inspections of equipment/fuel tanks to check for leaks. If leaks are observed, transfer the tank contents to an alternate tank and replace or repair the leaking tank, as appropriate;
- Maintain all equipment in accordance with the manufacturer's specifications; and,
- Operate all vehicles and equipment safely, and park them a safe distance away from Site hazards and sensitive resources, to the extent practicable.

3.2 Spill Response Plan

The Remedial Contractor will develop and implement appropriate spill response procedures in case an unplanned release occurs. These procedures are to be followed in response to spills of oil, products, materials, etc. The Contractor will maintain an emergency contact list for the Contractor; fire official(s), ambulance service, local, county and State Police, and local hospitals. The Contractor will also identify responsible personnel who will be in position at all times to receive incoming phone calls and to dispatch

Contractor personnel and equipment in the event of an emergency situation. In addition, the Contractor will maintain a spill kit on-Site, throughout remedial construction activities, containing at a minimum: absorbent pads, absorbent booms, fire extinguishers, personal protective equipment (PPE) and shovels.

The following lists the minimum requirements for the procedures the Remedial Contractor will include and implement in their Spill Response Plan:

- **Stopping Usage of the Affected Equipment:** The equipment will be shut off immediately and/or all valves closed and the leak stopped, if possible.
- **Containing the Spill:** If the spilled material is floating on water, absorbent pads/booms will be placed surrounding the spill. If the spilled material sinks below the water surface, a dam, weir, or other containment will be used to stop the flow of the spilled material. If the spill occurs on land, a containment unit will be constructed to stop the flow of the spilled material. Absorbent material will be applied, as necessary.
- **Cleaning the Spill:** Spills in water will be recovered using pumps, sorbent materials, vacuum trucks, etc. until the spilled material is fully recovered and no sheen or other evidence of the spill is observed. Spills on land will be recovered using pumps, sorbent materials, shovels and heavy equipment, as necessary, until the spilled material is fully recovered. All sorbent materials used to clean up the spill will be disposed of in an appropriate manner. All equipment used will be decontaminated with an approved cleaning solution on the decontaminated pad.
- **Containerizing Spill Materials:** Spill materials, impacted soil, sorbent pads, etc. will be containerized in New York State Department of Transportation (NYSDOT) approved containers. The containers will be labeled with the waste type and date of accumulation in accordance with applicable regulations. Samples will be collected to characterize the spilled materials for disposal. All materials will be disposed of at a National Grid-approved, properly permitted off-Site disposal facility.
- **Disposal of Spill Materials:** Recovered spill materials and impacted spill cleanup debris will be disposed of at a facility permitted to accept the materials and approved by National Grid. The Contractor will be responsible for coordinating disposal activities.
- **Performing Post-Spill Maintenance:** Following cleanup of the spill, the Contractor will verify that all used spill cleanup material and equipment have been disposed of or decontaminated, as appropriate. If the equipment that caused the spill cannot be properly repaired, replacement equipment will be obtained.

Section 4

References

NYSDEC, New York State Standards and Specifications for Erosion and Sediment Control, November 2016.

Appendix O: Interim Site Management Plan (CD-ROM)

PATCHOGUE FORMER MANUFACTURED

GAS PLANT

SUFFOLK COUNTY

PATCHOGUE, NEW YORK

INTERIM SITE MANAGEMENT PLAN

NYSDEC Site Number: 1-52-182

Prepared for:

National Grid

175 East Old Country Road

Hicksville, New York

Prepared by:

Brown and Caldwell Associates

Upper Saddle River, New Jersey

(201) 574-4700

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
0	Jan. 15, 2016	Initial Submission	

January 2016

CERTIFICATION STATEMENT

I Marek Ostrowski certify that I am currently a NYS registered professional engineer and that this Interim Site Management Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

_____ P.E.

_____DATE

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MANUFACTURED GAS PLANT

SUFFOLK COUNTY

VILLAGE OF PATCHOGUE, TOWN OF BROOKHAVEN, NEW YORK

INTERIM SITE MANAGEMENT PLAN

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List of Acronyms

AST	Above-ground Storage Tank
BC	Brown and Caldwell
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
BUG	Brooklyn Union Gas
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulation
COC	Certificate of Completion
CP	Commissioner Policy
CSM	Conceptual Site Model
CY	Cubic Yards
DER	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
EC	Engineering Control
ECL	Environmental Conservation Law
EWP	Excavation Work Plan
FSP	Field Sampling Plan
HASP	Health and Safety Plan
IC	Institutional Control
IHWDS	Inactive Hazardous Waste Disposal Site
ISMP	Interim Site Management Plan
ISS	In-Situ Stabilization
LILCO	Long Island Lighting Company
MGP	Manufactured Gas Plant
msl	Mean Sea Level
NAPL	Non Aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PRR	Periodic Review Report
PSA	Preliminary Site Assessment
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SDG	Sample Delivery Group
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System

SPDI	Supplemental Pre-Design Investigation
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
VHB	Vanasse, Hangen, Brustlin
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Patchogue Former Manufactured Gas Plant (MGP) Site (herein referred to as "Site"), as well as the inspections, monitoring, maintenance and reporting intrusive activities required by this Interim Site Management Plan (ISMP):

Site Identification:

Site Identification No. 1-52-182

Patchogue Former MGP Site, 234 West Main Street, Village of Patchogue, Suffolk County, New York

Site Institutional Controls:	1. The Site may be used for restricted residential, commercial/industrial use in accordance with the Site use restrictions as well as the applicable local zoning regulations	
	2. Environmental Easement a. Periodic certification of institutional or engineering controls; b. Development of property for restricted residential, commercial or industrial uses as defined in Part 375-1.8(g) and in accordance with local zoning regulations. c. Restricts use of groundwater as a potable or process water d. Prohibits vegetable gardens or farming; and e. Requires compliance with this Interim Site Management Plan.	
	3. ECs must be inspected at a frequency and in a manner defined in the ISMP.	
Site Engineering Controls:	1. Cover system	
	2. Perimeter chain link fencing with lockable gates	
Inspections:		Frequency
1. Cover inspection		Annually
2. Perimeter chain link fencing with lockable gates		Annually

Monitoring:	
1. Groundwater Monitoring	Semi-Annually
2. Monitoring of Engineering and Institutional Controls	Annually
Maintenance:	
1. Cover system	As needed
2. Perimeter chain link fencing with lockable gates	Annually
Reporting:	
1. Results of Groundwater Monitoring	Semi-Annually
2. Periodic Review Report (Certification of Engineering and Institutional Controls)	Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Interim Site Management Plan.

1.0 INTRODUCTION

1.1 General

This Interim Site Management Plan (ISMP) is a required element of the remedial program for the Patchogue Former Manufactured Gas Plant (MGP) located in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (hereinafter referred to as the "Site"). Refer to Figure 1 for Site location. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site (IHWDS) Program, Site No. 1-52-182 which is administered by New York State Department of Environmental Conservation (NYSDEC).

The use of the Site as a former MGP has resulted in impacts to soils on an off-site property located immediately adjacent to (east of) the Site. This property, located at 212 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York will be herein referred to as the "Off-Site Property". National Grid does not own this property. Refer to section 2.1.1 for Off-Site Property location, description and owner information.

KeySpan Gas East Corporation d/b/a National Grid (a predecessor company of National Grid) entered into an Order on Consent on September 30, 1999 with the NYSDEC to remediate the Site. KeySpan Gas East Corporation is the Remedial Party (RP, also known as the Respondent) to the Administrative Order on Consent (AOC). The Site location and boundaries of this Site are provided in Figures 2A and 2B. The boundaries of the Site will be fully described in the metes and bounds Site description that will be part of the Environmental Easement. Once established, the Environmental Easement will be provided in Appendix A. The Environmental Easement is granted by the owner of the Site (the "Grantor") to the NYSDEC.

After completion of the remedial work, some MGP-related impacts will be in the subsurface at the Site and the Off-Site Property. Site Institutional and Engineering Controls (ICs and ECs), will be incorporated into the Site remedy to control exposure to remaining MGP-related impacts to ensure protection of public health and the environment. An

Environmental Easement will be granted to the NYSDEC, by the RP and recorded with the Suffolk County Clerk, which requires compliance with this ISMP and all established ECs and ICs for the Site.

ECs and ICs will be incorporated into the remedy for the Site to control exposure to remaining MGP-related impacts to ensure protection of public health and the environment. The ECs to be established on the Site as part of the remedy include a soil cover system as well as fencing with lockable gates. ICs consist of an Environmental Easement to be granted to the NYSDEC, by the RP and recorded with the Suffolk County Clerk which requires compliance with the ISMP and all established ECs and ICs for the Site. This ISMP will be finalized into an SMP once the remedy for the Site has been implemented. Post-remedial monitoring (groundwater monitoring) to determine the success of the remedy will be conducted as well as periodic inspections of the Site to assess compliance with the provisions of the Environmental Easement, and this ISMP.

ECs and ICs will also be incorporated into the remedy for the Off-Site Property to control exposure to remaining MGP-related impacts to ensure protection of public health and the environment. The Off-Site Property owner shall not interfere with the fencing and lockable gates maintained by the RP along the property line adjacent to the Site. Following the implementation of the remedy, the RP shall repair or replace the asphalt cover and the fencing/gates on the Site, as necessary.

The ECs on the Off-Site Property include the asphalt and building cover system. The Off-Site Property will be subject to similar post-remedial monitoring as described above for the Site with regard to the cover systems. The RP (National Grid) shall replace and/or repair any of the cover system on the Off-Site Property removed or damaged during implementation of the remedy. The Off-Site Property Owner will be responsible to maintain the asphalt/building cover system to address normal wear and tear and shall replace the asphalt if broken during activities conducted on the Off-Site Property (e.g., utility installation). The Off-Site Property owner agrees to execute and record with the Suffolk County Clerk a Declaration of Covenants and Restrictions (DCR) to memorialize the ISMP.

This ISMP was prepared to manage remaining MGP-related impacts at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This ISMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This ISMP details the specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the ISMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this ISMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the Order on Consent (Index #D1-001-99-05; Site #1-52-182) for the Site, and thereby subject to applicable penalties.

Reports associated with the Site and the Off-Site Property can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site and the Off-Site Property is provided in Appendix B of this ISMP.

This ISMP was prepared by Brown and Caldwell Associates (BC), on behalf of National Grid, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This ISMP addresses the means for implementing the ICs and ECs at the Site that are required by the Environmental Easement to be established after the implementation of the remedy.

1.2 Revisions

Revisions to this plan will be proposed by National Grid in writing to the NYSDEC's Project Manager. Revisions may be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the Site and/or Off-Site Property conditions. In accordance

with the Environmental Easement for the Site (to be established after implementation of the remedy), the NYSDEC will provide a notice of any approved changes to the ISMP, and append these notices to the ISMP that is retained in its files.

1.3 Notifications

1.3.1 Site Notification Requirements

Notifications will be submitted by the property owner (currently National Grid) to the NYSDEC and National Grid (by subsequent property owners), as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in Site use that are required under the terms of the Order on Consent, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 30-day advance notice of any field activity associated with the remedial program.
- 45-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Once National Grid is made aware, notice will be provided to NYSDEC within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Once National Grid is made aware, notice will be provided to NYSDEC by verbal notice by noon of the following day of any emergency, such as a fire, flood or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any proposed change in the ownership of the Site, use of the Site, or the responsibility for implementing this ISMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC and National Grid (in the case of subsequent property owners) will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party (RP, also known as the Respondent) has been provided with a copy of the Order on Consent, the Record of Decision (ROD), and all approved work plans and reports, including this ISMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC and National Grid.

Table 1A includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B.

Table 1A: Site Notifications*

Name	Contact Information
Elizabeth Lukowski, NYSDEC Project Manager	(518) 402-9564; eblukows@gw.dec.state.ny.us
Sarah Aldridge, National Grid Project Manager	(516) 545-2568 sarah.aldridge@nationalgrid.com

* Note: Notifications are subject to change and will be updated as necessary.

1.3.2 Off-Site Property Notification Requirements

Notifications will be submitted by the Off-Site Property owner to National Grid, as needed, for the following reasons:

- 60-day advance notice of any proposed changes in the use of the Off-Site Property.
- 45-day advance notice of any proposed ground-intrusive activity to be conducted on the Off-Site Property pursuant to the Excavation Work Plan.
- Once National Grid is made aware, notice will be provided by National Grid to NYSDEC within 48-hours of any damage or defect to the foundation, structures

or EC on the Off-Site Property that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.

- Once National Grid is made aware, notice will be provided by National Grid to NYSDEC by verbal notice by noon of the following day of any emergency, such as a fire, flood or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Off-Site Property, with written confirmation by National Grid within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- National Grid will submit follow-up status reports on actions taken to respond to any emergency event on the Off-Site property requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs on the Off-Site property.

Any proposed change in the ownership of the Off-Site Property, use of the Off-Site Property, or the responsibility for implementing this ISMP will include the following notifications:

- At least 60 days prior to the change, National Grid will be notified in writing of the proposed change. This will include a certification that the prospective purchaser has been provided with a copy of this ISMP.
- Within 15 days after the transfer of all or part of the Off-Site Property, the new owner's name, contact representative, and contact information will be confirmed in writing to National Grid.

Table 1B includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B.

Table 1B: Off-Site Property Notifications*

Name	Contact Information
John Cashel	516-250-6386

* Note: Notifications are subject to change and will be updated as necessary.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Location and Description

2.1.1 Site Location and Description

The Site is located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York and is identified as District 204 Section 12 Block 9 and Lot 6.4 on the Village of Patchogue Tax Map (see Figure 2A). The Site is an approximately 3.6-acre area with a maximum length (north-south) of approximately 680 feet and a maximum width (east-west) of 180 feet, and is bounded 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 municipal storage yard (see Figure 2B – Site Layout Map). The Site has relatively flat topography with a typical elevation of approximately five feet above mean sea level (msl). The boundaries of the Site will be more fully described in Appendix A once the Environmental Easement is finalized after completion of the implementation of the remedy. Site property boundaries are provided on Figures 2A, 2B, and 3. The owner(s) of the Site parcel(s) at the time of issuance of this ISMP are: KeySpan Gas East Corporation d/b/a National Grid (a predecessor company of National Grid), 175 East Old Country Road, Hicksville, New York 11801.

2.1.2 Off-Site Property Location and Description

The Off-Site Property is located at 212 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York and is identified as District 204 Section 12 Block 9 and Lot 67.1 on the Village of Patchogue Tax Map (see Figure 2A). The Site is an approximately 0.9-acre area with a maximum length (north-south) of approximately 230 feet and a maximum width (east-west) of 260 feet,

and is bounded to the north by West Main Street, beyond which is a property occupied by Briarcliff College and Patchogue Lake; to the east by the Patchogue River, to the south by a portion of the Site and the Patchogue River; and to the west by the Site beyond which are a residential area and municipal storage yard (see Figures 2B and Figure 3). The Off-Site property has relatively flat topography with a typical elevation of approximately five feet above mean sea level (msl). The Off-Site Property and boundaries are provided on Figure 3. The owner of the Off-Site Property at the time of issuance of this ISMP is 210 West Main Realty Corp., 50 Gilpin Avenue, Hauppauge, New York 11788.

2.2 Physical Setting

2.2.1 Site Land Use

The Site is informally divided into three areas: the Northern Area, the Central/Core Area, and the Southern Area. The Northern Area is a rectangular area comprising the northern portion of the Site and is enclosed with a chain-link fence. This area is mostly clear of vegetation and 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 also rectangular in shape and is enclosed by a chain-link fence. This area is vegetated primarily by grass, weeds and low brush and stone installed as part of a previous remedial activity conducted at the Site. A steep slope runs along the western boundary of the Site. The Southern Area comprises the tapered southern end of the property. This area has considerable concrete debris and dense vegetation. The Site is zoned industrial and is currently undeveloped and vacant.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include commercial, residential, and industrial properties. The properties immediately south of the Site include residential properties; the properties immediately north of the Site include commercial/industrial properties; the properties immediately east of the Site include the former Above All Store Fronts and the Patchogue River; and the properties to the west of the Site include Costanza Marine Contractors. 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 to the east of the Site beyond the adjacent commercial property and the Patchogue River.

Existing conditions at the Site are shown in Figure 4.

2.2.2 Site Geology

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 below ground surface (bgs), which was the depth of the deepest borings drilled during the Site investigation activities.

Geologic cross section locations are shown in Figure 5A. The geologic cross-sections are shown on Figure 5B. Site specific boring logs are provided in Appendix C.

2.2.3 Site Hydrogeology

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 bgs. Groundwater 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.

A groundwater contour map is shown in Figure 6. Groundwater elevation measurements are provided in Table 2. Groundwater monitoring well construction logs are provided in Appendix C.

2.3 Site Investigations and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

Historical conditions of the Site are shown in Figure 7.

2.3.1 Site History

The Site was operated as a MGP from 1904 to 1926. MGPs such as this converted coal and/or petroleum products to a flammable gas which was used in the surrounding community in much the same way that natural gas is used today.

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 Preliminary Site Assessment (PSA) Report (Vanasse, Hangen, Brustlin [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 Remedial Investigation Report (RIR) (TetraTech EC, December 2009).

2.3.2 Regulatory and Remedial Investigation History

The history of the Site, the findings from the assessment and investigation activities into the subsurface conditions and the nature and extent of MGP-related impacts at the Site are presented in the following documents listed on Table 3:

- "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" prepared by Vanasse, Hangen, Brustlin and dated March 2002 (referred to as PSA);
- "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York", as prepared by TetraTech EC, Inc. and dated December 2009 (referred to as RIR);
- "Focused Feasibility Study, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk" prepared by Brown and Caldwell Associates and dated May 2011;
- "Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, February 2012);
- "Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" (Brown and Caldwell Associates, February 2012);
- "Remedial Design Report (50%-75% Submission), Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, December 2012); and
- Off-Site Investigation Letter Report; Prepared by Brown and Caldwell Associates, June 2014.

The aforementioned reports are on file with the NYSDEC.

2.3.3 Conceptual Site Model (CSM)

A summary of the dense non-aqueous phase liquid (DNAPL) observations and BTEX and PAH Concentration results from the PSA (VHB, 2002), the RI activities (TetraTech EC, Inc., 2009), the Pre-Design Investigation (PDI), Supplemental PDI (SPDI) and off-site investigations are shown on Figures 5A, 5B, 8A, 8B, 8C and in Appendix E.

2.3.3.1 Site CSM

This pre-remediation Site CSM includes the results from the PSA (VHB, 2002), the RI activities (TetraTech EC, Inc., 2009), the PDI and SPDI conducted on the 234 West Main Street property (the Site).

MGP related impacts, in the form of DNAPL, were observed at investigation locations generally corresponding with the former locations of MGP-related structures located in the Central/Core Area. The DNAPL is present in two portions of the Central/Core Area as shown on the FFS Reference Figures (Figures 3-2 and Figure 3-3) in Appendix D. These areas are:

- The larger of the two areas 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 ; and

- The smaller of the two areas (significantly smaller than the previously described area) located in the northwestern corner of the Central/Core Area.

In the central and northeastern part of the Central/Core Area, the majority of the DNAPL mass is situated in the upper ±5 to ±10 feet of the soil as shown on geologic cross-section presented as Figure 3-3 in Appendix D. Within this depth interval, DNAPL is present in zones or layers which are either saturated with DNAPL or where the DNAPL occurs at lower degrees of saturation in the form of grain coatings and blebs. The zones and layers containing DNAPL within this interval are often separated by layers where no visible impacts are discernable. At depths below approximately 10 feet bgs, DNAPL 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 DNAPL 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 Figure 3-2 in Appendix D). The deepest DNAPL encountered in the soil were DNAPL blebs at a depth of 22.4 feet bgs in boring SB-132 (refer to Figures 3-2 and 3-3 in Appendix D).

DNAPL 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, DNAPL was observed as DNAPL globules, black and hardened DNAPL, and as grain coatings within the upper five feet of soil. At SB-111, DNAPL was only encountered as a 0.2 foot thick layer at a depth interval of 7.1 to 7.3 feet bgs (refer to Figure 3-3 in Appendix D).

Analyses of soil samples obtained during the investigation activities indicate that elevated BTEX and PAH concentrations (concentrations in excess of the Soil Cleanup Objective [SCO]) in the soil are associated with intervals where DNAPL was encountered (refer to Figure 3-3 in Appendix D). Concentrations of BTEX and PAH compounds in soil samples collected from intervals that are not impacted by DNAPL are typically non-detect, or if detected, are below the SCO for unrestricted use.

Some dissolved phase BTEX and PAH compounds have been detected in groundwater at concentrations above the Class GA groundwater quality criteria at well locations within the Central/Core Area (i.e., MW-5 and MW-6). On occasion, traces of DNAPL have been identified in these wells. The dissolved phase compounds are apparently attributable to contributions from the DNAPL 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.

2.3.3.2 – Off-Site Property CSM

This pre-remediation CSM of Off-Site Property (212 West Main Street owned by 210 West Main Realty Corp.) CSM includes the results from the RI activities (TetraTech EC, Inc., 2009) and investigation activities conducted on the Off-Site Property by BC, on behalf of National Grid, in May 2014.

MGP related impacts, in the form of MGP DNAPL were observed at investigation locations on the Off-Site Property (212 West Main Street) located adjacent to the Patchogue Former MGP Site. The DNAPL was observed in ten investigation locations generally located east/southeast of the single building on the Site as shown on the Off-Site

Investigation Reference Figures (Figures 1, 2 and 3) in Appendix E.

The impacts encountered off-site consist of black viscous, tacky, stringy tar-like material that partially coats the sand grains and exhibits a moderate naphthalene-like odor. These impacts are generally encountered from approximately 3.5 to six feet bgs.

Analyses of soil samples obtained during the investigation activities indicate that elevated BTEX and PAH concentrations (concentrations in excess of the SCO) in the soils are associated with intervals proximal to where soils were encountered that either had an oily appearance (PASB-36 and PASB-37) or were saturated with oil (PASB-41) (refer to Figure 2 and 3 in Appendix E). Concentrations of BTEX and PAH compounds in soil samples collected from intervals that are not oil-impacted are typically non-detect, or if detected, are below the SCO for unrestricted use.

Wells MW-9S, MW-9D, MW-3 are directly downgradient of the former MGP structures, and wells MW-4S and MW-4D are downgradient and/or sidegradient. These wells are located next to the river, on the opposite side of the off-site property from the National Grid property.

There are no wells within the Off-Site Property to allow an evaluation as to whether there is MGP-related dissolved-phase constituents extending partially onto the property. There are source materials on the National Grid property directly adjacent to the Off-Site Property. In addition, the October 2010 depth-discrete groundwater samples (GW-1, GW-2, and GW-3), located adjacent to this property, indicated concentrations above Class GA groundwater quality criteria. This suggests that groundwater data within the Off-Site Property would be required to assess whether MGP-related dissolved-phase constituents are extending partly onto the Off-Site Property. Evaluation of the data from the wells located downgradient of the Off-Site Property and adjacent to the river notes the plume does not extend to the river.

2.3.4 Impacted Media and Contaminants of Concern

2.3.4.1 – Site

Releases from process equipment, tanks and piping during the former transfer and distribution processes may have resulted in MGP-related impacts in Site soils. The

locations where MGP impacts were observed during the investigation activities are concentrated in the former locations of the MGP-related structures such as the gas holder, purifier house boiler, and tanks in the Central/Core Area of the Site. These impacts were observed in the subsurface soils, predominantly in the upper ±10 feet of soil. Locally, these impacts are present at depths up to nearly 23 feet bgs, although the intervals of deeper impact are thin and less frequent.

Groundwater sampling conducted during the RI and subsequent SPDI and quarterly monitoring activities indicates that dissolved phase BTEX and PAH compounds are present at concentrations above the Class GA groundwater quality criteria in the Central/Core Area of the Site. These elevated groundwater concentrations are coincident with the locations where DNAPL was encountered in the subsurface. As indicated in the RIR, the RI investigation indicates surface soil, soil vapor, and surface water are not significant contaminant transport mechanisms and thus are not considered impacted media. In addition, the RIR and the evaluation of the Patchogue River sediments discussed in the on-site conceptual model also support that sediment is not a medium of concern at the Site.

In summary, based on the findings of the Site investigations (i.e., the PSA, RI and PDI/SPDI), exposure assessments and the evaluation of the river sediments, the impacted media that were addressed in the FFS included surface soils, subsurface soil, source material, and groundwater. The surface soils include the areal extent of the portion of the Site subject to previous filling activities and the former MGP operations area (the Central/Core Area of the Site). The surficial soils include soils to a depth of two feet. This layer includes impacted areas presumably from the former MGP operations and other historical Site activities. The impacted subsurface soils include those soils in the two portions of the Central/Core Area (i.e., the relatively large area occupying the central and northeastern part of the Central/Core Area, and the smaller area in the northwestern corner of the Central/Core Area). The depth of impacted soil ranges from ground surface to nearly 23 feet bgs. The impacted soil contains DNAPL and associated stains, sheens and odors, as well as concentrations of BTEX and PAH compounds above SCOs. DNAPL-impacted source material (source material) is considered to be the DNAPL identified during visual observations noted as part of the investigation activities and described in the boring logs as blebs, black saturated, globs and DNAPL material. MGP DNAPL-impacts are the contaminants of concern and the source material of impacts to soils and groundwater.

Petroleum impacts, noted through visual and olfactory observations during the investigation activities, were co-mingled with the MGP-related impacts. Groundwater will be remediated by the treatment or removal of MGP DNAPL impacts as the potential source to groundwater.

2.3.4.2 – Off-Site Property

Releases from process equipment, tanks and piping during the former transfer and distribution processes may have resulted in MGP-related impacts in off-site soils. MGP-related DNAPL consisting of black viscous, tacky, stringy tar-like material that partially coats the sand grains and exhibits a moderate naphthalene-like odor, was observed at investigation locations on the Off-Site Property adjacent to the Patchogue Former MGP Site. Petroleum impacts, noted through visual and olfactory observations during the investigation activities, were co-mingled with the MGP-related impacts.

As discussed above in Section 2.3.3.2, additional groundwater quality data is necessary to evaluate the extent of MGP-related dissolved-phase constituents that may extend partially onto the Off-Site Property.

Source material is considered to be the DNAPL identified during visual observations noted as part of the investigation activities and described in the boring logs as black viscous, tacky, stringy tar-like material that partially coats the sand grains and exhibits a moderate naphthalene-like odor. MGP-related DNAPL impacts are the contaminants of concern and the source material of impacts to soils and potentially to groundwater. Potentially impacted groundwater would be remediated by the treatment or removal of MGP DNAPL impacts as the potential source to potential groundwater impacts on the Off-Site Property.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the ROD dated March 31, 2011 are as follows:

Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

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

NAPL (in the form of DNAPL)

RAOs for Environmental Protection

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

Soil Vapor

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

2.5 Remaining MGP-Related Impacts

2.5.1 Site Soils

Tables 4A1, 4A2 and 4A3 and Figures 8A, 8B and 8C summarize the results of remaining MGP-related on-site impacts that exceed the Unrestricted Use, Restricted Residential Use or Commercial Use SCOs, respectively, after completion of remedial action. The exceedances are observed in soil samples collected from depths that range from one to 10 feet bgs. One or more PAH compounds exceed the applicable SCOs at eight on-site soil boring locations; no exceedances of BTEX were observed at these locations.

2.5.2 Off-Site Property Soils

Table 4B1, 4B2 and 4B3 as well as Figures 8A, 8B and 8C summarize the results of remaining MGP-related off-site impacts that exceed the Unrestricted Use, Restricted Residential Use or Commercial Use SCOs, respectively, after completion of remedial action. The exceedances are observed in soil samples collected from five to seven feet bgs. One or more PAH compounds exceed the applicable SCOs at two off-site soil boring locations; no exceedances of BTEX were observed at these locations.

2.5.3 Groundwater

Isolated impacts to groundwater were detected in two monitoring wells (MW-5 and MW-6), during the RI, in the area of the former MGP operations and DNAPL-impacted soils. The isolated exceedances of the Class GA groundwater quality criteria

noted in the samples are anticipated to diminish since the DNAPL-impacted soils (source material) is addressed. Groundwater monitoring activities will continue at the Site to assess natural attenuation, as determined by the NYSDEC, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the Site Standards, Criteria and Guidelines (SCGs), or have become asymptotic at an acceptable level over an extended period.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Should MGP-related impacts remain at the Site/Off-Site Property after implementation of the remedy, Institutional Controls (ICs) and Engineering Controls (ECs) will be required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of IC/ECs at the Site. The IC/EC Plan is one component of this ISMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of IC/ECs on the Site and the Off-Site Property;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement for the Site (to be established after implementation of the remedy);
- A description of the DCR for the Site as well as the Off-Site Property as established through agreement between National Grid and the owner of the Off-Site Property;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix F) for the proper handling of remaining MGP-related impacts that may be disturbed during maintenance or redevelopment work on the Site;
- A description of the roles and responsibilities of each party with respect to this ISMP, and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the remedy, as determined by the NYSDEC.

3.2 Institutional Controls

3.2.1 Site Institutional Controls

A series of ICs is required by the ROD to be implemented at the Site after completion of the remedy: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining MGP-related impacts; and, (3) limit the use and development of the Site to restricted residential, commercial and industrial uses only. Adherence to these ICs on the Site is required by the Environmental Easement and will be implemented under this ISMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 9. These ICs are:

- The RP (Respondent) or Site Owner is to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
- The property may be used for: restricted residential, commercial and industrial use or as defined by Part 375-1.8(g), though land use is subject to local zoning laws;
- ECs must be operated and maintained by National Grid as specified in this ISMP;
- ECs must be inspected at a frequency and in a manner defined in the ISMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the New York State Department of Health (NYSDOH) or the Suffolk County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in this ISMP;
- Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in this ISMP;
- Future intrusive activities that will disturb remaining MGP-related impacted material must be conducted in accordance with this ISMP;

- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this ISMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this ISMP;
- Access to the Site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement (to be established after implementation of the remedy).
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 9, and any potential impacts that are identified must be monitored or mitigated;
- Vegetable gardens and farming on the Site are prohibited;
- Must comply with the Department approved ISMP; and
- Must comply with the Department approved Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP).

3.2.2 Off-Site Property Institutional Controls

ICs will be implemented after completion of the remedy at the Off-Site Property, which are agreed to between National Grid and the owner of the Off-Site Property. The ICs include: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to remaining MGP-related impacts; and, (3) limit the use and development of the Off-Site Property to restricted residential, commercial and industrial uses. The Off-Site Property owner agrees to execute and record a Declaration of Covenants and Restrictions (DCR) to memorialize the ISMP. The IC boundaries are shown on Figure 9. These ICs are:

- The RP (Respondent) is to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
- The Off-Site Property may be used for: restricted residential, commercial and industrial use or as defined by Part 375-1.8(g), though land use is subject to local zoning laws;

- ECs must be operated and maintained by the Owner through notification to National Grid as specified in this ISMP;
- National Grid will inspect at a frequency and in a manner defined in the ISMP.
- The use of groundwater underlying the Off-Site Property will be prohibited without prior approval of National Grid in order to ensure it is safe for use as drinking water or for industrial purposes. The owner of the Off-Site Property must first notify National Grid and obtain written approval to do so from the National Grid;
- Groundwater and other environmental or public health monitoring must be performed as defined in this ISMP;
- Data and information pertinent to management of the Off-Site Property must be reported to National Grid at the frequency and in a manner as defined in this ISMP;
- The Owner of the Off-Site Property must notify National Grid prior to future intrusive activities that will disturb remaining MGP-related impacted material. The invasive activities must be conducted in accordance with this ISMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this ISMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this ISMP;
- Access to the Off-Site property must be provided to National Grid with reasonable prior notice to the owner of the Off-Site Property to assess compliance with the restrictions identified by the DCR.
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 9, and any potential impacts that are identified must be monitored or mitigated;
- Vegetable gardens and farming on the Off-Site Property are prohibited;
- Must comply with the DCR and the provisions of this ISMP; and
- Must comply with National Grid's Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP).

3.3 Engineering Controls

The following engineering controls (ECs) are to be implemented after completion of the remedy on the Site and the Off-Site Property.

3.3.1 Site Engineering Controls

3.3.1.1 Site - Soil Cover System

The western portion of the Site was subject to previous remedial activities to allow for relocated on the utility poles currently on the eastern perimeter of the Site to the western side. The remedial activities included, but were not limited to, establishment of a 24 inches of clean gravel cover which minimizes potential exposure to MGP-related impacts in this area.

Exposure to remaining MGP-related impacts at the Site is prevented by a cover system placed over the Site. This cover system is comprised of a minimum of 24 inches of clean backfill. Figure 10 presents the location of the cover system and applicable demarcation layers. The EWP provided in Appendix F outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining MGP-related impacts are disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this ISMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a HASP and associated CAMP prepared for the Site and provided in Appendix G.

3.3.1.2 Site – Perimeter Fencing with Lockable Gates

Unauthorized access to the Site is prevented by fencing with lockable gates placed around the perimeter of the Site. The fence is 6 feet in height. Figure 10 presents the location of the fencing. Procedures for the inspection of the fencing are documented in the Monitoring and Sampling Plan (Section 4.0 of this ISMP). Figure 10 shows the location of the ECs for the Site.

3.3.2 Off-Site Property Engineering Controls – Asphalt and Building Cover System

Exposure to the remaining MGP-related impacts on the adjacent Off-Site Property are minimized by the presence of the building and its foundation system as well an asphalt cover system. Figure 10 presents the location of the cover system. Procedures for the inspection of the asphalt cover are documented in the Monitoring and Sampling Plan (Section 4.0 of this ISMP). Figure 10 shows the location of the ECs for the Off-Site Property.

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered complete when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

3.3.3.1 Site - Soil Cover System

The on-site soil cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this ISMP in perpetuity.

3.3.3.2 Site – Perimeter Fencing with Lockable Gates

The on-site fencing system is a permanent control and the quality and integrity of this system, will be inspected at defined, regular intervals in accordance with this ISMP in perpetuity.

3.3.3.3 Off-Site Property – Building and Asphalt Cover System

The building and its foundation and the asphalt cover system on the Off-Site Property is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this ISMP in perpetuity.

3.3.3.4 Monitoring Wells associated with Monitored Natural Attenuation

National Grid, as the RP, will perform post-remediation groundwater monitoring activities, via a monitoring well network, on the Site and the Off-Site Property to assess natural attenuation will continue, as determined by the NYSDEC in consultation with NYSDOH, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the Site SCGs, or have become asymptotic at an acceptable level over an extended period. The monitoring well network to be utilized to perform the post-remediation monitoring will be developed during the design phase of the remedial project. Semi-annual groundwater monitoring which is currently conducted at the Site and the Off-Site Property may or may not be conducted during implementation of the remedy. In the event that monitoring data indicates that monitoring for natural attenuation may no longer be required, a proposal to discontinue the system will be submitted by the RP. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

It is the responsibility of the owner of the Off-Site Property to provide National Grid (or subsequent property owners) access to the monitoring wells located on the Off-Site Property. National Grid (or subsequent property owners) will supply the Off-Site Property owner with a minimum of three days' notice prior to the need to access the wells.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy on both the Site and the Off-Site Property. National Grid, as the RP (Respondent), maintains responsibility for implementing the requirements of the Monitoring and Sampling Plan. The owner of the Off-Site Property maintains the notification requirements included in this ISMP. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. National Grid maintains responsibility to present proposed revisions of the plan to the NYSDEC and gain their approval. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for samples collected as part of Site management for the Site are included in the Quality Assurance Project Plan (QAPP) provided in Appendix H.

This Monitoring and Sampling Plan, to be implemented by National Grid, describes the methods to be used for:

- Sampling and analysis of groundwater via wells located on the Site as well as on the Off-Site Property;
- Monitoring of the cover systems on the Site and the Off-Site Property;
- Monitoring of the perimeter fencing and lockable gates on the Site;
- Assessing compliance with applicable NYSDEC SCGs, particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating Site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on designed monitoring systems;

- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Inspection and maintenance requirements for the soil and asphalt cover;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this ISMP.

4.2 Site-Wide Inspection

A comprehensive site-wide inspection will be performed by National Grid's Qualified Environmental Professional (QEP) on both the Site and the Off-Site Property and documented annually by National Grid. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed by National Grid's QEP after severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix I – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with ICs, including usage of the Site and the Off-Site Property;
- An evaluation of the condition and continued effectiveness of ECs located on the Site and the Off-Site Property;
- General conditions of the Site and the Off-Site Property at the time of the inspection;
- The management activities being conducted on the Site and the Off-Site Property including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that Site and Off-Site Property records are up to date.

Inspections of remedial components installed at the Site and the Off-Site Property will be conducted by National Grid's QEP. A comprehensive site-wide inspection will be conducted and documented according to the ISMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs located on the Site and the Off-Site Property continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this ISMP and the Environmental Easement established on the Site;
- Compliance with requirements of this ISMP and the DCR established on the Off-Site Property;
- Achievement of remedial performance criteria; and
- If Site and Off-Site records are complete and up to date.

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed by National Grid's QEP on the Site and the Off-Site Property in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the Site or the Off-Site Property, once National Grid is notified by 210 West Main Realty Corp., verbal notice to the NYSDEC, by National Grid once notified, must be given by noon of the following day, to the extent possible. In addition, an inspection of the Site and the Off-Site Property will be conducted by National Grid's QEP within 5 days of the event to verify the effectiveness of the ICs and ECs . Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public. This confirmation will be made by National Grid.

4.3 Post-Remediation Monitoring and Sampling

National Grid's QEP will collect groundwater samples from the monitoring wells located on the Site and the Off-Site Property on a semi-annual basis. Sampling locations, required analytical parameters and schedule are provided in Table 5 – Post Remediation Groundwater Sampling Requirements and Schedule. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Detailed sample collection and analytical procedures and protocols are provided in Appendix J – Generic Field Sampling Plan (FSP) and Appendix H – Generic QAPP.

4.3.1 Groundwater Sampling

Groundwater monitoring will be performed by National Grid's QEP using the monitoring wells located on the Site and the Off-Site Property on a semi-annually to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells will be installed to monitor upgradient, on-site and downgradient groundwater conditions at the Site. The network of wells on the Site and the Off-Site Property will be designed to determine the degree of contaminant reduction in the groundwater associated with implementation of the remedy and natural attenuation processes.

Table 6 summarizes the well identification numbers, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the current pre-remediation groundwater monitoring, upgradient wells, on-site wells and downgradient wells are sampled to evaluate the effectiveness of the remedial system. Monitoring well construction logs are included in Appendix C of this document. A plan for the post-remediation monitoring well network will be developed during the design of the remedial plan.

If biofouling or silt accumulation occurs in the monitoring wells located on the Site and/or the Off-Site Property, the wells will be physically agitated/surged and redeveloped by National Grid's QEP. Additionally, monitoring wells will be properly decommissioned and replaced by National Grid's QEP, if an event renders the wells unusable.

Repair and/or replacement of wells in the monitoring well network will be performed by National Grid's QEP based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the

NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This ISMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.3.2 Monitoring and Sampling Protocol

Sampling activities will be recorded by National Grid's QEP in a field book and associated sampling log as provided in Appendix I - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the Generic FSP provided as Appendix J of this document.

4.4 Engineering Control Monitoring

The cover systems and the perimeter fencing with lockable gates at the Site and the cover systems on the Off-Site Property provide a physical barrier over remaining MGP-related impacts. Annual inspections of these ECs will be performed by National Grid's QEP in order to determine their integrity, operability, and effectiveness. The ECs will be inspected to document that they continue to function as designed and intended to protect public health and safety and the environment. National Grid's QEP will conduct the inspections of the ECs on the Site and the Off-Site Property. Correction of deficiencies and/or required maintenance will be conducted in a timely manner by National Grid for the ECs on the Site. The Owner of the Off-Site Property will maintain responsibility to monitor and maintain the ECs on the Off-Site Property once established after implementation of the remedy. Each, alteration, excavation, or disturbance of the ECs is to

be addressed appropriately and in a timely manner to maintain the integrity of the engineering control. A record of inspections will be maintained by National Grid, including the inspection dates, name of the inspector, and results of inspection. During these inspections, an inspection form will be completed as provided in Appendix I – Site Management Forms.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

The remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to be constructed on the Site or the Off-Site Property to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this ISMP. As such, National Grid does not anticipate maintaining responsibility regarding the operation or maintenance of any active post-remedial systems.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

Periodic assessments/evaluations of the effectiveness of the implementation of a remedy or the post-remedy implementation conditions of the Site and the Off-Site Property are to be conducted in accordance with the requirement of this ISMP. National Grid will maintain responsibility to perform these assessments/evaluation on the Site and the Off-Site Property.

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the Site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding. A vulnerability assessment has not been prepared for the Site at the time of the preparation of this SMP. A vulnerability assessment will not be conducted as part of this ISMP. The assessment will be performed as part of the final design of the remedy including the stormwater management practices as well as the placement of post-remedial groundwater monitoring wells.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the ISMP provides a summary of any green remediation evaluations to be completed for the Site and the Off-Site Property during management of these sites, and as reported in the Periodic Review Report (PRR).

National Grid will maintain responsibility to perform the Green Remediation Evaluation before the implementation of additional investigation activities to be conducted on the Off-Site Property, during remedy design and implementation and throughout the duration of the management activities covered under this ISMP both on the Site and the Off-Site Property. At the time of the preparation of this ISMP, no additional investigation activities are proposed for the Site.

The major component of the remedy to be implemented at the Site is the ISS of MGP source materials. ISS is generally considered a greener remediation technology than excavation and off-site disposal. The green aspects of ISS are discussed in the following subsections of this ISMP.

Material Usage:

The ISS activities to be implemented at the Site may utilize either Portland cement or coal fired power plants byproducts. Use of coal fired power plant byproducts uses recycled materials to replace the Portland cement, minimizing waste products and the embedded energy and greenhouse gases related to production of the raw Portland cement material.

Water Conservation:

Implementing ISS at the Site will conserve local water supplies. ISS can be performed "in the wet," which eliminates the requirement for dewatering or other groundwater management during excavation. Additionally, water that is removed from an excavation footprint often requires treatment and discharge to local waterways or to a municipal sewer. This is energy intensive and can impact local water balances, depending on the amount of water that requires discharge.

Energy Conservation:

ISS requires on-site machinery and equipment usage. While there are deliveries of materials to the Site, in general, the number of equipment-hours and related fuel consumption required for completion of the remedy is less than the number of equipment-hours and related fuel consumption required for excavation and off-site transport of materials for disposal. This results in a reduction of energy used on-site in the form of

diesel fuel. ISS will also require a lesser duration of implementation, further reducing energy requirements on-site during

Impact To Community:

ISS is performed within the Site footprint, and typically does not require the large volume of truck traffic associated with remove of impacted materials for off-site disposal or the deliveries of backfill to the Site. This reduces the impacts to the neighboring community. Related impacts to the community that could be a reduced by ISS include increased traffic including that of heavy trucks, their wear-and-tear on local roadways, and related particulate emissions from their operation. There are also impacts to the community in which the final disposal facility is located in the form of long-term management of the contaminants which impact the material.

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the NYSDEC Project Manager feels appropriate (e.g., during significant maintenance events or in conjunction with storm recovery activities). No major system components are anticipated to be part of the remedy to be implemented on the Site and the Off-Site Property. If necessary, as noted above, National Grid will be responsible to perform this evaluation on both the Site and the Off-Site Property.

Modifications resulting from green remediation evaluations will be routinely implemented by National Grid, as necessary, on both the Site and the Off-Site Property and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR. As noted above, no major remedial system components are to remain on the Site and the Off-Site property after completion of the implementation of the remedy.

6.2.2 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site and the Off-Site Property and use of consumables in relation to visiting the Site and the Off-Site Property in order to evaluate

the conditions of the engineering controls, changes in Site/Off-Site Property usage and/or to collect samples, and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities will be prepared by National Grid so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

7.0. REPORTING REQUIREMENTS

7.1 Site Management Reports

Site management inspection, maintenance and monitoring events will be recorded by National Grid's QEP on the appropriate Site Management Forms provided in Appendix I. These forms are subject to revision by the NYSDEC for use on the Site or by National Grid for use on the Off-Site Property.

Applicable inspection forms and other records, including groundwater sampling reports, generated for the Site and the Off-Site Property by National Grid during the reporting period will be provided in electronic format to the NYSDEC by National Grid's QEP in accordance with the requirements of Table 7 and summarized in the Periodic Review Report (PRR).

Table 7: Schedule of Interim Monitoring/Inspection Reports

All reporting will be prepared and submitted to the NYSDEC by National Grid's QEP.

Task/Report	Reporting Frequency*
Inspection Report	Annually**
Periodic Review Report	Annually
Groundwater Monitoring Report	Semi-Annually

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

**As the frequency of the Inspection Report and the Periodic Review Report are both annual, the results of the annual inspection will be included in the Period Review Report. A separate Inspection Report will not be prepared.

Interim monitoring/inspection reports to be prepared by National Grid on the Site and the Off-Site Property will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., groundwater, soil, etc.);
- Copies of field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of laboratory data sheets and the required laboratory data deliverables required for points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

National Grid is responsible to conduct the interim monitoring and inspections on the Site and the Off-Site Property. National Grid will prepare the Interim Monitoring/Inspection Reports to document the results of these interim monitoring and inspection activities. Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;

- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and,
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

No remedial system components are anticipated to remain on the Site and the Off-Site Property after completion of the implementation of the remedy. Therefore, the completion of maintenance event reporting forms is not anticipated.

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

7.2 Periodic Review Report

A PRR will be submitted for the Site by National Grid's QEP to the Department beginning 90 days after the end of the first year after approval of this ISMP. The PRR will be prepared and submitted to the NYSDEC by National Grid and summarize activities subject to this ISMP conducted on the Site and the Off-Site Property. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the

event that the Site or the Off-Site Property is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the Site and the Off-Site Property by National Grid described in Appendix A - Environmental Easement (Site only). The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 90 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report, to be prepared by National Grid, will include:

- Identification, assessment and certification of ECs and ICs required by the remedy for the Site.
- Results of the required annual inspections and after severe weather condition, if applicable, inspections of the Site and the Off-Site Property conducted by National Grid's QEP.
- Applicable site management forms and other records generated for the Site/Off-Site Property by National Grid's QEP during the reporting period in electronic format, if not previously submitted.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater) to be prepared by National Grid's QEP, which include a listing of compounds analyzed, along with the applicable standards, with exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of analyses, copies of laboratory data sheets, and the required laboratory data deliverables for samples collected by National Grid's QEP during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- An evaluation of the Site and the Off-Site Property by National Grid's QEP, which includes the following:
    - The compliance of the remedy with the requirements of the ROD;
    - Any new conclusions or observations regarding contamination based on inspections of the Site and the Off-Site Property conducted by National Grid's QEP or data generated by the Monitoring and

Sampling Plan for the media being monitored; and

- Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan.

The PRRs for the Site and the Off-Site Property will be submitted by National Grid, in hard-copy format, to the NYSDEC Central Office and Regional Office in which the Site/Off-Site Property is located, and in electronic format to the NYSDEC Central Office, the NYSDEC Regional Office and the NYSDOH Bureau of Environmental Exposure Investigation.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a National Grid's New York State Professional Engineer or Qualified Environmental Professional will prepare, and include in the PRR, the following certification as per the requirements of NYSDEC DER-10:

For the Site:

"*For each institutional or engineering control identified for the Site, I certify that all of the following statements are true:*

- *The inspection of the Site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this Site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any ISMP for this control;*
- *Access to the Site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*

- *If a financial assurance mechanism is required under the oversight document for the Site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the Site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, Marek Ostrowski, of Brown and Caldwell located at 2 Park Way, Upper Saddle River, New Jersey, am certifying as the Owner's/Remedial Party's/Respondent's Designated Site Representative have been authorized and designated by the owner Remedial Party to sign this certification for the Site."

For the Off-Site Property:

"*For each engineering control identified for the Off-Site Property, I certify that all of the following statements are true:*

- *The inspection of the Off-Site Property to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The engineering control(s) employed at this Off-Site Property is unchanged from the date the control was put in place, or last approved by the National Grid;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any ISMP for this control;*

- *Access to the Off-Site Property will continue to be provided to National Grid to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the Off-Site Property, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the Off-Site Property is compliant with this ISMP;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Off-Site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, Marek Ostrowski, of Brown and Caldwell located at 2 Park Way, Upper Saddle River, New Jersey, am certifying as the Owner's/Remedial Party's/Respondent's Designated Site Representative have been authorized and designated by the owner Remedial Party to sign this certification for the Site."

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed on the Site or the Off-Site Property, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC by National Grid's Qualified Environmental Professional for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

8.0 REFERENCES

6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

Brown and Caldwell Associates, May 2011. *Focused Feasibility Study, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk.*

Brown and Caldwell Associates, February 2012. *Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York.*

Brown and Caldwell Associates, February 2012. *Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182*.

Brown and Caldwell Associates, December 2012. *Remedial Design Report (50%-75% Submission), Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York.*

NYSDEC, 2011. DER-31 / Green Remediation. August 11, 2010 (January 20, 2011 Addendum).

NYSDEC, 2010. *DER-10 / Technical Guidance for Site Investigation and Remediation*. Office of Remediation and Materials Management. May 3, 2010.

NYSDEC, 1998. *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1.* June 1998 (April 2000 addendum).

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

Vanessa, Hangen, Brustlin, March 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.*

TABLES

TABLE 2
GROUNDWATER ELEVATION MEASUREMENTS
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

	6/22/2015					
Well ID	Top of Casing Elevation [(a)] (ft., NAVD)	Depth to Water (ft., BTOC)	Water Elevation (ft., NAVD)	Depth to NAPL (ft., BTOC)	Total Depth of Well (ft., BGS)	Remarks
MW-1	11.47	5.81	5.66	ND	15.22	
MW-3	5.56	2.45	3.11	ND	10.56	
MW-4S	7.97	5.07	2.90	ND	12.25	
MW-4D	7.79	4.83	2.96	ND	26.68	
MW-5	NA [(b)]	NA	NA	13.03	13.19	Red brown NAPL blebs on probe.
MW-6	5.01	0.45	4.56	4.51	18.48	Probe indicates NAPL at 4.51' BTOC,moderate tar-like odor.
MW-7S	8.45	4.52	3.93	ND	12.43	
MW-7D	8.31	4.34	3.97	ND	28.25	
MW-8S	5.08	0.93	4.15	ND	9.95	
MW-8D	4.98	0.80	4.18	ND	25.14	
MW-9S	4.47	1.55	2.92	ND	--	
MW-9D	4.66	1.51	3.15	ND	--	
SG-1	5.23	4.07	1.16	ND	NA	
SG-2	5.17	NA	NA	ND	NA	
PZ-1A	8.05	3.64	4.41	ND	10.08	
PZ-1B	8.91	4.55	4.36	ND	22.54	
PZ-2A	8.77	4.43	4.34	ND	--	Faint tar-like odor.
PZ-2B	8.29	3.92	4.37	ND	--	Moderate tar-like odor.
PZ-3A	8.78	4.88	3.90	ND	8.91	Moderate tar-like odor.
PZ-3B	8.90	5.18	3.72	ND	21.26	
PZ-4A	4.79	1.72	3.07	ND	4.88	

Notes:
NAVD - North American Vertical Datum
BGS - Below Ground Surface
BTOC - Below Top of Casing
NAPL - Non-aqueous phase liquid
NA - Not applicable
ND - Not Detected
(a) - Monitoring wells resurveyed on 7/3/12 following utility corridor construction activities. See "Construction Completion Report, Utility Corridor Work Plan Implementation (Brown and Caldwell, December 2012)".
(b) - Above ground casing at MW-5 was lowered during utility corridor construction activities, but was not resurveyed.
(--) - Not Measured

TABLE 3
HISTORICAL AND REMEDIAL DOCUMENTS
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Description	Report Date	Author
Preliminary Site Assessment Work Plan, Patchogue	May 2001	VHB/Vanasse Hangen Brustin, Inc.
Preliminary Site Assessment Report, Order on Consent D1-0001-99-05, NYDEC Site No. 1-52-182, Former Patchogue MGP Site, Village of Patchogue, Suffolk County, New York	March 2002	VHB/Vanasse Hangen Brustin, Inc.
Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York	December 2009	Tetra Tech EC, Inc.
Work Plan for Pre-Design Investigation Activities	May 10, 2010	BC Associates
Supplemental Pre-Design Investigation Work Plan, Patchogue, Suffolk County, New York, Site No. 1-52-182	September 14, 2010	BC Associates
Focused Feasibility Study, Patchoge Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk	May 2011	BC Associates
First Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site - Site ID No. 1-52-182, Patchgue, New York	May 2011	BC Associates
Second Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	July 2011	BC Associates
Third Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	October 2011	BC Associates
Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182	February 8, 2012	BC Associates
Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	February 2012	BC Associates
Fourth Quarter 2011 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	February 2012	BC Associates
First Quarter 2012 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	May 2012	BC Associates
Second Quarter 2012 Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	September 2012	BC Associates
Remedial Design Report (50-75% Submission), Patchoge Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	December 2012	BC Associates
Construction Completion Report, Utility Corridor Work Plan Implementation, Patchogue Former Manufactured Gas Plant Site, BYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	December 2012	BC Associates
Second Half 2012 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	April 2013	BC Associates
Off-Site Investigation Work Plan	August 8, 2013	BC Associates
First Half 2013 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	October 2013	BC Associates
Second Half 2013 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2013	BC Associates
First Half 2014 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	November 2014	BC Associates
Second Half 2014 Semi-Annual Groundwater Monitoring Report, Patchogue Former MGP Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York	March 2015	BC Associates

TABLE 4A1
REMAINING ON-SITE SOIL SAMPLE EXCEEDANCES OF NYSPART375 UNRESTRICTED USE (UU)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375UU	Units	PASB-03 4-6 PSA	PASB-08 6-10 PSA	PASB-23 3-5 RI	PASB-31 2-4 RI	PASB-33 1-3 RI	SB-112 1-3 SPDI	SB-113 1-3 SPDI	SB-114 1-3 SPDI
Volatile Organic Compounds (VOCs)										
BTEX										
Benzene	0.06	mg/kg	0.013 B	0.005 U	0.0043 U	0.0043 U	0.0043 U	0.0006 U	0.0006 J	0.0009 J
Toluene	0.7	mg/kg	0.014	0.005 U	0.0048 U	0.0048 U	0.0052 U	0.001 U	0.001 J	0.001 J
Ethylbenzene	1	mg/kg	0.005 U	0.005 U	0.0053 U	0.014 J	0.0048 U	0.001 U	0.001 J	0.002 J
Xylenes, Total	0.26	mg/kg	0.002 J	0.015 U	NA	NA	NA	0.001 U	0.001 U	0.006
Total BTEX	NE	mg/kg	0.029	ND	ND	0.014 J	ND	ND	0.0026	0.0099
Polycyclic Aromatic Hydrocarbons (PAHs)										
Acenaphthene	20	mg/kg	0.33 U	0.33 U	0.17 J	9.1 D	0.24 J	0.038 U	0.17 J	0.11 J
Acenaphthylene	100	mg/kg	0.33 U	0.33 U	0.58	1.1	2.6	1.2	3.2	0.84
Anthracene	100	mg/kg	0.17 J	0.33 U	0.61	8 D	39 D	1	2.2	0.89
Benzo(a)anthracene	1	mg/kg	0.33 U	0.33 U	2	6.1	8.2	3.1	12	2
Benzo(a)pyrene	1	mg/kg	1.4	1	0.95	5.4	8	3.4	8	2.1
Benzo(b)fluoranthene	1	mg/kg	0.33 U	0.33 U	2.1	4.7	9.1	3.9	14	3.4
Benzo(g,h,i)perylene	100	mg/kg	1.1	0.55	1.4	2.5	6.5	2.7	9.1	2.1
Benzo(k)fluoranthene	0.8	mg/kg	0.69	0.25 J	0.95	1.3	3.5	1.5	4.4	1.5
Chrysene	1	mg/kg	0.33 U	0.33 U	2.1	5.1	17 D	3.7	15	2.6
Dibenzo(a,h)anthracene	0.33	mg/kg	0.71	0.4	0.34 J	0.57 J	1.2 J	0.65	1.6	0.52
Fluoranthene	100	mg/kg	1.7	0.94	3	11 D	14	2.5	14	2
Fluorene	30	mg/kg	0.71	0.34	0.27 J	6.2	1.4 J	0.16 J	0.62 J	0.16 J
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	0.6	1	0.88	1.6	4.2	2.5	8.6	2
Naphthalene	12	mg/kg	1.6	0.33 U	0.19 J	4.5	0.82 J	0.087 J	1.5	0.34
Phenanthrene	100	mg/kg	1.6	0.74	1.6	23 D	11	0.52	3	0.6
Pyrene	100	mg/kg	0.2 J	0.33 U	4.6 D	19 D	18 D	4.1	19	3.7
Total PAHs	NE	mg/kg	10	5.2	22	109	145	31	116	25
Inorganic Constituents										
Cyanide, Total	27	mg/kg	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA

Notes:
NYSPART375UU - NYS Part 375 Unrestricted Use (UU) Soil Cleanup Objective.
PSA - Preliminary Site Assessment.
RI - Remedial Investigation samples
SPDI - Supplemental Pre-Design Investigation samples
Values presented with an underline exceed the NYSPART375UU
U - The analyte was analyzed for, but was not detected. Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.
J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.
B - Analyte was found in the sample as well as the associated blank.
D - Diluted
ND - Not detected.
NA - Not analyzed.
NE- Not established.

TABLE 4A2
REMAINING ON-SITE SOIL SAMPLE EXCEEDANCES OF NYSPART375 - RESTRICTED RESIDENTIAL (RR)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375RR	Units	PASB-03 4-6 PSA	PASB-08 6-10 PSA	PASB-23 3-5 RI	PASB-31 2-4 RI	PASB-33 1-3 RI	SB-112 1-3 SPDI	SB-113 1-3 SPDI	SB-114 1-3 SPDI
Volatile Organic Compounds (VOCs)										
BTEX										
Benzene	2.9	mg/kg	0.013 B	0.005 U	0.0043 U	0.0043 U	0.0043 U	0.0006 U	0.0006 J	0.0009 J
Toluene	100	mg/kg	0.014	0.005 U	0.0048 U	0.0048 U	0.0052 U	0.001 U	0.001 J	0.001 J
Ethylbenzene	30	mg/kg	0.005 U	0.005 U	0.0053 U	0.014 J	0.0048 U	0.001 U	0.001 J	0.002 J
Xylenes, Total	100	mg/kg	0.002 J	0.015 U	NA	NA	NA	0.001 U	0.001 U	0.006
Total BTEX	NE	mg/kg	0.029	ND	ND	0.014 J	ND	ND	0.0026	0.0099
Polycyclic Aromatic Hydrocarbons (PAHs)										
Acenaphthene	100	mg/kg	0.33 U	0.33 U	0.17 J	9.1 D	0.24 J	0.038 U	0.17 J	0.11 J
Acenaphthylene	100	mg/kg	0.33 U	0.33 U	0.58	1.1	2.6	1.2	3.2	0.84
Anthracene	100	mg/kg	0.17 J	0.33 U	0.61	8 D	39 D	1	2.2	0.89
Benzo(a)anthracene	1	mg/kg	0.33 U	0.33 U	2	6.1	8.2	3.1	12	2
Benzo(a)pyrene	1	mg/kg	1.4	1	0.95	5.4	8	3.4	8	2.1
Benzo(b)fluoranthene	1	mg/kg	0.33 U	0.33 U	2.1	4.7	9.1	3.9	14	3.4
Benzo(g,h,i)perylene	100	mg/kg	1.1	0.55	1.4	2.5	6.5	2.7	9.1	2.1
Benzo(k)fluoranthene	1	mg/kg	0.69	0.25 J	0.95	1.3	3.5	1.5	4.4	1.5
Chrysene	1	mg/kg	0.33 U	0.33 U	2.1	5.1	17 D	3.7	15	2.6
Dibenzo(a,h)anthracene	0.33	mg/kg	0.71	0.4	0.34 J	0.57 J	1.2 J	0.65	1.6	0.52
Fluoranthene	100	mg/kg	1.7	0.94	3	11 D	14	2.5	14	2
Fluorene	100	mg/kg	0.71	0.34	0.27 J	6.2	1.4 J	0.16 J	0.62 J	0.16 J
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	0.6	1	0.88	1.6	4.2	2.5	8.6	2
Naphthalene	100	mg/kg	1.6	0.33 U	0.19 J	4.5	0.82 J	0.087 J	1.5	0.34
Phenanthrene	100	mg/kg	1.6	0.74	1.6	23 D	11	0.52	3	0.6
Pyrene	100	mg/kg	0.2 J	0.33 U	4.6 D	19 D	18 D	4.1	19	3.7
Total PAHs	NE	mg/kg	10	5.2	22	109	145	31	116	25
Inorganic Constituents										
Cyanide, Total	27	mg/kg	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA

Notes:
NYSPART375RR - NYS Part 375 Restricted Residential (RR) Soil Cleanup Objective.
PSA - Preliminary Site Assessment.
RI - Remedial Investigation samples
SPDI - Supplemental Pre-Design Investigation samples
Values presented with an underline exceed the NYSPART375RR
U - The analyte was analyzed for, but was not detected. Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.
J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.
B - Analyte was found in the sample as well as the associated blank.
D - Diluted
ND - Not detected.
NA - Not analyzed.
NE- Not established.

TABLE 4A3
REMAINING ON-SITE SOIL SAMPLE EXCEEDANCES OF NYSPART375 COMMERCIAL USE (C)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375C	Units	PASB-03 4-6 PSA	PASB-08 6-10 PSA	PASB-23 3-5 RI	PASB-31 2-4 RI	PASB-33 1-3 RI	SB-112 1-3 SPDI	SB-113 1-3 SPDI	SB-114 1-3 SPDI
Volatile Organic Compounds (VOCs)										
BTEX										
Benzene	44	mg/kg	0.013 B	0.005 U	0.0043 U	0.0043 U	0.0043 U	0.0006 U	0.0006 J	0.0009 J
Toluene	500	mg/kg	0.014	0.005 U	0.0048 U	0.0048 U	0.0052 U	0.001 U	0.001 J	0.001 J
Ethylbenzene	390	mg/kg	0.005 U	0.005 U	0.0053 U	0.014 J	0.0048 U	0.001 U	0.001 J	0.002 J
Xylenes, Total	500	mg/kg	0.002 J	0.015 U	NA	NA	NA	0.001 U	0.001 U	0.006
Total BTEX	NE	mg/kg	0.029	ND	ND	0.014 J	ND	ND	0.0026	0.0099
Polycyclic Aromatic Hydrocarbons (PAHs)										
Acenaphthene	500	mg/kg	0.33 U	0.33 U	0.17 J	9.1 D	0.24 J	0.038 U	0.17 J	0.11 J
Acenaphthylene	500	mg/kg	0.33 U	0.33 U	0.58	1.1	2.6	1.2	3.2	0.84
Anthracene	500	mg/kg	0.17 J	0.33 U	0.61	8 D	39 D	1	2.2	0.89
Benzo(a)anthracene	5.6	mg/kg	0.33 U	0.33 U	2	6.1	8.2	3.1	12	2
Benzo(a)pyrene	1	mg/kg	1.4	1	0.95	5.4	8	3.4	8	2.1
Benzo(b)fluoranthene	5.6	mg/kg	0.33 U	0.33 U	2.1	4.7	9.1	3.9	14	3.4
Benzo(g,h,i)perylene	500	mg/kg	1.1	0.55	1.4	2.5	6.5	2.7	9.1	2.1
Benzo(k)fluoranthene	56	mg/kg	0.69	0.25 J	0.95	1.3	3.5	1.5	4.4	1.5
Chrysene	56	mg/kg	0.33 U	0.33 U	2.1	5.1	17 D	3.7	15	2.6
Dibenzo(a,h)anthracene	0.56	mg/kg	0.71	0.4	0.34 J	0.57 J	1.2 J	0.65	1.6	0.52
Fluoranthene	500	mg/kg	1.7	0.94	3	11 D	14	2.5	14	2
Fluorene	500	mg/kg	0.71	0.34	0.27 J	6.2	1.4 J	0.16 J	0.62 J	0.16 J
Indeno(1,2,3-cd)pyrene	5.6	mg/kg	0.6	1	0.88	1.6	4.2	2.5	8.6	2
Naphthalene	500	mg/kg	1.6	0.33 U	0.19 J	4.5	0.82 J	0.087 J	1.5	0.34
Phenanthrene	500	mg/kg	1.6	0.74	1.6	23 D	11	0.52	3	0.6
Pyrene	500	mg/kg	0.2 J	0.33 U	4.6 D	19 D	18 D	4.1	19	3.7
Total PAHs	NE	mg/kg	10	5.2	22	109	145	31	116	25
Inorganic Constituents										
Cyanide, Total	27	mg/kg	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA

Notes:
NYSPART375C - NYS Part 375 Commercial (C) Soil Cleanup Objective.
PSA - Preliminary Site Assessment.
RI - Remedial Investigation samples
SPDI - Supplemental Pre-Design Investigation samples
Values presented with an underline exceed the NYSPART375C
U - The analyte was analyzed for, but was not detected. Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.
J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.
B - Analyte was found in the sample as well as the associated blank.
D - Diluted
ND - Not detected.
NA - Not analyzed.
NE- Not established.

TABLE 4B1
REMAINING OFF-SITE PROPERTY SOIL SAMPLE EXCEEDANCES OF NYSPART375 UNRESTRICTED USE (UU)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375UU	Units	PASB-37 5-7 RI	PASB-45 5-7 RI
Volatile Organic Compounds (VOCs)				
BTEX				
Benzene	0.06	mg/kg	0.11 U	0.024 J
Toluene	0.7	mg/kg	0.0054 U	0.084
Ethylbenzene	1	mg/kg	0.005 UJ	1.2 D
Xylenes, Total	0.26	mg/kg	NA	NA
Total BTEX	NE	mg/kg	ND	1.3
Polycyclic Aromatic Hydrocarbons (PAHs)				
Acenaphthene	20	mg/kg	7.2	23
Acenaphthylene	100	mg/kg	4.7	16
Anthracene	100	mg/kg	14	61
Benzo(a)anthracene	1	mg/kg	22	87 D
Benzo(a)pyrene	1	mg/kg	17	81
Benzo(b)fluoranthene	1	mg/kg	15	80
Benzo(g,h,i)perylene	100	mg/kg	9	19
Benzo(k)fluoranthene	0.8	mg/kg	5.2	24
Chrysene	1	mg/kg	0.32 U	87 D
Dibenzo(a,h)anthracene	0.33	mg/kg	2.3 J	1.7 J
Fluoranthene	100	mg/kg	43 D	120 D
Fluorene	30	mg/kg	11	25
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	7.5	13
Naphthalene	12	mg/kg	3.9 J	3.4 J
Phenanthrene	100	mg/kg	57 D	130 D
Pyrene	100	mg/kg	56 D	180 D
Total PAHs	NE	mg/kg	275	951
Inorganic Constituents				
Cyanide, Total	27	mg/kg	NA	NA

Notes:
NYSPART375UU - NYS Part 375 Unrestricted Use (UU) Soil Cleanup Objective.
PSA - Preliminary Site Assessment.
RI - Remedial Investigation samples
SPDI - Supplemental Pre-Design Investigation samples
Values presented with an underline exceed the NYSPART375UU
U - The analyte was analyzed for, but was not detected. Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.
J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.
B - Analyte was found in the sample as well as the associated blank.
D - Diluted
ND - Not detected.
NA - Not analyzed.
NE- Not established.

TABLE 4B2
REMAINING OFF-SITE PROPERTY SOIL SAMPLE EXCEEDANCES OF NYSPART375 RESTRICTED RESIDENTIAL (RR)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375RR	Units	PASB-37 5-7 RI	PASB-45 5-7 RI
Volatile Organic Compounds (VOCs)				
BTEX				
Benzene	2.9	mg/kg	0.11 U	0.024 J
Toluene	100	mg/kg	0.0054 U	0.084
Ethylbenzene	30	mg/kg	0.005 UJ	1.2 D
Xylenes, Total	100	mg/kg	NA	NA
Total BTEX	NE	mg/kg	ND	1.3
Polycyclic Aromatic Hydrocarbons (PAHs)				
Acenaphthene	100	mg/kg	7.2	23
Acenaphthylene	100	mg/kg	4.7	16
Anthracene	100	mg/kg	14	61
Benzo(a)anthracene	1	mg/kg	22	87 D
Benzo(a)pyrene	1	mg/kg	17	81
Benzo(b)fluoranthene	1	mg/kg	15	80
Benzo(g,h,i)perylene	100	mg/kg	9	19
Benzo(k)fluoranthene	1	mg/kg	5.2	24
Chrysene	1	mg/kg	0.32 U	87 D
Dibenzo(a,h)anthracene	0.33	mg/kg	2.3 J	1.7 J
Fluoranthene	100	mg/kg	43 D	120 D
Fluorene	100	mg/kg	11	25
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	7.5	13
Naphthalene	100	mg/kg	3.9 J	3.4 J
Phenanthrene	100	mg/kg	57 D	130 D
Pyrene	100	mg/kg	56 D	180 D
Total PAHs	NE	mg/kg	275	951
Inorganic Constituents				
Cyanide, Total	27	mg/kg	NA	NA

Notes:
NYSPART375RR - NYS Part 375 Restricted Residential (RR) Soil Cleanup Objective.
PSA - Preliminary Site Assessment.
RI - Remedial Investigation samples
SPDI - Supplemental Pre-Design Investigation samples
Values presented with an underline exceed the NYSPART375RR
U - The analyte was analyzed for, but was not detected. Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.
J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.
B - Analyte was found in the sample as well as the associated blank.
D - Diluted
ND - Not detected.
NA - Not analyzed.
NE- Not established.

TABLE 4B3
REMAINING OFF-SITE PROPERTY SOIL SAMPLE EXCEEDANCES OF NYSPART375 COMMERCIAL (C)
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Constituent	NYSPART375C	Units	PASB-37 5-7 RI	PASB-45 5-7 RI
Volatile Organic Compounds (VOCs)				
BTEX				
Benzene	44	mg/kg	0.11 U	0.024 J
Toluene	500	mg/kg	0.0054 U	0.084
Ethylbenzene	390	mg/kg	0.005 UJ	1.2 D
Xylenes, Total	500	mg/kg	NA	NA
Total BTEX	NE	mg/kg	ND	1.3
Polycyclic Aromatic Hydrocarbons (PAHs)				
Acenaphthene	500	mg/kg	7.2	23
Acenaphthylene	500	mg/kg	4.7	16
Anthracene	500	mg/kg	14	61
Benzo(a)anthracene	5.6	mg/kg	22	87 D
Benzo(a)pyrene	1	mg/kg	17	81
Benzo(b)fluoranthene	5.6	mg/kg	15	80
Benzo(g,h,i)perylene	500	mg/kg	9	19
Benzo(k)fluoranthene	56	mg/kg	5.2	24
Chrysene	56	mg/kg	0.32 U	87 D
Dibenzo(a,h)anthracene	0.56	mg/kg	2.3 J	1.7 J
Fluoranthene	500	mg/kg	43 D	120 D
Fluorene	500	mg/kg	11	25
Indeno(1,2,3-cd)pyrene	5.6	mg/kg	7.5	13
Naphthalene	500	mg/kg	3.9 J	3.4 J
Phenanthrene	500	mg/kg	57 D	130 D
Pyrene	500	mg/kg	56 D	180 D
Total PAHs	NE	mg/kg	275	951
Inorganic Constituents				
Cyanide, Total	27	mg/kg	NA	NA

Notes:
NYSPART375C - NYS Part 375 Commercial (C) Soil Cleanup Objective.
PSA - Preliminary Site Assessment.
RI - Remedial Investigation samples
SPDI - Supplemental Pre-Design Investigation samples
Values presented with an underline exceed the NYSPART375C
U - The analyte was analyzed for, but was not detected.Value indicates the actual limit of the quantitation necessary to accurately and precisely measure the analyte in the sample.
J - Estimated concentration. The result is below the quantitation limit but above the method detection limit.
B - Analyte was found in the sample as well as the associated blank.
D - Diluted
ND - Not detected.
NA - Not analyzed.

TABLE 5
POST REMEDIATION GROUNDWATER SAMPLING REQUIREMENTS AND SCHEDULE
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

Sample Location	Analytical Parameters			Schedule
	BTEX compounds (USEPA SW-846 Method 8260B)	Methyl Tertiary Butyl Ether (MTBE) (USEPA SW-846 Method 8260B)	PAHs (USEPA SW-846 Method 8270C)	
MW-1	X	X	X	Semi-Annually
MW-3	X	X	X	Semi-Annually
MW-4S	X	X	X	Semi-Annually
MW-4D	X	X	X	Semi-Annually
MW-5	X	X	X	Semi-Annually
MW-6	X	X	X	Semi-Annually
MW-7S	X	X	X	Semi-Annually
MW-7D	X	X	X	Semi-Annually
MW-8S	X	X	X	Semi-Annually
MW-8D	X	X	X	Semi-Annually
MW-9S	X	X	X	Semi-Annually
MW-9D	X	X	X	Semi-Annually
PZ-1A	X	X	X	Semi-Annually
PZ-1B	X	X	X	Semi-Annually
PZ-2A	X	X	X	Semi-Annually
PZ-2B	X	X	X	Semi-Annually
PZ-3A	X	X	X	Semi-Annually
PZ-3B	X	X	X	Semi-Annually
PZ-4A	X	X	X	Semi-Annually

TABLE 6

MONITORING WELL CONSTRUCTION DETAILS

PATCHOGUE FORMER MGP SITE

PATCHOGUE, NEW YORK

Monitoring Well ID	Well Location	Coordinates (Easting/Northing)	Well Diameter (inches)	Elevation (above mean sea level)			
				Casing	Surface	Screen Top	Screen Bottom
MW-1	Upgradient	Easting: 1255132.538 ft Northing: 219674.03 ft	2	11.23	7.53	0.53	-4.47
MW-3	Downgradient	Easting: 1255328.742 ft Northing: 219200.312 ft	2	5.56	5.42	0.42	-4.58
MW-4S	Downgradient	Easting: 1255290.459 ft Northing: 219131.475 ft	2	7.97	4.23	-0.77	-5.77
MW-4D	Downgradient	Easting: 1255291.583 ft Northing: 219134.531 ft	2	7.79	4.36	-15.64	-20.64
MW-7S	On-Site	Easting: 1255153.2993 ft Northing: 219212.046 ft	2	8.45	5.37	1.37	-3.63
MW-7D	On-Site	Easting: 1255151.943 ft Northing: 219210.1789 ft	2	8.31	5.20	-14.80	-19.80
MW-8S	Downgradient	Easting: 1255313.690 ft Northing: 219375.899 ft	2	5.08	5.05	1.05	-3.95
MW-8D	Downgradient	Easting: 1255314.267 ft Northing: 219376.872 ft	2	4.98	5.04	-14.96	-19.96
MW-9S	Downgradient	Easting: 1255360.270 ft Northing: 219232.1222 ft	2	4.47	4.70	0.70	-4.30
MW-9D	Downgradient	Easting: 1255361.552 ft Northing: 219233.3286 ft	2	4.66	4.69	-15.31	-20.31
PZ-4A	On-Site	Easting: 1255365.3 ft Northing: 219236.5 ft	2.00	4.80	5.00	2	0.00

TABLE 9A
DECISION TREE FOR INTRUSIVE ACTIVITIES ON-SITE
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

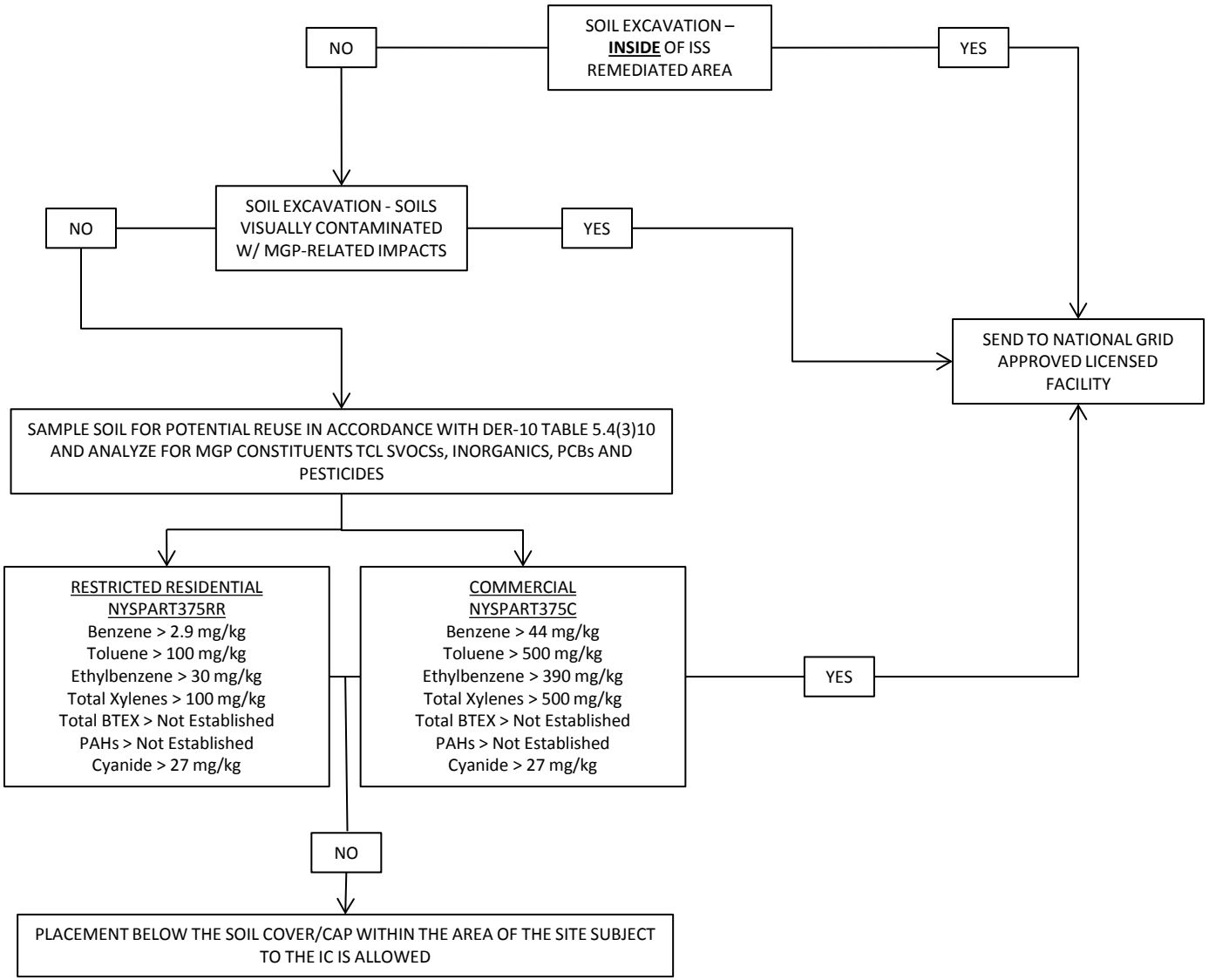

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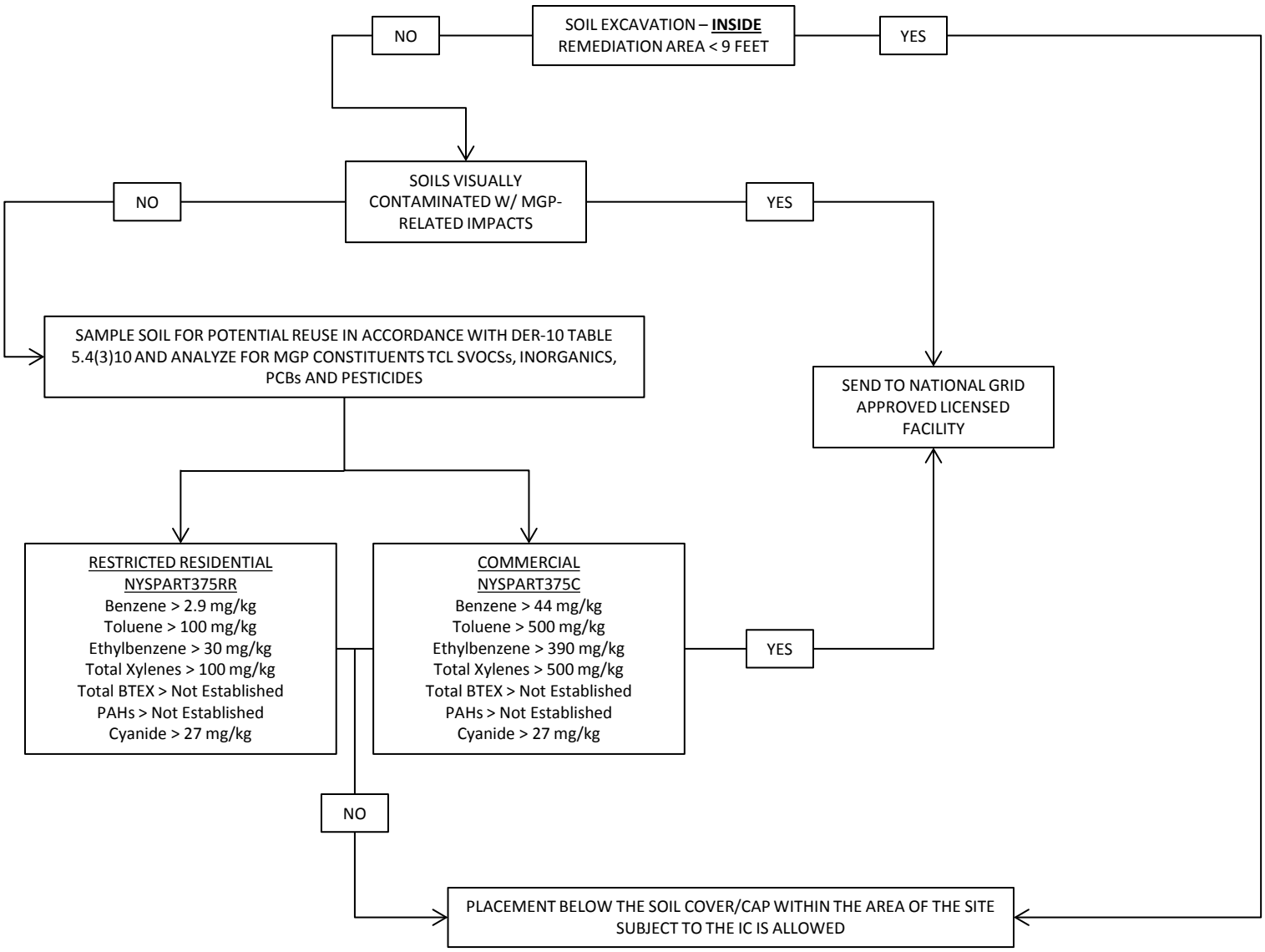
TABLE 9B
DECISION TREE FOR INTRUSIVE ACTIVITIES OFF-SITE
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK



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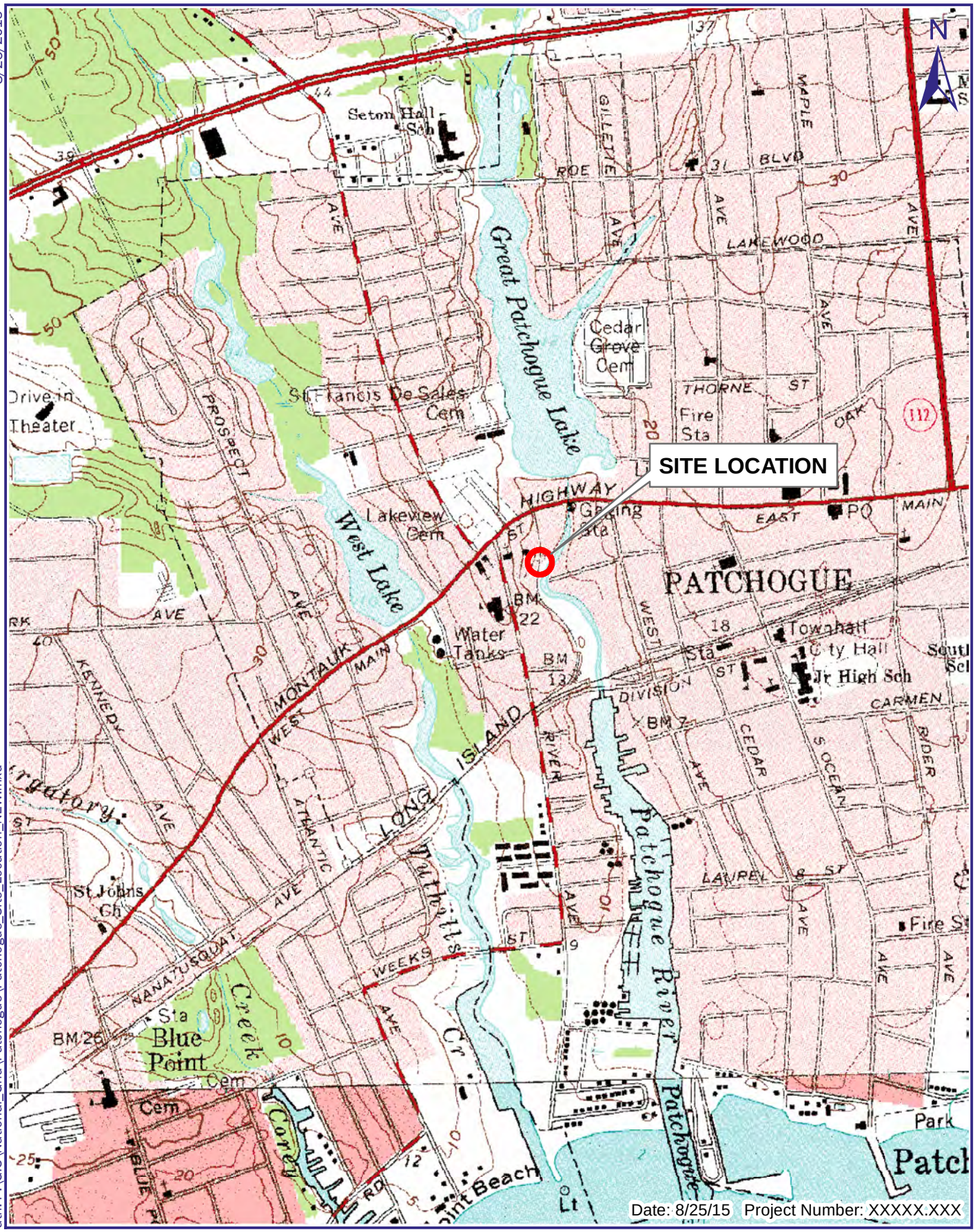
FIGURES



8/25/2015

Author: TCaputi Path: P:\GIS\National_Grid\Patchogue\Patchogue_Site_Location_NEW.mxd

Brown AND Caldwell
Associates

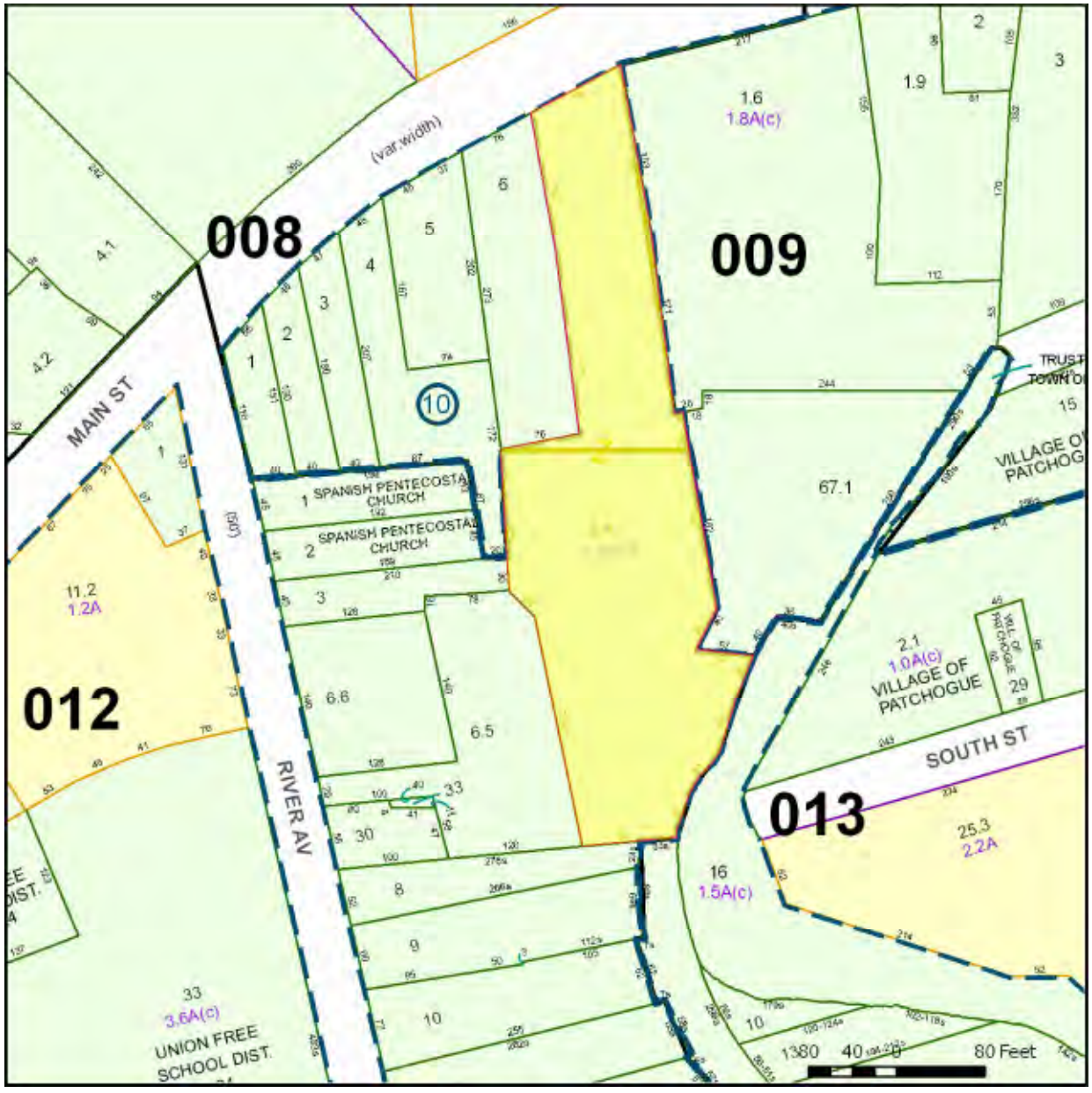
FIGURE 1
SITE LOCATION MAP
NATIONAL GRID - PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

0 210 420
Feet

COUNTY OF SUFFOLK

REAL PROPERTY TAX SERVICE AGENCY

DISTRICT 0204 - SECTION - 01200 - BLOCK - 0900 - LOT - 006004



Map

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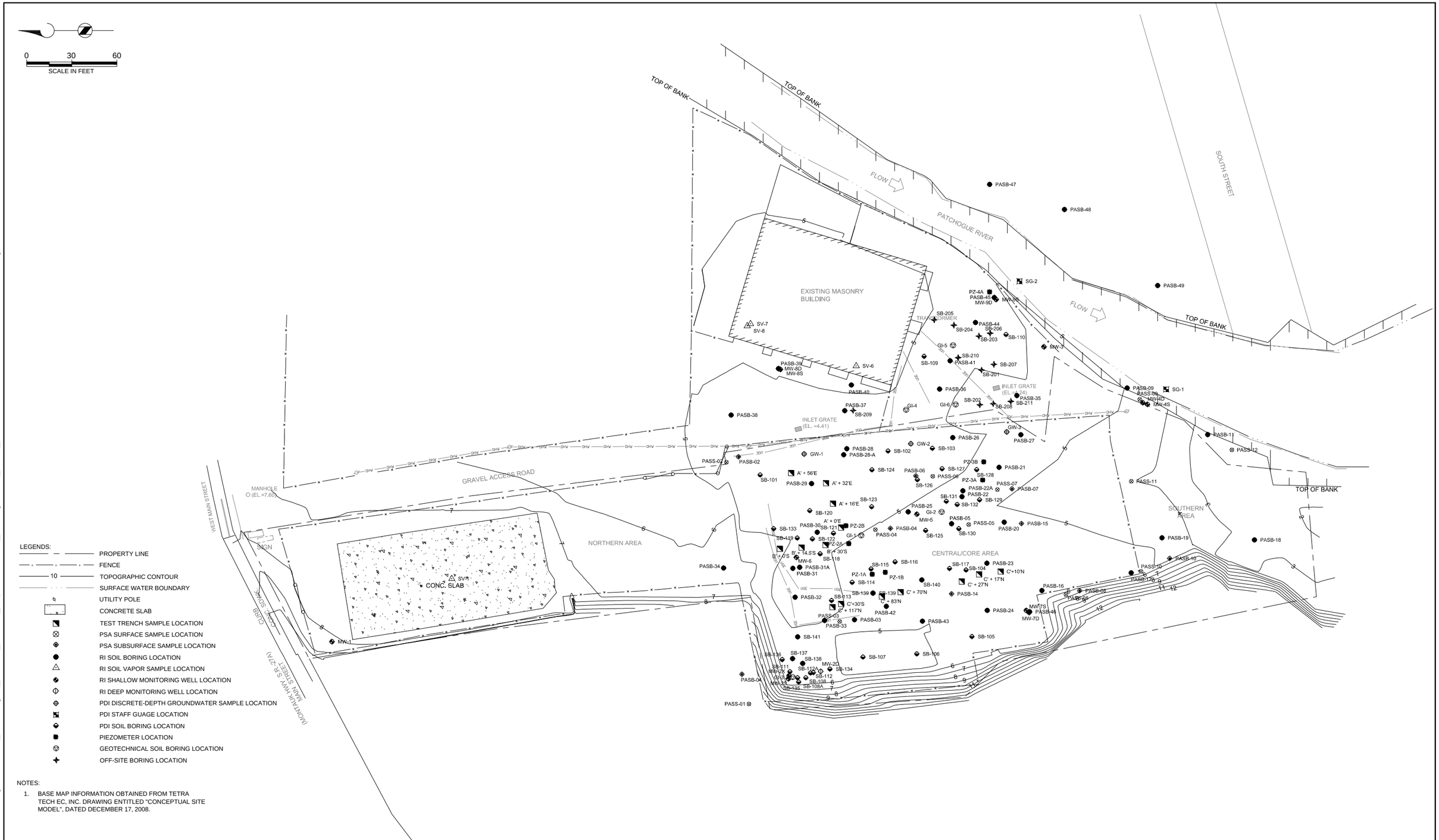
9/30/2015

FIGURE 2A
TAX MAP
NATIONAL GRID-PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

Brown AND Caldwell Associates

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETSIC-CIVIL File Name: Fig-2B Plot Date: October 5, 2015 8:04 AM Cadd User: Near

0 30 60
SCALE IN FEET



LEGENDS:

- PROPERTY LINE
- FENCE
- 10 TOPOGRAPHIC CONTOUR
- SURFACE WATER BOUNDARY
- UTILITY POLE
- CONCRETE SLAB
- 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 GUAGE LOCATION
- PDI SOIL BORING LOCATION
- PIEZOMETER LOCATION
- GEOTECHNICAL SOIL BORING LOCATION
- OFF-SITE BORING LOCATION

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: October 5, 2015

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

SITE LAYOUT MAP

FIGURE

2B

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-3 Plot Date: October 5, 2015 8:10 AM Cadd User: Near, I

0 30 60
SCALE IN FEET

TOP OF BANK
FLOW
PATCHOGUE RIVER
SOUTH STREET
EXISTING MASONRY BUILDING
TRANSFORMER
INLET GRATE (EL. =4.24)
INLET GRATE (EL. =4.41)
GRAVEL ACCESS ROAD
MANHOLE (EL.=7.80)
WEST MAIN STREET
SIGN
CURB
CONC. SLAB
(MONTAUK HWY S.R.27A) MAIN STREET
NORTHERN AREA
CENTRAL/CORE AREA
SOUTHERN AREA
PASB-47
PASB-48
PASB-49
SG-2
PZ-4A
PASB-45
MW-9D
MW-9S
SB-205
SB-204
PASB-44
SB-206
SB-203
SB-110
MW-3
GI-5
SB-109
SB-210
PASB-41
SB-207
SB-201
SV-7
SV-8
SV-6
PASB-39
MW-8D
MW-8S
PASB-40
PASB-38
PASB-37
SB-209
GI-4
PASB-36
GI-6
SB-202
SB-208
PASB-35
SB-211
PASB-09
PASS-09
MW-4D
MW-4S
SG-1
PASB-11
PASS-12
PASS-11
PASB-26
PASB-27
GW-2
SB-103
SB-102
GW-1
PASB-28
PASB-28-A
PASS-02
PASB-02
SB-101
SB-124
PASB-06
SB-127
PASB-21
PZ-3B
SB-128
PZ-3A
PASS-07
PASB-07
PASB-22A
PASB-22
SB-131
SB-132
SB-129
SB-126
PASS-06
SB-123
SB-120
PASB-25
GI-2
MW-5
PASB-05
PASS-05
PASB-20
PASB-15
SB-133
PASB-30
SB-121
PZ-2B
PASB-04
SB-125
SB-130
SB-119
SB-122
PZ-2A
GI-1
PASB-19
PASB-18
PASB-10
PASB-17
PASB-16
PASB-08
PASB-23
SB-117
SB-104
C'+10'N
C'+17'N
C'+27'N
SB-115
SB-116
PZ-1A
PZ-1B
SB-114
SB-140
PASB-14
SB-139
SB-135
C'+70'N
C'+83'N
C'+30'S
C'+117'N
PASB-42
PASB-24
MW-7S
PASB-40
MW-7D
PASB-03
PASB-43
PASB-33
SB-141
SB-105
SB-137
SB-138
SB-107
SB-106
MW-2D
SB-134
SB-112A
SB-112
SB-108A
SB-108
SB-136
PASB-04
PASS-01
MW-1
PASB-34
PASB-31A
PASB-31
PASB-32
SB-113
SB-118
MW-6
B'+14.5'S
B'+30'S
A'+0'E
A'+16'E
A'+32'E
A'+56'E
SV-9
CONC. SLAB

LEGENDS:
- PROPERTY LINE
- FENCE
- 10 TOPOGRAPHIC CONTOUR
- SURFACE WATER BOUNDARY
- UTILITY POLE
- CONCRETE SLAB
- 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 GUAGE LOCATION
- PDI SOIL BORING LOCATION
- PIEZOMETER LOCATION
- GEOTECHNICAL SOIL BORING LOCATION
- OFF-SITE BORING LOCATION

NOTES:
1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: October 5, 2015

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

SITE PLAN OF ON-SITE AND OFF-SITE PROPERTIES

FIGURE
3

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-4 Plot Date: October 5, 2015 8:13 AM Cadd User: Near, I

0 30 60
SCALE IN FEET

LEGEND:

- PROPERTY LINE
- FENCE
- 10 TOPOGRAPHIC CONTOUR
- UGE UGE UNDERGROUND ELECTRIC
- OHW OHW OHW OVERHEAD ELECTRIC WIRE
- SURFACE WATER BOUNDARY
- UTILITY POLE
- CONCRETE
- GRAVEL ROAD
- GRAVEL COVER
- VEGETATIVE COVER
- ASPHALT PAVEMENT
- MW-1 MONITORING WELL LOCATION
- PZ-3B PIEZOMETER LOCATION

NOTES:

1. THE UTILITIES SHOWN SHALL BE CONSIDERED APPROXIMATE. THE LOCATION OF UTILITIES MAY DIFFER FROM THAT SHOWN AND ADDITIONAL UTILITIES MAY BE PRESENT ON-SITE.
2. THE LOCATION OF UTILITIES SHALL BE VERIFIED PRIOR TO INTRUSIVE ACTIVITIES. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING AND COORDINATING WITH NEW YORK CITY ONE CALL CENTER & LONG ISLAND AT 1-800-272-4480.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: October 5, 2015

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

EXISTING SITE CONDITIONS

FIGURE

4

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-5A Plot Date: October 5, 2015 8:17 AM Cadd User: Near

0 30 60
SCALE IN FEET

LEGENDS:

- PROPERTY LINE
- FENCE
- 10 TOPOGRAPHIC CONTOUR
- SURFACE WATER BOUNDARY
- UTILITY POLE
- CONCRETE SLAB
- 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 GUAGE
- PDI SOIL BORING LOCATION
- PIEZOMETER LOCATION
- GEOTECHNICAL SOIL BORING LOCATION
- OFF-SITE BORING LOCATION
- NAPL/TAR OBSERVED IN SOIL
- CROSS SECTION ALIGNMENT
- (20.5) DEPTH BELOW GRADE SURFACE (FT.) WHERE DEEPEST OCCURRENCE OF NAPL WAS OBSERVED

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.

Brown AND Caldwell

SCALE: 1" = 60'

142128

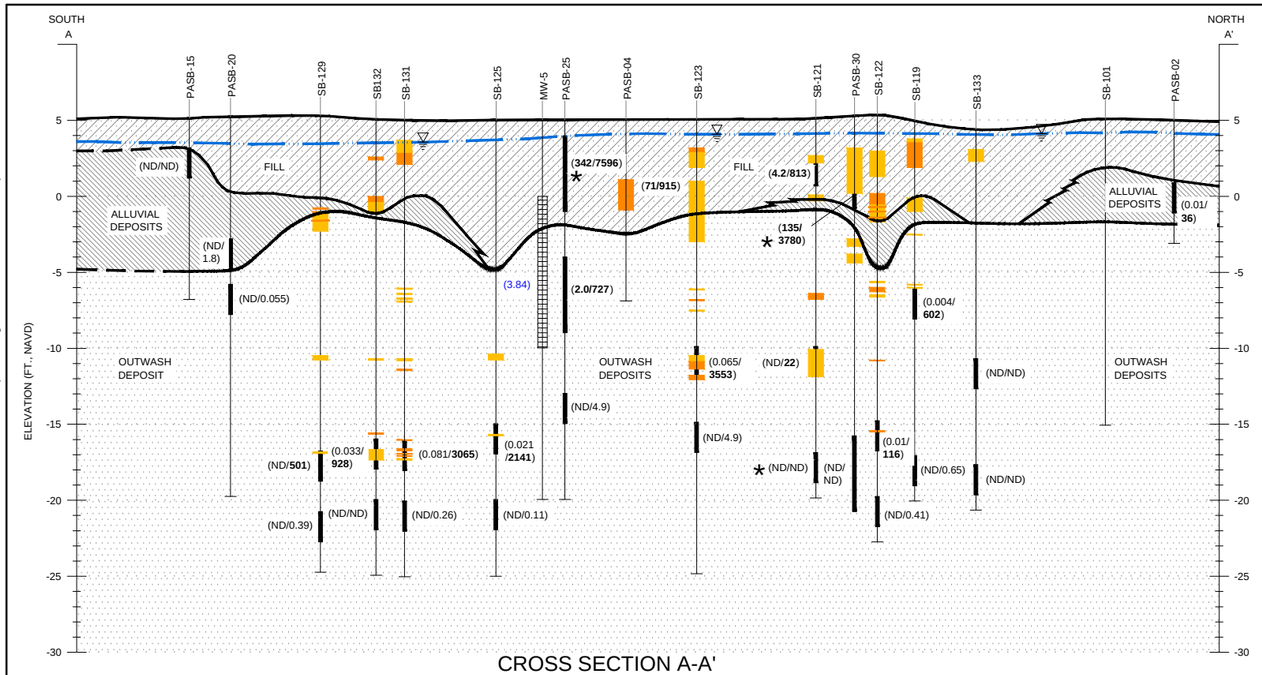
DATE: October 5, 2015

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

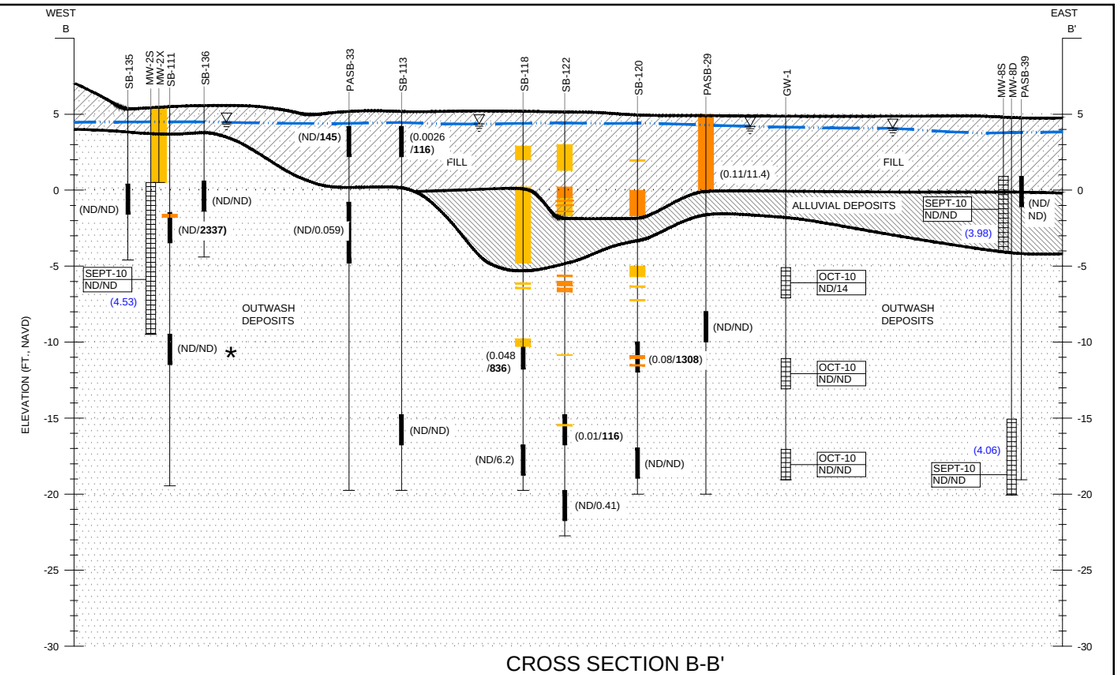
CROSS-SECTION LOCATIONS AND NAPL/TAR OBSERVATIONS LOCATIONS

FIGURE

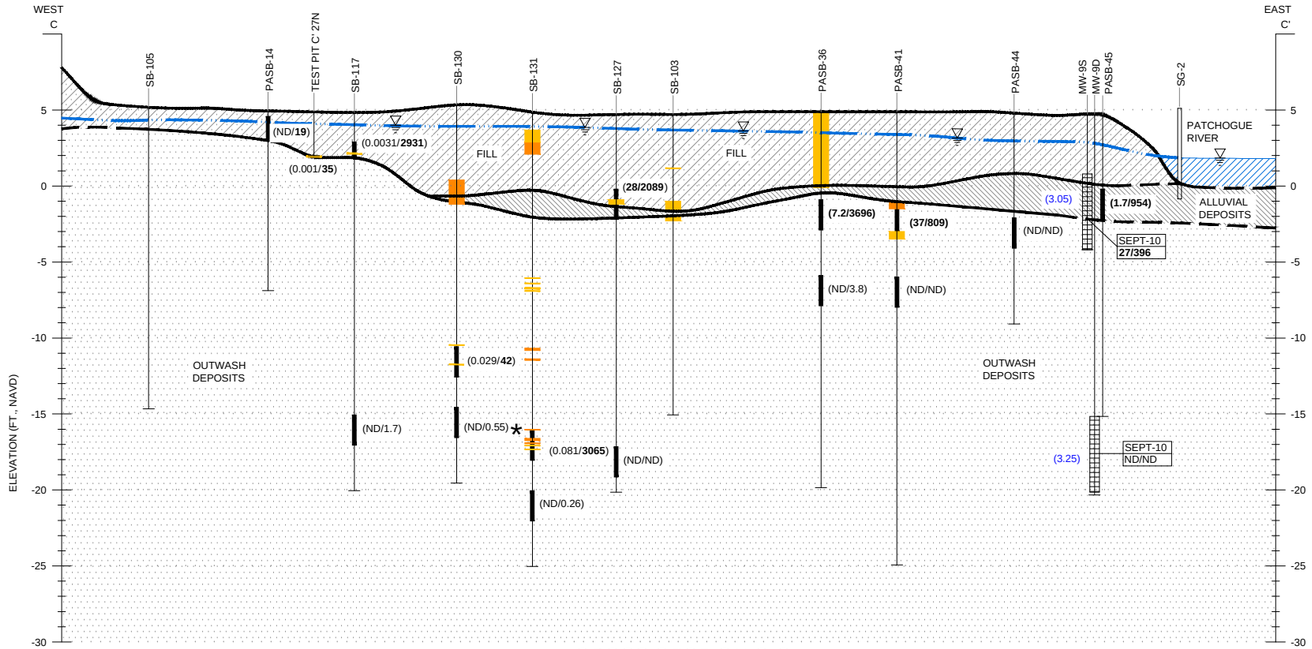
5A



CROSS SECTION A-A'

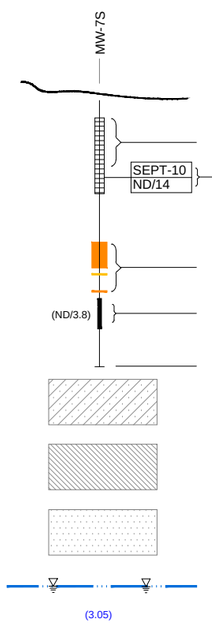


CROSS SECTION B-B'



CROSS SECTION C-C'

LEGEND:



MONITORING WELL / SOIL BORING IDENTIFICATION AND APPROXIMATE LOCATION

GENERALIZED GROUND SURFACE

WELL SCREEN INTERVAL

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.

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

0 5 10
SCALE IN FEET
VERTICAL

0 40 80
SCALE IN FEET
HORIZONTAL

Brown AND Caldwell

SCALE: AS NOTED

142128

DATE: October 5, 2015

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

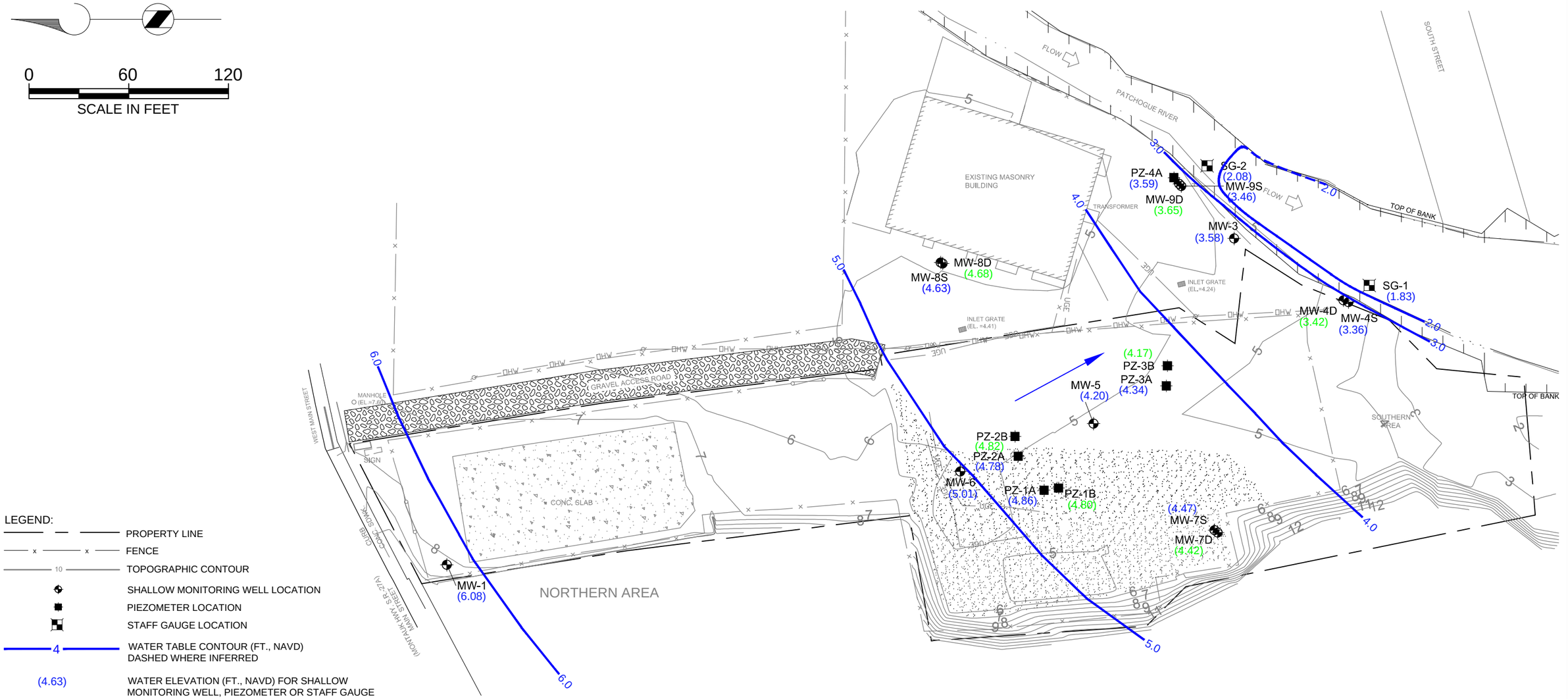
GEOLOGICAL CROSS SECTIONS

FIGURE

5B

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: FIG-5B (Geological Cross Sections) Plot Date: October 5, 2015

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: FIG-6 Plot Date: October 5, 2015 8:37 AM Cadd User: Near,



LEGEND:

- PROPERTY LINE
- FENCE
- TOPOGRAPHIC CONTOUR
- SHALLOW MONITORING WELL LOCATION
- PIEZOMETER LOCATION
- STAFF GAUGE LOCATION
- 4 — WATER TABLE CONTOUR (FT., NAVD) DASHED WHERE INFERRED
- (4.63) — WATER ELEVATION (FT., NAVD) FOR SHALLOW MONITORING WELL, PIEZOMETER OR STAFF GAUGE
- (3.41) — GROUNDWATER HEAD ELEVATION (FT., NAVD) FOR WELLS OR PIEZOMETERS SCREENED BELOW WATER TABLE (FROM DEEP MONITORING WELL OR PIEZOMETER)
- GENERALIZED DIRECTION OF GROUNDWATER FLOW

NOTES:
1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.
2. CONTOURS BASED ON GROUNDWATER ELEVATIONS OBTAINED ON 12/16/2014.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: October 5, 2015

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

GROUNDWATER CONTOUR MAP

FIGURE

6

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-7 Plot Date: October 5, 2015 8:41 AM Cadd User: Near, I

0 30 60
SCALE IN FEET

TOP OF BANK
FLOW
PATCHOGUE RIVER
SOUTH STREET
EXISTING MASONRY BUILDING
TRANSFORMER
INLET GRATE (EL.=4.24)
INLET GRATE (EL.=4.41)
RETORTS
COAL BIN
PURIFIER HOUSE
BOILER
OIL TANK
STORAGE SHED
SHED
SOUTHERN AREA
GRAVEL ACCESS ROAD
MANHOLE (EL.=7.60)
WEST MAIN STREET
SIGN
NORTHERN AREA
CENTRAL/CORE AREA
GAS HOLDER 60,000 CA
SHED
COOKE SQUARE
(MONTAUK HWY, S.R. 27A) MAIN STREET

LEGENDS:
- PROPERTY LINE
- FENCE
- 10 TOPOGRAPHIC CONTOUR
- UTILITY POLE
- FORMER STRUCTURE

NOTES:
1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: October 5, 2015

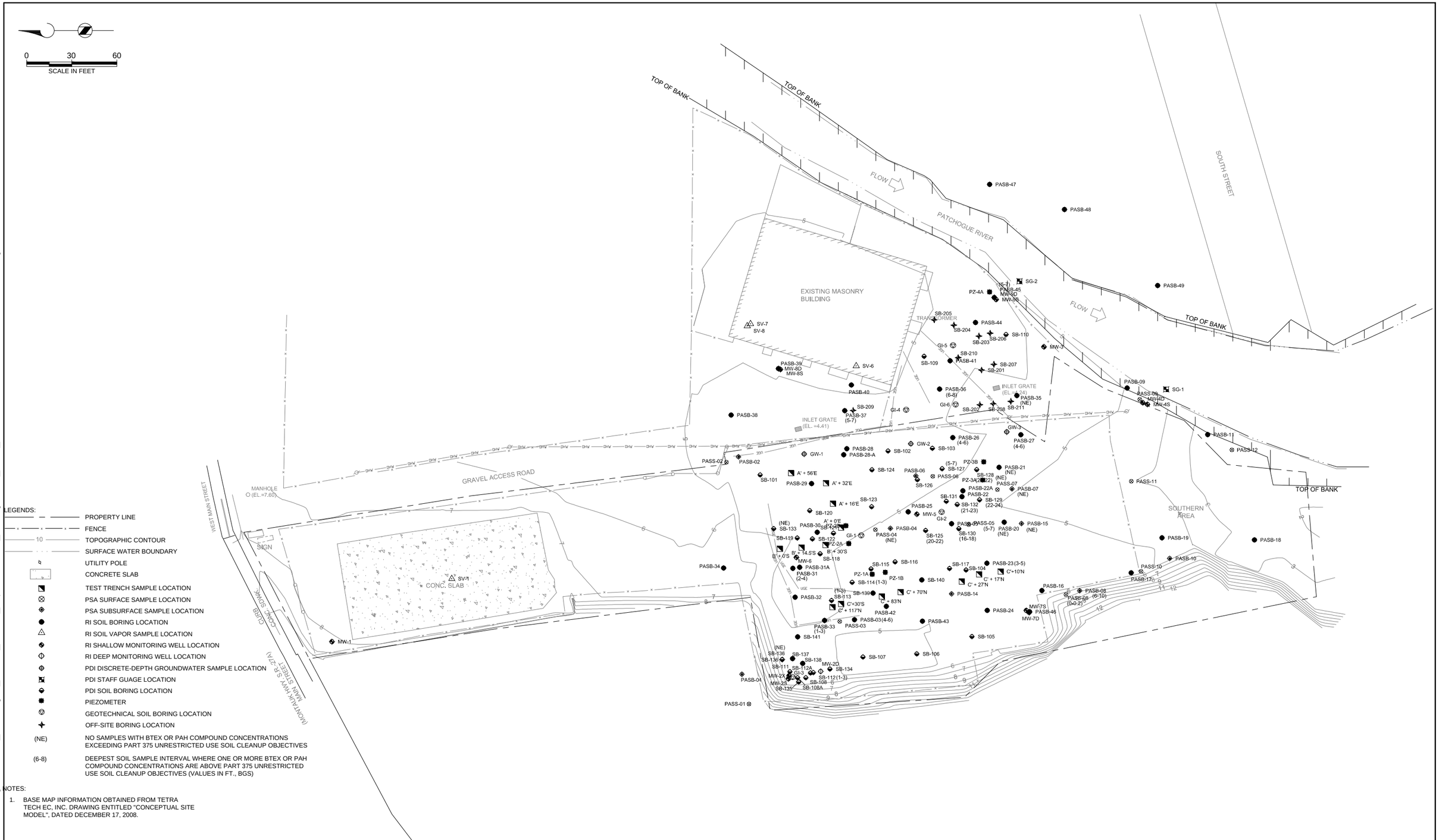
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

HISTORICAL SITE FEATURES

FIGURE
7

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-8A Plot Date: December 9, 2015 11:16 AM Cadd User: N

0 30 60
SCALE IN FEET



LEGENDS:

	PROPERTY LINE
	FENCE
10	TOPOGRAPHIC CONTOUR
	SURFACE WATER BOUNDARY
	UTILITY POLE
	CONCRETE SLAB
	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 GUAGE LOCATION
	PDI SOIL BORING LOCATION
	PIEZOMETER
	GEOTECHNICAL SOIL BORING LOCATION
	OFF-SITE BORING LOCATION
(NE)	NO SAMPLES WITH BTEX OR PAH COMPOUND CONCENTRATIONS EXCEEDING PART 375 UNRESTRICTED USE SOIL CLEANUP OBJECTIVES
(6-8)	DEEPEST SOIL SAMPLE INTERVAL WHERE ONE OR MORE BTEX OR PAH COMPOUND CONCENTRATIONS ARE ABOVE PART 375 UNRESTRICTED USE SOIL CLEANUP OBJECTIVES (VALUES IN FT., BGS)

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: December 9, 2015

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

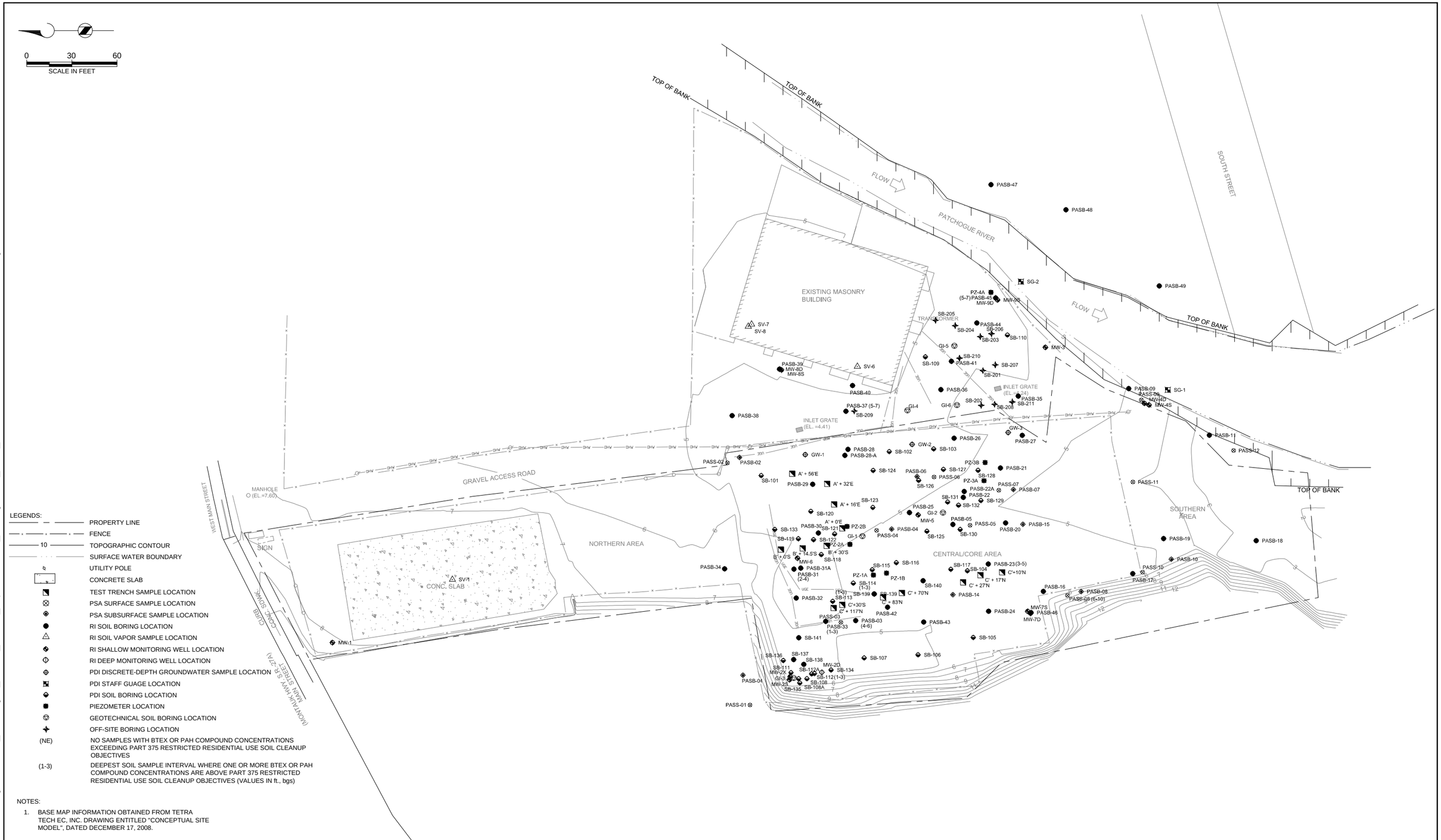
BTEX AND PAH CONCENTRATION IN SOIL ABOVE UNRESTRICTED USE (DEEPEST OCCURRENCE)

FIGURE

8A

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-8B Plot Date: December 9, 2015 11:27 AM Cadd User: N

0 30 60
SCALE IN FEET



LEGENDS:

- PROPERTY LINE
- FENCE
- 10 — TOPOGRAPHIC CONTOUR
- SURFACE WATER BOUNDARY
- UTILITY POLE
- CONCRETE SLAB
- 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 GUAGE LOCATION
- PDI SOIL BORING LOCATION
- PIEZOMETER LOCATION
- GEOTECHNICAL SOIL BORING LOCATION
- OFF-SITE BORING LOCATION
- (NE) NO SAMPLES WITH BTEX OR PAH COMPOUND CONCENTRATIONS EXCEEDING PART 375 RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVES
- (1-3) DEEPEST SOIL SAMPLE INTERVAL WHERE ONE OR MORE BTEX OR PAH COMPOUND CONCENTRATIONS ARE ABOVE PART 375 RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVES (VALUES IN ft., bgs)

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: December 9, 2015

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

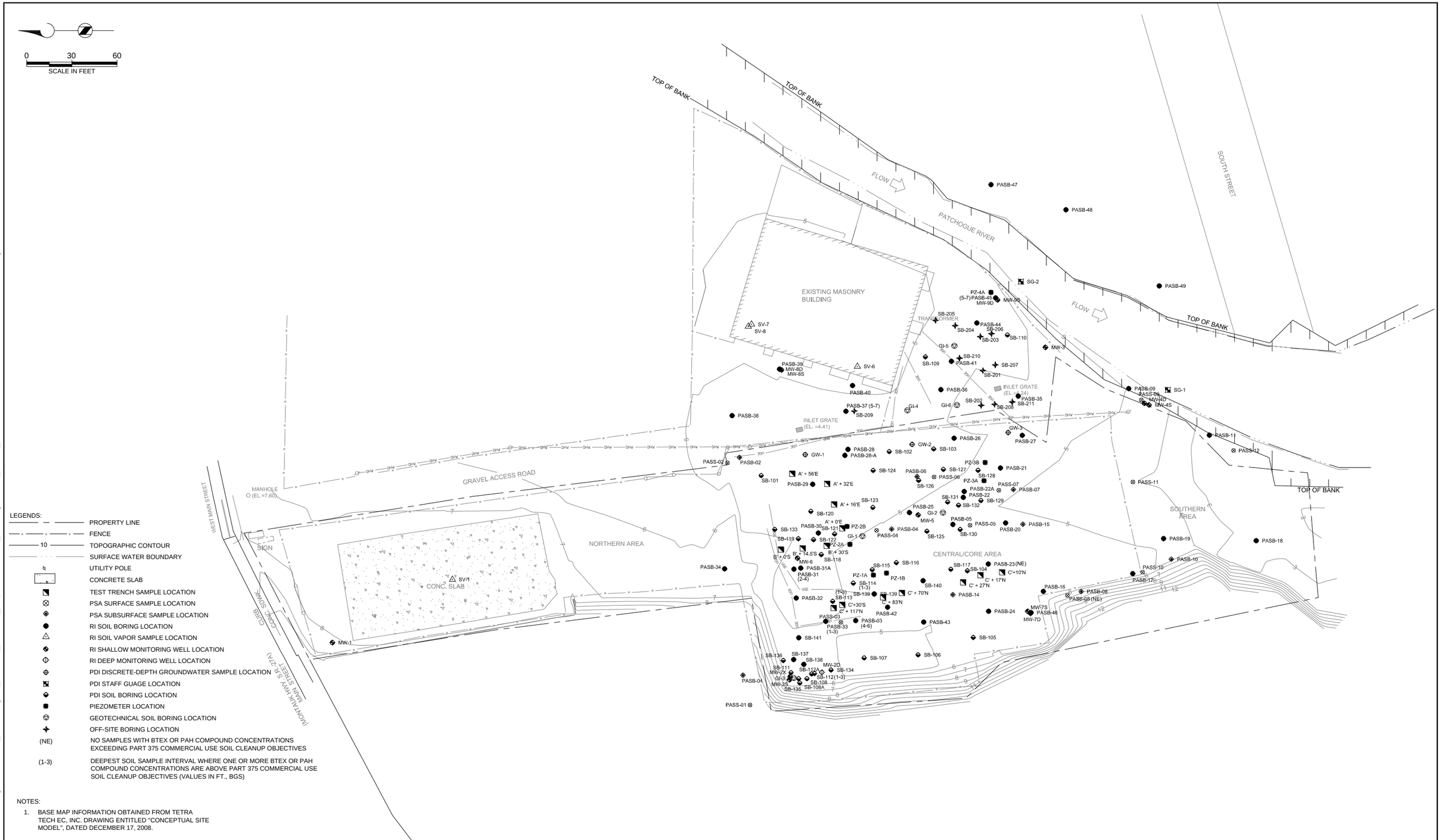
BTEX AND PAH CONCENTRATION IN SOIL ABOVE RESTRICTED RESIDENTIAL (DEEPEST OCCURRENCE)

FIGURE

8B

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-8C Plot Date: December 9, 2015 11:49 AM Cadd User: N

0 30 60
SCALE IN FEET



LEGENDS:

- PROPERTY LINE
- FENCE
- 10 TOPOGRAPHIC CONTOUR
- SURFACE WATER BOUNDARY
- UTILITY POLE
- CONCRETE SLAB
- 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 GUAGE LOCATION
- PDI SOIL BORING LOCATION
- PIEZOMETER LOCATION
- GEOTECHNICAL SOIL BORING LOCATION
- OFF-SITE BORING LOCATION
- (NE) NO SAMPLES WITH BTEX OR PAH COMPOUND CONCENTRATIONS EXCEEDING PART 375 COMMERCIAL USE SOIL CLEANUP OBJECTIVES
- (1-3) DEEPEST SOIL SAMPLE INTERVAL WHERE ONE OR MORE BTEX OR PAH COMPOUND CONCENTRATIONS ARE ABOVE PART 375 COMMERCIAL USE SOIL CLEANUP OBJECTIVES (VALUES IN FT., BGS)

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.

Brown AND Caldwell

SCALE: 1" = 60'

142128

DATE: December 9, 2015

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

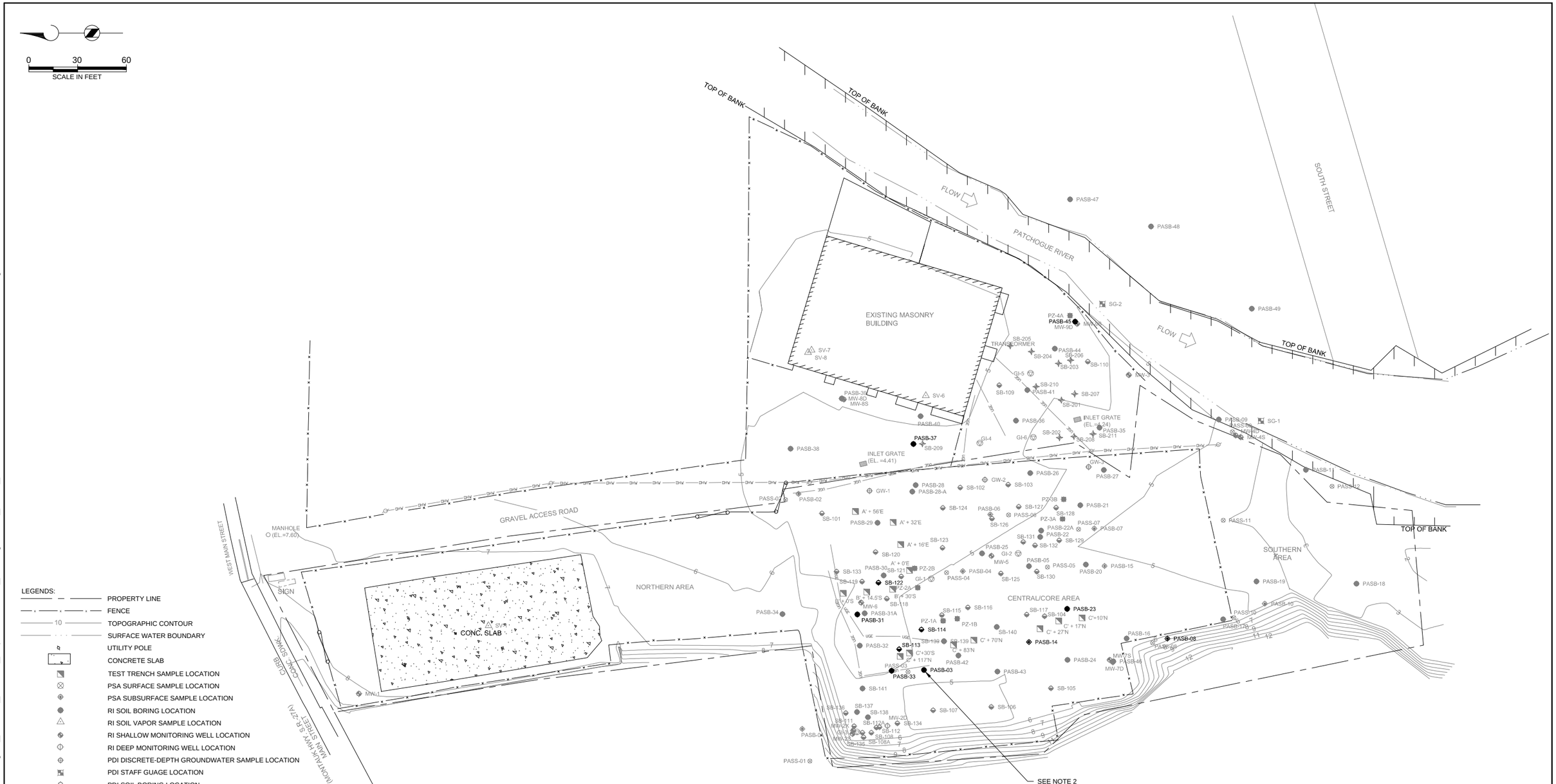
BTEX AND PAH CONCENTRATION IN SOIL ABOVE COMMERCIAL USE (DEEPEST OCCURRENCE)

FIGURE

8C

Path: P:\National_Grid\Patchogue\142128_Patchogue_UCWP_RDWP_Implement\Site_Management_Plan_CAD\2-SHEETS\C-CIVIL File Name: Fig-9 Plot Date: October 6, 2015 4:12 PM Cadd User: Near, I

0 30 60
SCALE IN FEET



LEGENDS:

- PROPERTY LINE
- FENCE
- TOPOGRAPHIC CONTOUR
- SURFACE WATER BOUNDARY
- UTILITY POLE
- CONCRETE SLAB
- 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
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- PDI DISCRETE-DEPTH GROUNDWATER SAMPLE LOCATION
- PDI STAFF GUAGE LOCATION
- PDI SOIL BORING LOCATION
- PIEZOMETER LOCATION
- GEOTECHNICAL SOIL BORING LOCATION
- OFF-SITE BORING LOCATION

NOTES:

1. BASE MAP INFORMATION OBTAINED FROM TETRA TECH EC, INC. DRAWING ENTITLED "CONCEPTUAL SITE MODEL", DATED DECEMBER 17, 2008.
2. LOCATIONS WITH SOIL CONCENTRATIONS IN EXCEEDANCE OF RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVES ARE SHOWN IN BOLD.

Brown AND Caldwell

SCALE: 1" = 60'

142128

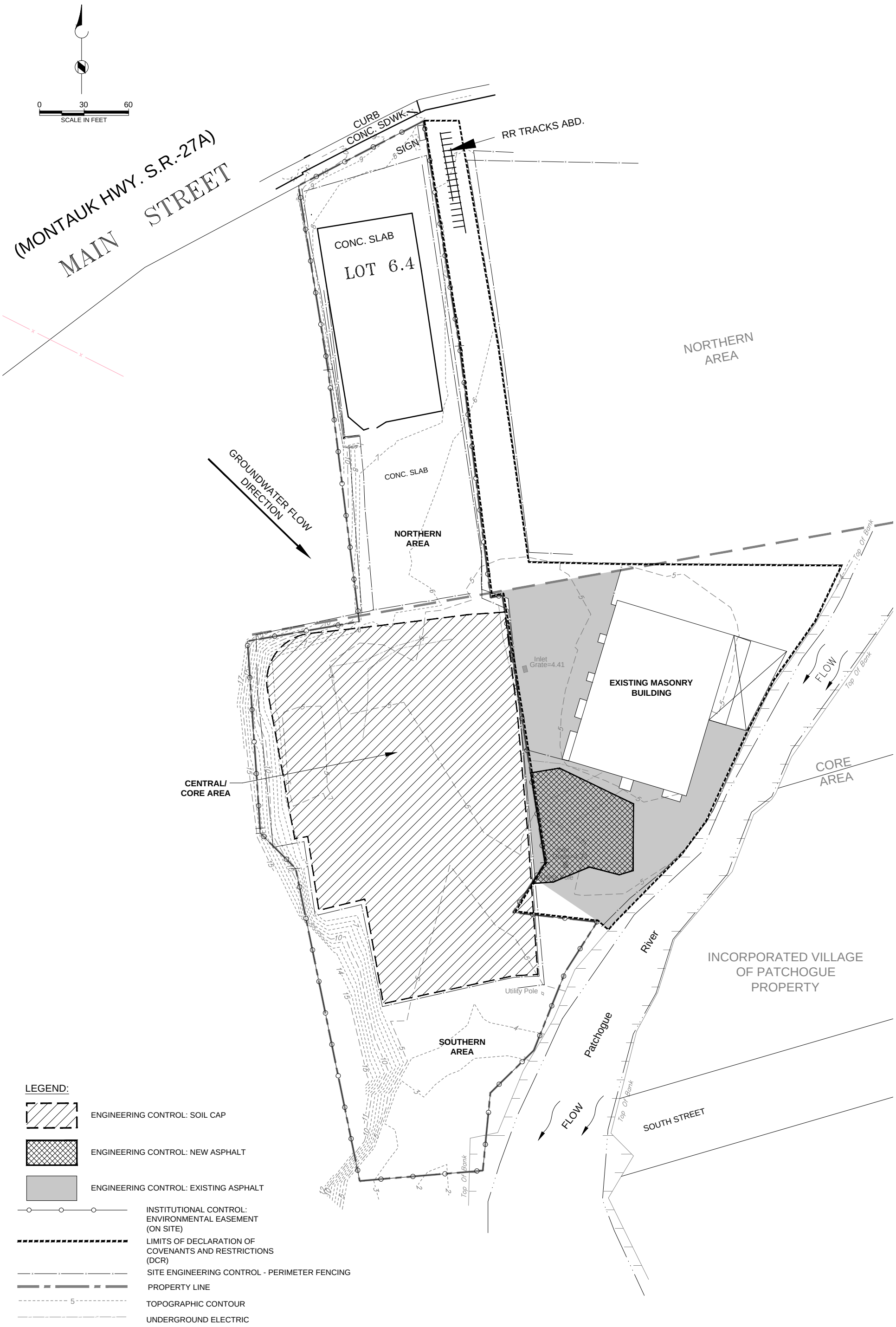
DATE: October 6, 2015

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

REMAINING SOIL SAMPLE EXCEEDANCES

FIGURE

9



Brown AND Caldwell	SCALE: 1" = 40' 142128 DATE: August 24, 2015	NATIONAL GRID PATCHOGUE FORMER MGP SITE VILLAGE OF PATCHOGUE, NEW YORK	INSTITUTIONAL AND ENGINEERING CONTROL BOUNDARIES AND LOCATION	FIGURE 10

APPENDIX A

ENVIRONMENTAL EASEMENT

(TO BE PREPARED BY THE NYSDEC FOR THE SITE AFTER COMPLETION OF THE IMPLEMENTATION OF THE REMEDY.)

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau C, 11th Floor
625 Broadway, Albany, New York 12233-7014
Phone: (518) 402-9662 • **Fax:** (518) 402-9679
Website: www.dec.ny.gov

Joe Martens
Commissioner

William J. Ryan, Project Manager
Site Investigation and Remediation Department
National Grid
175 East Old Country Road
Hicksville, NY 11801

Re: **Environmental Easement for** Patchogue site
Site ID No.: #152182
Patchogue, Suffolk County

Dear Mr. Ryan:

The above referenced Site requires an Environmental Easement as part of the of the remediation process. There are several items which constitute the New York State Department of Environmental Conservation's standard Environmental Easement Package. These items include the following:

a) Environmental Easement Template;
b) Notice form;
c) Attorney/Applicant Checklist and Certification;
d) Title requirements; and
e) Survey Requirements.

These items can be found on the Department's web page at the following link: http://www.dec.ny.gov/chemical/48236.html. The Environmental Easement Package should be sent to your attorney. Any questions regarding the legal requirements should be addressed to the Office of General Counsel attorney assigned to your Site, Yvonne Ward, at 518-402-9507. When the package has been completed, it must be submitted in its entirety to the Attorney assigned to this matter. Please be advised that failure to include all the necessary documentation/information required in the Environmental Easement package will result in a delay of Department review and approval of the Easement.

The Environmental Easement template must be completed with site-specific information. When submitting the Environmental Easement Package for review, please note that the following additional documents will be required (refer to checklist):

a) An updated title report (current within 6 months) along with copies of any encumbrances (e.g., mortgages, judgments, easements, leases, liens etc.). See attached title requirements.

INTERNATIONAL YEAR OF FORESTS · 2011

b) Any Schedule "B" exception supporting documents (notice requirements will be needed for prior easements, rights-of-way, liens, encumbrances etc., and any interests affecting the property).
c) The current deed(s).
d) A survey covering the property as described in the current deed along with a metes and bounds of the same.
e) An ALTA survey or a survey that meets the Department's requirements of the area(s) to be addressed by the Environmental Easement, with corresponding metes and bounds description. The survey should include the information, as addressed by the attached survey requirements.
f) A commitment letter and a proposed final policy from the title company stating that it will issue the proposed title insurance policy upon recordation of the Easement.
g) A review of organizational documents and partnership agreements with evidence of successors in interest such as LLC Documents/Certificate of Incorporation papers/Limited Partnership papers, etc. of the owners of the property, where applicable.

If you have any questions concerning the technical aspects of this matter, please contact me at 518-402-9662 or eblukows@gw.dec.state.ny.us.

Sincerely,

Elizabeth B. Lukowski
Project Manager

Ec: Bill Ryan, NG
Ted Leissing NG
Joseph Giordano, NG
G. Cross
M. Ryan
N. Barber

APPENDIX B

LIST OF SITE CONTACTS

APPENDIX B – LIST OF SITE AND OFF-SITE PROPERTY CONTACTS

This Appendix should include a listing of Site contacts. The below table should be edited as necessary to include Site contacts necessary for implementation of the ISMP.

Name	**Phone/Email Address**
Site Owner: KeySpan Gas East Corporation Off-Site Property Owner: John Cashel 210 West Main Realty Corp., 50 Gilpin Avenue, Hauppauge, New York 11788	(516) 545-2568 sarah.aldridge@nationalgrid.com 516-250-6386
Remedial Party/Respondent: National Grid	(516) 545-2568 sarah.aldridge@nationalgrid.com
National Grid's Qualified Environmental Professional: Keith Bogatch	201-574-4700 kbogatch@brwncald.com
NYSDEC DER Project Manager: Elizabeth Lukowski, NYSDEC Project Manager	(518) 402-9564; eblukows@gw.dec.state.us
On and Off-Site access contacts such as tenants, adjacent property owners, etc.: See Property Owners above	See Property Owners above
Remedial Party/Respondent Attorney: Francis J. Murphy National Grid- Legal Dept. 175 East Old Country Road Hicksville, NY 11801	(516) 545-4790 Francis.Murphy@nationalgrid.com

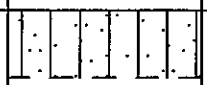
APPENDIX C

SOIL BORING AND MONITORING WELL CONSTRUCTION LOGS

	Project Name: Former Patchogue MGP	Site Id: MW-1
	Township/Range: Patchogue, New York	Coordinate X: 1255132.53
	Logged By: Tom Fowler	Coordinate Y: 219674.03
	Drilling Method: Geoprobe	Total Depth: 15.00'
		Date Started: 01/28/08
Remarks:		Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
1	40	FI		0–2: Dark Gray Brown fine SAND and organic silt, some decomposed wood;	01/28/08	0 ppm	Installed 2" monitoring well.
2				2–4.6: Dark Gray Brown fine to medium SAND, some silt, moist		0 ppm	
3		SM				0 ppm	
4						0 ppm	
5	96	GM		4.6–5: Dark Gray Brown GRAVEL and silty sand, little organics, wet	01/28/08		No PID hits in any portion.
6				5–10: Dark Gray Brown/Dark Brown fine to medium SAND, some organic silt, little gravel, medium dense, wet		0 ppm	
7						0 ppm	Screened 7–12' bgs.
8						0 ppm	
9						0 ppm	
10	90	SM		10–15: Gray Brown fine to medium SAND medium dense, wet	01/28/08		
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: MW-1
Township/Range: Patchogue, New York	Coordinate X: 1255132.53
Logged By: Tom Fowler	Coordinate Y: 219674.03
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 01/28/08
Remarks:	Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: MW-2D
	Township/Range: Patchogue, New York	Coordinate X: 1255112.75
	Logged By: Tom Fowler	Coordinate Y: 219348.84
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 02/04/08
Remarks:		Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	36	PT		0–1.5: Brown PEAT	02/04/08		
1						0 ppm	
				1.5–5: Dark Brown fine to medium SAND,			
2				medium density, moist to wet.		0 ppm	
3						0 ppm	
4						0 ppm	
5	28			5–10: Gray Brown fine to coarse SAND,	02/04/08		
				little gravel, medium density, wet			
6						0 ppm	PASBMW2D–6–10
							Full TCL
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	46			10–15: Gray Brown fine to medium SAND,	02/04/08		
				medium density, wet; from 10–10.4 orange brown			
11						0 ppm	
12						0 ppm	
13		SP				0 ppm	
14						0 ppm	

	Project Name: Former Patchogue MGP	Site Id: MW-2D
	Township/Range: Patchogue, New York	Coordinate X: 1255112.75
	Logged By: Tom Fowler	Coordinate Y: 219348.84
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 02/04/08
Remarks:		Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15–20: Gray Brown fine to medium SAND, medium density, wet; from 18–19 medium brown	02/04/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	40			20–25: Gray Brown fine to medium SAND, medium density, wet	02/04/08		Screened 20 – 25' bgs
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: MW-2S
	Township/Range: Patchogue, New York	Coordinate X: 1255107.89
	Logged By: Tom Fowler	Coordinate Y: 219370.35
	Drilling Method: Geoprobe	Total Depth: 15.00'
		Date Started: 01/28/08
Remarks:		Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	30						
1				0–4: Dark Brown PEAT	01/28/08	0 ppm	Installed a 2" well
2		PT				0 ppm	
3						0 ppm	
4				4–4.2: Dark Brown fine to coarse SAND, little gravel		0 ppm	
5	0			4.2–5: Yellow Brownfine to medium SAND, medium density, wet	01/28/08		No PID readings around backfill or empty tube
6				5–10: No Recovery			
7							Screened 5–10' bgs
8							
9							
10	0	SP		10–15: No Recovery	01/28/08		
11							
12							
13							
14							

Project Name: Former Patchogue MGP	Site Id: MW-2S
Township/Range: Patchogue, New York	Coordinate X: 1255107.89
Logged By: Tom Fowler	Coordinate Y: 219370.35
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 01/28/08
Remarks:	Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: MW-2X
	Township/Range: Patchogue, New York	Coordinate X: 1255109.58
	Logged By: Tom Fowler	Coordinate Y: 219369.97
	Drilling Method: Geoprobe	Total Depth: 5.00'
		Date Started: 02/04/08
Remarks:		Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	8						
1		FI		0-5: Gray Brown Silty SAND with some wood chips, some glass fragments, some tarry globules, strong odor, moist	02/04/08	28 ppm	Bottom on foot of Lexan or Macro tube is squashed. Located 15 ft. south of MW-2S.
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

	Project Name: Former Patchogue MGP	Site Id: MW-3
	Township/Range: Patchogue, New York	Coordinate X: 1255328.74
	Logged By: Tom Fowler	Coordinate Y: 219200.31
	Drilling Method: Geoprobe	Total Depth: 10.00'
		Date Started: 01/28/08
Remarks:		Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	70			0–4: Dark Brown/Dark Gray fine to medium SAND and silt, some gravel, medium density, moist	01/28/08	0 ppm	Install 2" well.
1							
2		SM				0 ppm	
3						0 ppm	
4						0 ppm	
		SP		4–5: Gray Brown fine to medium SAND little silt, trace gravel, medium density, wet			
5	96			5–7: Dark Brown fine to medium SAND and peat, wet	01/28/08		Screened 5–10' bgs.
6		SM				0 ppm	
7				7–8: Gray Brown fine to coarse SAND and gravel, medium density, wet		0 ppm	
8				8–9: Orange Brown/Light Gray fine to coarse SAND, medium density, wet		0 ppm	
		SP					
9				9–10: Gray fine to coarse SAND and gravel, medium density, wet		0 ppm	
10							
11							
12							
13							
14							

Project Name: Former Patchogue MGP	Site Id: MW-4D
Township/Range: Patchogue, New York	Coordinate X: 1255291.58
Logged By: Tom Fowler	Coordinate Y: 219134.53
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08
Remarks:	Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	60						
				0–5: Dark Brown PEAT, some sand, some gravel,	02/04/08		Installed 2"
1				little wood, moist		0 ppm	well
2						0 ppm	
3		PT				0 ppm	
4						0 ppm	
5	26			5–6: Dark Brown PEAT	02/04/08		PASBMW4D–5–10
							Full TCL
6				6–10: Gray Brown fine to coarse SAND, little		0 ppm	
				gravel, medium density, wet			
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	18			10–15: Orange Brown fine to coarse SAND, medium	02/04/08		
				density, wet			
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	

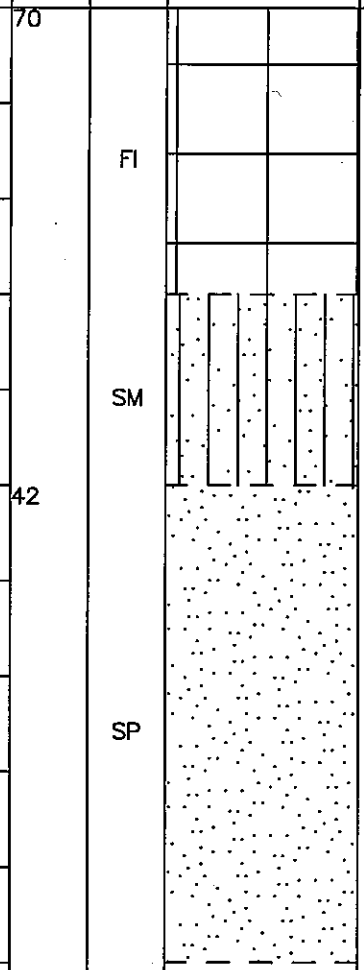
Project Name: Former Patchogue MGP	Site Id: MW-4D
Township/Range: Patchogue, New York	Coordinate X: 1255291.58
Logged By: Tom Fowler	Coordinate Y: 219134.53
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08
Remarks:	Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	46	SP		15–18: Orange Brown fine to medium SAND	02/04/08		Little bog iron
16						0 ppm	
17						0 ppm	
18				18–20: Orange Brown fine to coarse SAND and gravel, medium density, wet		0 ppm	
19						0 ppm	
20	30			20–25: Light Brown fine to coarse SAND, medium density, wet	02/04/08		Screened 20 – 25' bgs
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: MW-4S
Township/Range: Patchogue, New York	Coordinate X: 1255290.45
Logged By: Tom Fowler	Coordinate Y: 219131.47
Drilling Method: Geoprobe	Total Depth: 10.00'
	Date Started: 01/28/08
Remarks:	Date Completed: 01/28/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	40						
1				0-5: Dark Brown fine to medium SAND and organic Silt, little misc. debris, brick fragments, weathered wood, medium density,wet	01/28/08	0 ppm	Install 2" well
2						0 ppm	
3						0 ppm	
4		FI				0 ppm	
5	60			5-7: Brown weathered wood, wet	01/28/08		Screened 5-10' bgs
6						0 ppm	
7				7-8.5: Dark Brown PEAT, gray fine sand zone (7.3-7.6')		0 ppm	
8		PT				0 ppm	
9		SP		8.5-10: Gray Brown fine to medium SAND, some gravel, medium density, wet		0 ppm	
10							
11							
12							
13							
14							

Project Name: Former Patchogue MGP	Site Id: PASB-16
Township/Range: Patchogue, New York	Coordinate X: 1255166.56
Logged By: Tom Fowler	Coordinate Y: 219201.68
Drilling Method: Geoprobe	Total Depth: 10.00'
	Date Started: 02/01/08
Remarks:	Date Completed: 02/01/08



Depth	% Recovery	USCS Code	Material Description	DATE	PID	Notes
0-1	70	FI	0-3: Dark Gray Brown fine to coarse SAND and gravel, some brick	02/01/08	0 ppm	
1-2					0 ppm	
2-3					0 ppm	
3-4		SM	3-5: Brown/Dark Brown fine to medium SAND, some peat		0 ppm	
4-5						
5-6	42	SP	5-10: Gray Brown fine to coarse SAND, little to some gravel (increasing with depth), medium density, wet	02/01/08	0 ppm	
6-7					0 ppm	
7-8					0 ppm	
8-9					0 ppm	
9-10						
10-11						
11-12						
12-13						
13-14						

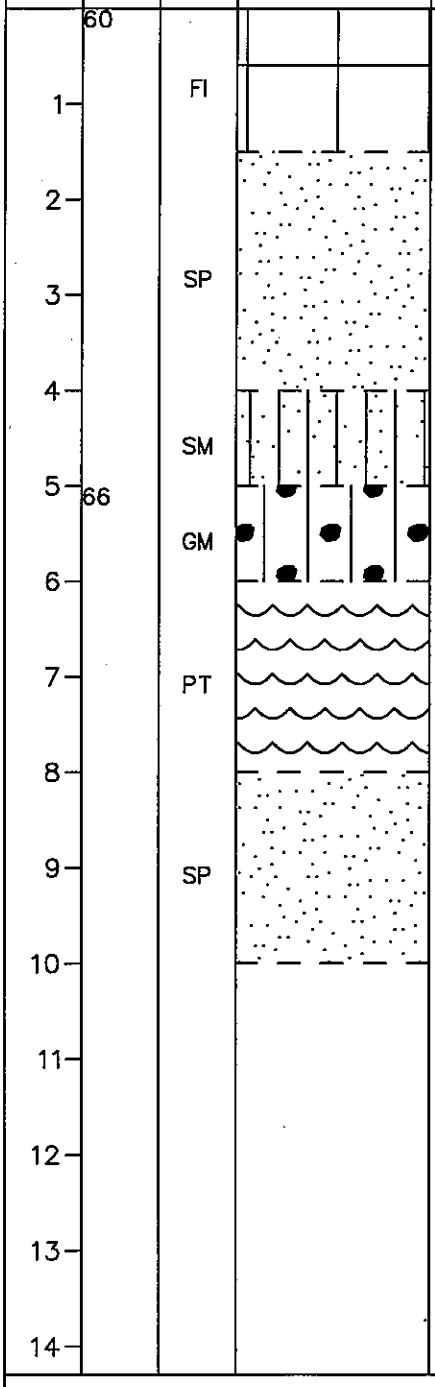
Project Name: Former Patchogue MGP	Site Id: PASB-17
Township/Range: Patchogue, New York	Coordinate X: 1255178.34
Logged By: Tom Fowler	Coordinate Y: 219142.26
Drilling Method: Geoprobe	Total Depth: 10.00'
	Date Started: 02/01/08
Remarks:	Date Completed: 02/01/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	64	FI		0–0.5: Brown silty SAND and gravel, brick	02/01/08		
1		SP		0.5–1.5: Brown fine to medium SAND		0 ppm	
				1.5–5: Brown fine to medium SAND and varying amounts of peat			
2						0 ppm	
3		SM				0 ppm	
4						0 ppm	
5	54			5–7: Brown fine to medium SAND, little peat, wet	02/01/08		
6						0 ppm	
7				7–10: Gray to Yellow Brown fine to coarse SAND,		0 ppm	
		SP		some gravel, medium density, wet			
8						0 ppm	
9						0 ppm	
10							
11							
12							
13							
14							

Project Name: Former Patchogue MGP	Site Id: PASB-18
Township/Range: Patchogue, New York	Coordinate X: 1255200.28
Logged By: Tom Fowler	Coordinate Y: 219060.21
Drilling Method: Hand Auger	Total Depth: 7.50'
	Date Started: 02/08/08
Remarks:	Date Completed: 02/08/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
1		PT		0-1.5: Gray Black PEAT, some sand, leaves. very soft.	02/08/08	0 ppm	
2		SM		1.5-3.5: Gray Brown fine to medium SAND, some silt, wet	02/08/08	0 ppm	
3						0 ppm	
4		PT		3.5-4: Dark Brown PEAT	02/08/08		
				4-6: Gray Brown fine to coarse SAND, trace gravel, wet	02/08/08	0 ppm	
5		SP				0 ppm	
6		PT		6-6.5: Brown PEAT	02/08/08	0 ppm	
7		SP		6.5-7.5: Yellow Brown fine to coarse SAND and gravel (sub-rounded)	02/08/08	0 ppm	
8							
9							
10							
11							
12							
13							
14							

Project Name: Former Patchogue MGP	Site Id: PASB-19
Township/Range: Patchogue, New York	Coordinate X: 1255201.64
Logged By: Tom Fowler	Coordinate Y: 219121.74
Drilling Method: Geoprobe	Total Depth: 10.00'
	Date Started: 01/29/08
Remarks:	Date Completed: 01/29/08



Depth	% Recovery	USCS Code	Material Description	DATE	PID	Notes
0	60					
1		FI	0-1.5: Dark Brown fine SAND, some gravel, brick fragments	01/29/08	0 ppm	
2			1.5-4: Gray Brown to Gray Black fine to medium SAND and gravel, some silt		0 ppm	
3		SP			0 ppm	3-4: Dark staining
4			4-5: Dark Brown fine to medium SAND, some silt		0 ppm	PASB19-2-4 Hg only
5	66	SM	5-6: Dark Brown GRAVEL and silt, some sand, wet	01/29/08		
6		GM	6-8: Dark Brown PEAT		0 ppm	PASB19-6-10 Hg only
7		PT			0 ppm	
8			8-10: Gray Brown to Orange Brown fine to coarse SAND and gravel, wet		0 ppm	
9		SP			0 ppm	
10						
11						
12						
13						
14						

Project Name: Former Patchogue MGP	Site Id: PASB-20
Township/Range: Patchogue, New York	Coordinate X: 1255212.00
Logged By: Tom Fowler	Coordinate Y: 219226.72
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
Remarks:	Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	62						
1				0-3: Dark Gray Brown GRAVEL and silty sand, broken bricks	01/29/08	0 ppm	
2		FI				0 ppm	
3				3-5: Gray Black/Gray Brown fine to medium SAND, medium density, wet		0 ppm	
4						0 ppm	
5	60			5-10: Gray Brown fine to medium SAND, medium density, wet	01/29/08		
6						0 ppm	
7						0 ppm	
8						0 ppm	8-8.5: Gray-black staining, slight
9						0 ppm	odor
10	52			10-15: Yellow Brown fine to medium SAND, medium density, wet	01/29/08		PASB20-8-10 Full TCL
11						0 ppm	PASB20-11-13 Full TCL
12						0 ppm	
13						0 ppm	
14		SP				0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-20
Township/Range: Patchogue, New York	Coordinate X: 1255212.00
Logged By: Tom Fowler	Coordinate Y: 219226.72
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
Remarks:	Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	26			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/29/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Orange Brown fine to medium SAND, medium density, wet	01/29/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-21
Township/Range: Patchogue, New York	Coordinate X: 1255248.57
Logged By: Tom Fowler	Coordinate Y: 219230.19
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	68						
				0-3: Dark Gray silty SAND and gravel-sized brick and concrete	01/30/08		
1						0 ppm	
		FI					
2						0 ppm	
3				3-5: Dark Gray Brown fine to medium SAND, some silt		0 ppm	Very slight odor
4						0.1 ppm	PASB21-3-5 Full TCL
5	48			5-8: Dark Gray Brown fine to coarse SAND, medium density, wet	01/30/08		
6						0 ppm	
7						0 ppm	
8				8-10: Yellow Brown fine to medium SAND, medium density, wet;		0 ppm	
9						0 ppm	
10	44			10-15: Yellow Brown fine to medium SAND, little gravel, wet	01/30/08		
11						0 ppm	PASB21-11-13 Full TCL
12						0 ppm	
13						0 ppm	
14		SP				0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-21
Township/Range: Patchogue, New York	Coordinate X: 1255248.57
Logged By: Tom Fowler	Coordinate Y: 219230.19
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15-20: Yellow Brown fine to coarse SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	36			20-25: Yellow Brownfine to coarse SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-22
Township/Range: Patchogue, New York	Coordinate X: 1255229.01
Logged By: Tom Fowler	Coordinate Y: 219254.82
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	60						
				0-2: Gray/Red Brown GRAVEL with brick fragments	01/30/08		
1				and silty sand		3 ppm	
2				2-5: Dark Gray/Black fine to coarse SAND and gravel		ppm	
3		FI				ppm	PASB22-3-5
							Full TCL
4						ppm	moderate odor
5	46			5-5.5: Gray Black SAND with some wood fibers	01/30/08		odor
				5.5-7: Gray fine to medium SAND, medium denstiy, wet		8 ppm	
6							
7				7-10: Yellow Brown fine to coarse SAND, some gravel,		1 ppm	
				medium density, wet			
8						0 ppm	
9						0 ppm	
10	64			10-15: Yellow Brown fine to medium SAND, medium	01/30/08		
				density, wet			
11						0 ppm	PASB22-11-13
							Full TCL
12						0 ppm	
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-22
Township/Range: Patchogue, New York	Coordinate X: 1255229.01
Logged By: Tom Fowler	Coordinate Y: 219254.82
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	54	SP		15-20: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	36			20-25: Yellow Brown fine to coarse SAND, medium density, wet.	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-22A
	Township/Range:	Coordinate X: 1255232.92
	Logged By: T. Fowler	Coordinate Y: 219254.20
	Drilling Method: Geoprobe	Total Depth: 15.00'
		Date Started: 07/08/08
Remarks:		Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	64	SM			07/08/08		
		SM		0–0.5: Grey brown silty SAND, some gravel	07/08/08	0 ppm	
1				0.5–1: Dark brown to black fine to coarse silty	07/08/08	0 ppm	
				SAND, some gravel		0 ppm	
2		SM		1–3: Dark brown silty SAND, brick, concrete, and		0 ppm	
				cobble fragments, moist to wet		0 ppm	
3				3–5: Grey brown, fine to medium silty SAND, some	07/08/08	0 ppm	3–5: black tar
				silt, medium dense, wet			saturated wood
4		SM					shavings and soil;
							naphthalene–like
5	60			5–8: Dark brown fine to medium SAND, some silt,	07/08/08	0 ppm	odor
				concrete fragments, wet		0 ppm	5–8: black tar
6						0 ppm	saturated soil;
		SM				0 ppm	naphthalene–like
7						0 ppm	odor
						0 ppm	
8				8–10: Dark brown to black fine to medium SAND, some	07/08/08	0 ppm	8–8.2: black tar
				silt, some gravel, wood shavings, wet			saturated soil
9		SM					8.4–8.8: black
							tar saturated soil
10	40			10–13: Brown fine to coarse SAND,some gravel,	07/08/08	0 ppm	9.1–9.2: orange
				little silt, wet		0 ppm	brown staining
11						0 ppm	
		SP				0 ppm	
12						0 ppm	
13				13–14.5: Brown silty SAND, interlayered with	07/08/08		
				dark brown peat, wet			
14		SM					

	Project Name: Former Patchogue MGP	Site Id: PASB-22A
	Township/Range:	Coordinate X: 1255232.92
	Logged By: T. Fowler	Coordinate Y: 219254.20
	Drilling Method: Geoprobe	Total Depth: 15.00'
		Date Started: 07/08/08
Remarks:		Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15		SP		14.5–15: Brown, fine to coarse SAND, some gravel, medium dense, wet	07/08/08		14.5: 1 inch wide black coating
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-23
Township/Range: Patchogue, New York	Coordinate X: 1255184.73
Logged By: Tom Fowler	Coordinate Y: 219238.23
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	60						
				0-3: Dark Brown Sand and Silt, some brick and concrete fragments	01/30/08		
1						0.4 ppm	
2						ppm	
3				3-5: Gray Black fine SAND, some silt		ppm	very slight odor
4		FI				ppm	PASB23-3-5 Full TCL
5	44			5-7: Dark Gray Brown fine to medium SAND, medium density, wet	01/30/08		
6						0 ppm	
7				7-8.5: Brown Wood weathered		0 ppm	
8						0 ppm	
				8.5-8.8: Brown PEAT			
9		PT		8.8-10: Gray fine to coarse SAND, medium density, wet		0 ppm	
10	74			10-11: Gray fine to medium SAND, medium density, wet	01/30/08		
11				11-15: Yellow Brown fine to medium SAND, medium density, wet		0 ppm	
12						0 ppm	PASB23-12-15 Full TCL MS/MSD
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-23
Township/Range: Patchogue, New York	Coordinate X: 1255184.73
Logged By: Tom Fowler	Coordinate Y: 219238.23
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15				15-20: Gray Brown fine to medium SAND, medium density, wet	01/30/08		PASB23-15-20 Full TCL
16						0 ppm	
17		SP				0 ppm	
18						0 ppm	
19						0 ppm	
20				20-25: Orange Brown fine to coarse SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-24
Township/Range: Patchogue, New York	Coordinate X: 1255153.34
Logged By: Tom Fowler	Coordinate Y: 219238.01
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/01/08
Remarks:	Date Completed: 02/01/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	68						
				0-3: Dark Brown silty SAND, some gravel, concrete, moist	02/01/08		
1						0 ppm	
		FI					
2						0 ppm	
3				3-5: Brown fine to coarse SAND, grading to peat and sand, moist		0 ppm	
4						0 ppm	
5	72			5-7.5: Brown fine to coarse SAND and peat	02/01/08		PASB24-5-10 Full TCL (MS/MSD)
6						0 ppm	
		SM					
7						0 ppm	
				7.5-10: Gray Brown fine to coarse SAND, some peat zones			
8						0 ppm	
9						0 ppm	
10	64			10-15: Yellow Brown/Gray Brown fine to coase SAND, some gravel, medium density, wet	02/01/08		PASB24-10-15 Geotech
11						0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	

	Project Name: Former Patchogue MGP	Site Id: PASB-24
	Township/Range: Patchogue, New York	Coordinate X: 1255153.34
	Logged By: Tom Fowler	Coordinate Y: 219238.01
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 02/01/08
Remarks:		Date Completed: 02/01/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60			15-20: Yellow Brown fine to medium SAND, medium density, wet	02/01/08		
16						0 ppm	
17						0 ppm	
		SP					
18						0 ppm	
19						0 ppm	
20	64			20-25: Yellow Brown/Dark Brown fine to coarse SAND, medium density, wet	02/01/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-25
	Township/Range: Patchogue, New York	Coordinate X: 1255218.90
	Logged By: Tom Fowler	Coordinate Y: 219290.60
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/30/08
Remarks:		Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60			0-3: Dark Gray/Black fine to medium SAND, some gravel	01/30/08		moderate odor
1						6 ppm	PASB25-1-6 and
		FI					PASB25-31-36
2							(duplicate)
							Full TCL
3				3-5: Gray Black fine to medium SAND, loose, moist			
4							
5	46			5-7: Dark Reddish Brown fine to medium SAND, medium density, wet	01/30/08		Strong odor
6						120 ppm	
7				7-10: Gray/Yellow Brown fine to coarse SAND, little gravel, medium density, wet			
8						38 ppm	
9							9-9.2: red brown oily staining
10	48			10-15: Red Brown/Orange Brown fine to medium SAND, medium density, wet	01/30/08		PASB25-9-14
							Full TCL
11							
12							
13							
14		SP				4 ppm	13.8-14: Dark brown oily staining

Project Name: Former Patchogue MGP	Site Id: PASB-25
Township/Range: Patchogue, New York	Coordinate X: 1255218.90
Logged By: Tom Fowler	Coordinate Y: 219290.60
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	54			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	58			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-26
	Township/Range: Patchogue, New York	Coordinate X: 1255268.34
	Logged By: Tom Fowler	Coordinate Y: 219260.97
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/31/08
Remarks:		Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	74						
1				0-3: Dark Brown Silty SAND and gravel (concrete), moist	01/31/08		
2		FI					
3				3-4.5: Gray Black GRAVEL and fine to coarse sand, wet		42 ppm	Strong odor
4		GM					
				4.5-5: Gray Black fine to coarse SAND			Oily appearance
5	60			5-8.5: Dark Gray Brown fine to coarse SAND, medium density, wet	01/31/08		PASB26-4-6
							Full TCL
6						70 ppm	
7							
8							
				8.5-10: Gray to Brown fine to coarse SAND, some gravel			
9							
10	66			10-15: Yellow Brown fine to coarse SAND becoming fine to medium, medium density, wet	01/31/08		
11						0 ppm	PASB26-11-13
							Full TCL
12						0 ppm	
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-26
Township/Range: Patchogue, New York	Coordinate X: 1255268.34
Logged By: Tom Fowler	Coordinate Y: 219260.97
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
Remarks:	Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	56	SP		15-20: Orange Brown fine to medium SAND, medium density, wet	01/31/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Orange Brown fine to medium SAND, medium density, wet	01/31/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-27
Township/Range: Patchogue, New York	Coordinate X: 1255270.27
Logged By: Tom Fowler	Coordinate Y: 219215.68
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/30/08
Remarks:	Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	70						
1		SM		0-3: Dark Gray Brown fine to medium SAND with some silt	01/30/08	0 ppm	slight odor near top of core
2						0 ppm	
3				3-5: Gray Black fine to coarse SAND and gravel, medium density		0 ppm	
4						0 ppm	PASB27-4-6 Full TCL
5	62			5-10: Dark Gray fine to coarse SAND, little gravel, medium density, wet	01/30/08		
6						0.3 ppm	
7							
8							
9							
10	68			10-15: Yellow Brown fine to medium SAND, grayish spots at 10.5-13.5	01/30/08		
11						0 ppm	
12						0 ppm	
13						0 ppm	PASB27-13-15 Full TCL
14		SP				0 ppm	

	Project Name: Former Patchogue MGP	Site Id: PASB-27
	Township/Range: Patchogue, New York	Coordinate X: 1255270.27
	Logged By: Tom Fowler	Coordinate Y: 219215.68
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/30/08
Remarks:		Date Completed: 01/30/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	62			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/30/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-28
	Township/Range: Patchogue, New York	Coordinate X: 1255260.92
	Logged By: Tom Fowler	Coordinate Y: 219331.47
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/31/08
Remarks:		Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	74						
		FI		0-1: Dark Gray silty SAND and gravel (brick fragments), moist	01/31/08		
1							Moderate to strong odor PASB 28- 1-3 Full TCL
				1-3: Gray Black fine to coarse SAND, moist		34 ppm	
2		SP					
3				3-3.4: Brown PEAT			
		PT		3.4-5: Dark Gray Brown fine to coarse SAND, medium density, moist			
4							
5	40			5-10: Gray to Brown fine to coarse SAND, medium density, wet	01/31/08		
6						0 ppm	
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	54			10-15: Yellow Brown fine to coarse SAND, little gravel, medium density, wet	01/31/08		
11						0 ppm	PASB28-11-13 Full TCL
12						0 ppm	
13						0 ppm	
14		SP				0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-28
Township/Range: Patchogue, New York	Coordinate X: 1255260.92
Logged By: Tom Fowler	Coordinate Y: 219331.47
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
Remarks:	Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60			15-20: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	58			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-28A
Township/Range:	Coordinate X: 1255256.72
Logged By: T. Fowler	Coordinate Y: 219333.84
Drilling Method: Geoprobe	Total Depth: 5.00'
	Date Started: 07/08/08
Remarks:	Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
0	48	SP		0-5: Orange-brown, fine to medium SAND, trace gravel, medium dense, wet	07/08/08	0 ppm 0 ppm 0 ppm 0 ppm	Water Table ~0.8 feet bgs in borehole
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

Project Name: Former Patchogue MGP	Site Id: PASB-29
Township/Range: Patchogue, New York	Coordinate X: 1255237.72
Logged By: Tom Fowler	Coordinate Y: 219354.91
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
Remarks:	Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	66						
1				0-3: Dark Gray fine to coarse SAND, and gravel, some silt	01/31/08	6 ppm	
2		FI					
3				3-5: Gray Black fine to medium SAND			Some odor
4		SP				6 ppm	
5	70			5-6.5: Brown PEAT, fine to coarse sand zones, wet.	01/31/08	1 ppm	
6		PT					
				6.5-9: Dark Brown fine to coarse SAND, and gravel;			
7						1 ppm	
8							
9				9-10: Brown fine to medium SAND, medium density, wet			
10	58			10-15: Light Brown fine to medium SAND, medium density, wet	01/31/08		
11						0 ppm	Dark stain 11-11.3'
12						0 ppm	
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-29
Township/Range: Patchogue, New York	Coordinate X: 1255237.72
Logged By: Tom Fowler	Coordinate Y: 219354.91
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
Remarks:	Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	46	SP		15-20: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	40			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-30
	Township/Range: Patchogue, New York	Coordinate X: 1255205.35
	Logged By: Tom Fowler	Coordinate Y: 219351.12
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/31/08
Remarks:		Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	62						
1		FI		0-2: Dark Gray Brown GRAVEL and silty sand, slightly moist	01/31/08		
2				2-5: Dark Brown to Gray Black fine to medium SAND			
3							moderately strong odor and oily appearance
4						99 ppm	
5	52			5-10: Brown fine to coarse SAND, little gravel, medium density, wet, light gray 8-8.4	01/31/08		PASB30-4-6 and PASB30-34-36 (duplicate) Full TCL
6							
7							
8						159 ppm	
9							Gray black oily zones 8-8.5' and
10	54			10-15: Gray Brown fine to medium SAND, medium density, wet.	01/31/08		9-9.6'
11							
12							
13						8 ppm	
14		SP					

Project Name: Former Patchogue MGP	Site Id: PASB-30
Township/Range: Patchogue, New York	Coordinate X: 1255205.35
Logged By: Tom Fowler	Coordinate Y: 219351.12
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
Remarks:	Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	52			15-20: Gray to Light Brown fine to medium SAND, medium density, wet	01/31/08		
16							
17							
18						1 ppm	oily stained from 17.8-18' and 19.5-19.7'
19							
20	46			20-25: Yellow Brown fine to medium SAND, medium density, wet	01/31/08		
21							
22							PASB30-21-25 Full TCL (MS/MSD)
23						0 ppm	
24							
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-31
Township/Range: Patchogue, New York	Coordinate X: 1255181.32
Logged By: Tom Fowler	Coordinate Y: 219367.33
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
Remarks:	Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	70						
		Fl		0-1: Gray Brown GRAVEL (some brick fragments) and	01/29/08		1-2: some odor
1				silty sand, wet at 1' bgs		4 ppm	iridenscent
				1-2: Gray to Black fine to medium SAND, wet			sheen ~3' bgs
2				2-5: Gray to Black fine to medium SAND, wet			2.0-4.5: moderate
							odor
3							PASB31-2-4 and
							PASB31-32-34
4							(duplicate)
							Full TCL
5	40			5-10: Light Brown to Brown fine to coarse SAND,	01/29/08		Lighter color
				medium density			with depth
6						0 ppm	
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	30			10-15: Yellow Brown fine to medium SAND, medium	01/29/08		PASB31-10-15
				density, wet			Full TCL
11						0 ppm	
12						0 ppm	
13		SP				0 ppm	
14						0 ppm	

	Project Name: Former Patchogue MGP	Site Id: PASB-31
	Township/Range: Patchogue, New York	Coordinate X: 1255181.32
	Logged By: Tom Fowler	Coordinate Y: 219367.33
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/29/08
Remarks:		Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15-20: Brown fine to medium SAND, medium density, wet	01/29/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	44			20-25: Yellow Brown to Gray Brown fine to medium SAND, medium density, wet	01/29/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-31A
	Township/Range:	Coordinate X: 1255182.02
	Logged By: T. Fowler	Coordinate Y: 219362.81
	Drilling Method: Geoprobe	Total Depth: 15.00'
		Date Started: 07/08/08
Remarks:		Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	66				07/08/08		
				0-3: Dark brown to grey brown fine to medium SAND,		0 ppm	
1				moist to wet		0 ppm	
		SP				0 ppm	
2						0 ppm	
						0 ppm	
3				3-4.5: Dark grey brown fine to medium SAND, wet	07/08/08	0 ppm	3-4.5: naphthalene-like odor, black staining
		SP					
4							
				4.5-5: Light grey fine to medium SAND, wet	07/08/08		4.5-5: black staining
		SP					
5	90			5-10: Dark grey brown grading to light	07/08/08	0 ppm	5-10: trace naphthalene-like odor
				grey and then light brown fine to coarse SAND, wet		0 ppm	
6						0 ppm	
						0 ppm	
7						0 ppm	
		SP				0 ppm	
8						0 ppm	8-8.5: dark brown staining
						0 ppm	
9						0 ppm	
						0 ppm	
10	52			10-10.4: Light brown medium to coarse SAND, little gravel, wet	07/08/08	0 ppm	
		SP		10.4-15: Light grey brown fine to medium SAND, wet	07/08/08	0 ppm	
11						0 ppm	
						0 ppm	
12						0 ppm	
						0 ppm	
13		SP					
14							

Project Name: Former Patchogue MGP	Site Id: PASB-31A
Township/Range:	Coordinate X: 1255182.02
Logged By: T. Fowler	Coordinate Y: 219362.81
Drilling Method: Geoprobe	Total Depth: 15.00'
	Date Started: 07/08/08
Remarks:	Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-32
Township/Range: Patchogue, New York	Coordinate X: 1255162.10
Logged By: Tom Fowler	Coordinate Y: 219365.88
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
Remarks:	Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	66						
				0-2: Dark Gray to Gray Brown fine to medium SAND and	01/29/08		Slight odor
1		SM		silt, very moist		0 ppm	PASB32-0-2
							Full TCL
2				2-4.5: Medium Brown to Orange Brown fine to coarse SAND,	01/29/08	0 ppm	PASB32-2-4
				little gravel, wet at 3' bgs			Full TCL
3						0 ppm	
4						0 ppm	
				4.5-5: Light Orange Brown fine to coarse SAND, medium density			
5	44			5-10: Light Gray Brown fine to coarse SAND, medium density,	01/29/08		
				wet			
6						0 ppm	PASB32-6-10
							Full TCL
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	58			10-15: Light Gray fine to medium SAND, medium density, wet	01/29/08		
11						0 ppm	
12						0 ppm	
13						0 ppm	
		SP					
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-32
Township/Range: Patchogue, New York	Coordinate X: 1255162.10
Logged By: Tom Fowler	Coordinate Y: 219365.88
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
Remarks:	Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	40			15-20: Gray Brown fine to coarse SAND, medium density, wet	01/29/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Light Gray fine to medium SAND, medium density, wet	01/29/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-33
Township/Range: Patchogue, New York	Coordinate X: 1255146.67
Logged By: Tom Fowler	Coordinate Y: 219346.27
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/29/08
Remarks:	Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
	66						
		Fl		0-1: Dark Gray GRAVEL and silty sand	01/29/08		slight odor
1				1-3: Dark Gray Brown fine to medium SAND, little gravel, wet		0 ppm	1-3: slight odor
							PASB33-1-3
2						0 ppm	Full TCL
3				3-5: Medium Brown to Gray Brown fine to medium SAND, trace gravel, medium density, wet		0 ppm	
4						0 ppm	
5	56			5-10: Yellow Brown fine to coarse SAND, medium density, wet	01/29/08		
6						0 ppm	PASB33-6-10
							Full TCL
7						0 ppm	
8						0 ppm	
9						0 ppm	
10	66			10-15: Light Gray Brown fine to coarse SAND, medium density, wet	01/29/08		
11						0 ppm	
12						0 ppm	
13		SP				0 ppm	
14						0 ppm	

	Project Name: Former Patchogue MGP	Site Id: PASB-33
	Township/Range: Patchogue, New York	Coordinate X: 1255146.67
	Logged By: Tom Fowler	Coordinate Y: 219346.27
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/29/08
Remarks:		Date Completed: 01/29/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60			15–20: Light Gray Brown to Brown fine to medium SAND, grading to fine, medium density, wet	01/29/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	66			20–25: Light Gray Brown fine to medium SAND, medium density, wet	01/29/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-34
	Township/Range: Patchogue, New York	Coordinate X: 1255181.54
	Logged By: Tom Fowler	Coordinate Y: 219413.40
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 01/31/08
Remarks:		Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0	60						
1		FI		0-2: Whitish sand sized particles of broken concrete, some gravel	01/31/08	0.1 ppm	
2				2-3.5: Dark Brown fine to coarse SAND and gravel, some silt			
3		GM					
4				3.5-5: Dark Brown fine to coarse SAND, moist			
5	80			5-10: Gray Brown fine to coarse SAND, little gravel, medium density, wet	01/31/08		
6						0.1 ppm	
7							
8							
9							
10	40			10-15: Gray Brown to Light Gray Brown fine to medium SAND, medium density, wet	01/31/08		PASB34-10-15 Full TCL
11						0 ppm	
12						0 ppm	
13						0 ppm	
14		SP				0 ppm	

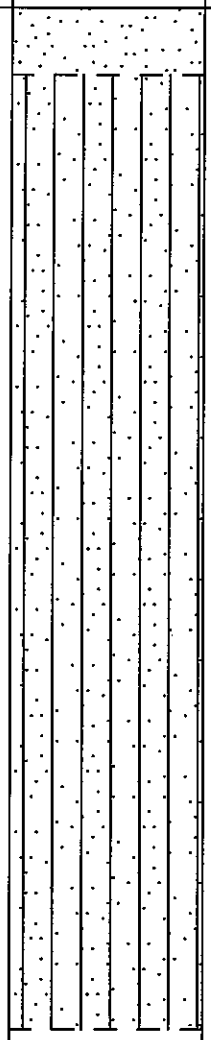
Project Name: Former Patchogue MGP	Site Id: PASB-34
Township/Range: Patchogue, New York	Coordinate X: 1255181.54
Logged By: Tom Fowler	Coordinate Y: 219413.40
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 01/31/08
Remarks:	Date Completed: 01/31/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	48			15-20: Light Brown fine to coarse SAND, medium density, wet	01/31/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	46			20-25: Light Brown fine to medium SAND, medium density, wet	01/31/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-35
Township/Range: Patchogue, New York	Coordinate X: 1255296.30
Logged By: Tom Fowler	Coordinate Y: 219218.32
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08
Remarks:	Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0							
1		FI		0-2: Dark Gray silty SAND and gravel, dense	02/04/08	0 ppm	Hand augered to 5' bgs. Hit refusal the first 2 attempts. Third attempt was successful. Refusals were at 4.5' and 3.5' bgs, respectively.
2				2-5: Dark Brown fine to medium SAND, some silt, wet		0 ppm	
3						0 ppm	
4						0 ppm	
5	56	SM		5-7: Dark Brown fine to medium SAND, some fine peat strata	02/04/08		
6						0 ppm	
7				7-10: Gray Brown fine to coarse SAND, some gravel, wet		0 ppm	
8						0 ppm	
9						0 ppm	
10	30			10-15: Yellow Brown fine to coarse SAND, some gravel, medium density, wet	02/04/08		
11		SP				0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-35
Township/Range: Patchogue, New York	Coordinate X: 1255296.30
Logged By: Tom Fowler	Coordinate Y: 219218.32
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/04/08
Remarks:	Date Completed: 02/04/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	48			15-20: Red Brown fine to coarse SAND, some dark brown peat strata, medium density, wet.	02/04/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	62	SM		20-25: Yellow Brown fine to coarse SAND, medium density, wet	02/04/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-36
Township/Range: Patchogue, New York	Coordinate X: 1255300.61
Logged By: Tom Fowler	Coordinate Y: 219269.70
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08
Remarks:	Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0							
1				0-5: Gray Black fine to coarse SAND and silt, some gravel, little ash, trace tarry material	02/05/08	0 ppm	Hand augered to 5' bgs.
2						0 ppm	
3		FI				0 ppm	
4						0 ppm	
5	62			5-5.5: Dark Brown PEAT	02/05/08		
6		PT		5.5-6: Dark Gray Brown GRAVEL and fine to medium SAND, oily appearance		0.2 ppm	5.5-6: Slight odor PASB36-6-8 Full TCL
7				6-10: Gray Brown fine to medium SAND, medium density, wet			7-8: Brown peat
8		GM					
9							
10	56			10-15: Orange Brown fine to coarse SAND, some gravel, medium density, wet	02/05/08		
11						0 ppm	PASB36-11-13 Full TCL
12						0 ppm	
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-36
Township/Range: Patchogue, New York	Coordinate X: 1255300.61
Logged By: Tom Fowler	Coordinate Y: 219269.70
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08
Remarks:	Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	42	SP		15-20: Yellow Brown fine to medium SAND, medium density, wet	02/05/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	28			20-25: Orange Brown fine to coarse SAND, trace gravel, medium density, wet	02/05/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

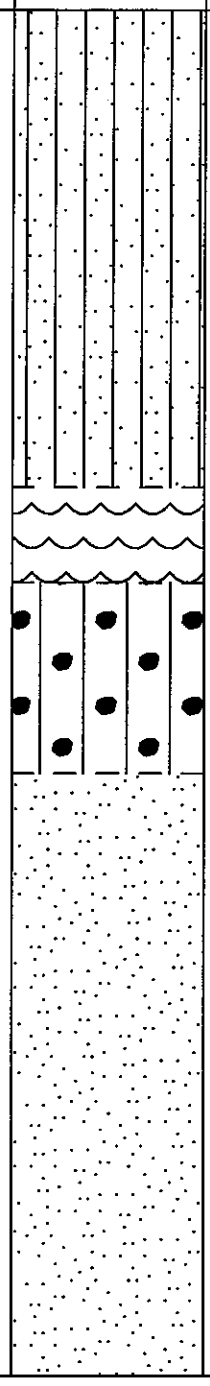
Project Name: Former Patchogue MGP	Site Id: PASB-37
Township/Range: Patchogue, New York	Coordinate X: 1255286.29
Logged By: Tom Fowler	Coordinate Y: 219332.80
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08
Remarks:	Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
0							
1				0-5: Gray Black fine to coarse SAND and silt, some gravel, possible fly ash, slight oily appearance	02/05/08	0 ppm	Hand augered to 5' bgs.
2						0 ppm	
3		FI				0 ppm	
4						0 ppm	
5	66			5-6.5: Dark Gray Brown fine to coarse SAND and gravel, some silt, dense, wet	02/05/08		PASB37-5-7 Full TCL
6		GM				0 ppm	
7		SP		6.5-7.5: Dark Gray Brown fine to coarse SAND		0 ppm	
8		PT		7.5-8: Brown PEAT			
9		SM		8-9: Brown fine to medium SAND, some peat near top		0 ppm	
10	66			9-10: Dark Brown fine to medium SAND and peat		0 ppm	
11				10-15: Dark Brown fine to coarse SAND, medium density, wet. 10-10.5 SAND and gravel	02/05/08	0 ppm	
12						0 ppm	
13						0 ppm	
14						0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-37
Township/Range: Patchogue, New York	Coordinate X: 1255286.29
Logged By: Tom Fowler	Coordinate Y: 219332.80
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08
Remarks:	Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	60	SP		15–20: Red Brown to Orange Brown fine to coarse SAND, medium density, wet	02/05/08		
16						0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	52			20–25: Yellow Brown to Red Brown fine to coarse SAND, medium density, wet	02/05/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-38
Township/Range: Patchogue, New York	Coordinate X: 1255283.36
Logged By: Tom Fowler	Coordinate Y: 219408.41
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08
Remarks:	Date Completed: 02/05/08



Depth	% Recovery	USCS Code	Material Description	DATE	PID	Notes
0	0					
1		SM	0-3: Dark Brown silty SAND, some gravel	02/05/08	0 ppm	Hand augered to 5' bgs.
2					0 ppm	
3			3-5: Gray Brown silty SAND, some gravel		0 ppm	
4					0 ppm	
5	56	PT	5-6: Brown PEAT	02/05/08		PASB38-5-7 Full TCL
6		GM	6-8: Dark Brown to Brown fine to coarse SAND, some gravel, some peat, wet		0 ppm	
7					0 ppm	
8			8-10: Brown to Dark Brown fine to coarse SAND, little gravel, medium density, wet		0 ppm	
9					0 ppm	
10	52		10-11: Brown fine to coarse SAND, little gravel	02/05/08		
11			11-15: Gray Brown fine to medium SAND, medium density, wet		0 ppm	
12					0 ppm	
13					0 ppm	
14					0 ppm	

Project Name: Former Patchogue MGP	Site Id: PASB-38
Township/Range: Patchogue, New York	Coordinate X: 1255283.36
Logged By: Tom Fowler	Coordinate Y: 219408.41
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 02/05/08
Remarks:	Date Completed: 02/05/08

Depth	% Recovery	USCS Code	Graphic Log	Material Description	DATE	PID	Notes
15	50			15-20: Gray Brown fine to coarse SAND, medium density, wet	02/05/08		
16		SP				0 ppm	
17						0 ppm	
18						0 ppm	
19						0 ppm	
20	42			20-25: Light Brown fine to medium SAND, medium density, wet	02/05/08		
21						0 ppm	
22						0 ppm	
23						0 ppm	
24						0 ppm	
25							
26							
27							
28							

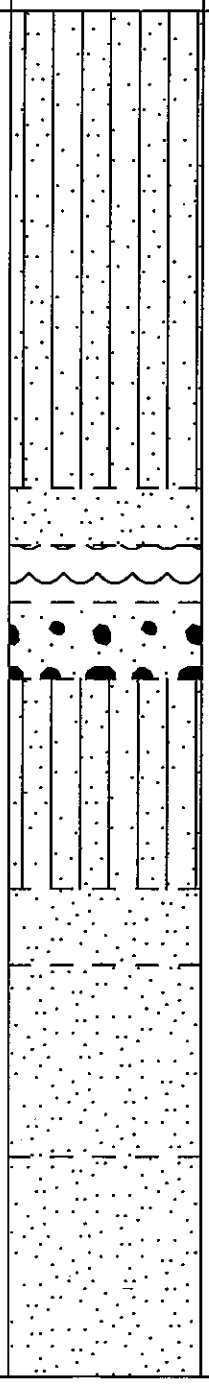
Project Name: Former Patchogue MGP	Site Id: PASB-39
Township/Range:	Coordinate X: 1255314.26
Logged By: T. Fowler	Coordinate Y: 219376.97
Drilling Method: Geoprobe	Total Depth: 24.00'
	Date Started: 07/09/08
Remarks:	Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	100				07/09/08		
1				0-4: Dark grey brown fine to medium SAND, some silt, wet at 4 feet			0-4: Hand augered
2		SP					
3							
4	50			4-5: Dark grey brown fine to coarse SAND,	07/09/08	0 ppm	PASB39-4-9:
		SP		little gravel, wet		0 ppm	VOC, SVOC,
5		SM		5-5.5: Dark brown fine SAND, some silt, wet	07/09/08	0 ppm	CN, TOC
				5.5-9: Dark brown fine to medium SAND,	07/09/08	0 ppm	
6				medium dense, wet		0 ppm	
						0 ppm	
7		SP					
8							
9	16			9-10: Light brown fine to coarse GRAVEL	07/09/08	0 ppm	
				and fine to coarse SAND, medium dense, wet		0 ppm	
10							
11							
		GP					
12							
13							
14	58			14-17: Dark grey brown fine to coarse SAND,	07/09/08	0 ppm	

	Project Name: Former Patchogue MGP	Site Id: PASB-39
	Township/Range:	Coordinate X: 1255314.26
	Logged By: T. Fowler	Coordinate Y: 219376.97
	Drilling Method: Geoprobe	Total Depth: 24.00'
		Date Started: 07/09/08
Remarks:		Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15		SM		some silt, some gravel, little peat, medium dense, wet		0 ppm	
						0 ppm	
16						0 ppm	
						0 ppm	
17						0 ppm	
				17–18: Dark brown PEAT, wet	07/09/08		
		PT					
18				18–19: Brown fine to coarse SAND, some gravel, wet	07/09/08		
		SP					
19	40			19–24: Orange brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
						0 ppm	
20						0 ppm	
						0 ppm	
21						0 ppm	
		SP				0 ppm	
22						0 ppm	
23							
24							
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-40
Township/Range:	Coordinate X: 1255303.37
Logged By: T. Fowler	Coordinate Y: 219328.40
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/10/08
Remarks:	Date Completed: 07/10/08



Depth	Recovery %	USCS Code	Material Description	Date	PID	Notes
0	100			07/10/08		
1			0–5: Dark grey fine to medium SAND and SILT, little gravel, moist			0–5: Hand augered. Water Table ~0.8 feet bgs in borehole PASB40–0–5: VOC, SVOC, CN, TOC
2		SM				
3						
4						
5	50		5–5.6: Dark brown, fine to coarse SAND, some	07/10/08	0 ppm	
		SP	gravel, little silt, wet	07/10/08	0 ppm	
6		PT	5.6–6.2: Dark brown PEAT, wet	07/10/08	0 ppm	
		GP	6.2–7: Dark brown GRAVEL and fine to coarse SAND, wet		0 ppm	
7			7–9.2: Dark brown fine to medium SAND, some peat, wet	07/10/08	0 ppm	
					0 ppm	
8		SM				
9			9.2–10: Dark brown fine to coarse SAND, some	07/10/08		
		SP	gravel, wet			
10	64		10–12: Brown fine to coarse SAND, some gravel, wet	07/10/08	0 ppm	
					0 ppm	
11		SP			0 ppm	
					0 ppm	
12			12–15: Light brown fine to medium SAND, medium	07/10/08	0 ppm	
			dense, wet		0 ppm	
13					0 ppm	
		SP				
14						

	Project Name: Former Patchogue MGP	Site Id: PASB-40
	Township/Range:	Coordinate X: 1255303.37
	Logged By: T. Fowler	Coordinate Y: 219328.40
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 07/10/08
Remarks:		Date Completed: 07/10/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	70			15-20: Light brown, fine to medium SAND, trace gravel, medium dense, wet	07/10/08	0 ppm	PASB40-15-17: VOC, SVOC, CN, TOC
16						0 ppm	
17						0 ppm	
18		SP				0 ppm	
19						0 ppm	
20	22			20-25: Brown fine to medium SAND, trace gravel, medium dense, wet	07/10/08	0 ppm	
21						0 ppm	20.8: dark red brown staining
22						0 ppm	
23		SP					
24							
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-41
	Township/Range:	Coordinate X: 1255319.48
	Logged By: T. Fowler	Coordinate Y: 219262.75
	Drilling Method: Geoprobe	Total Depth: 30.00'
		Date Started: 07/09/08
Remarks:		Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	100				07/09/08		
1		SM		0–2: Dark grey SAND and SILT, little gravel, moist			0–5: Hand augered 0–2: slight fuel–like odor
2				2–5: Light grey brown to dark grey SILT, some sand, little gravel, appears to be ash, wet	07/09/08		
3		ML					
4							
5	64			5–6: Dark brown PEAT, wet	07/09/08	5 ppm	
		PT					
6		GP		6–6.5: Dark brown to black GRAVEL, wet	07/09/08		6–6.5: saturated with oil
7		SP		6.5–8.5: Brown fine to medium SAND, some peat, wet	07/09/08	10 ppm	6.5–8: black staining
						8 ppm	
8						4 ppm	8–8.5: oil coated
9		GP		8.5–10: Light brown GRAVEL and fine to coarse SAND, wet	07/09/08		PASB-41-6-8: VOC, SVOC, CN, TOC
						0.5 ppm	
10	58	SP		10–11: Yellow brown fine to coarse SAND, medium dense, wet	07/09/08	0 ppm 0 ppm	
11				11–12.5: Orange brown and reddish brown laminations of fine SAND, wet	07/09/08	0 ppm	PASB-41-11-13: VOC, SVOC, CN, TOC
12		SP				0 ppm 0 ppm	
13				12.5–15: Dark brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
14		SP					

	Project Name: Former Patchogue MGP	Site Id: PASB-41
	Township/Range:	Coordinate X: 1255319.48
	Logged By: T. Fowler	Coordinate Y: 219262.75
	Drilling Method: Geoprobe	Total Depth: 30.00'
		Date Started: 07/09/08
Remarks:		Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	62			15–16.5: Orange brown laminated fine to medium SAND, medium dense, wet	07/09/08	0 ppm	
						0 ppm	
16		SP				0 ppm	
				16.5–18.2: Light brown fine SAND, little gravel, medium dense, wet	07/09/08	0 ppm	
17						0 ppm	
		SP				0 ppm	
18				18.2–18.5: Dark brown fine SAND, wet		0 ppm	18.2–18.5: dark
		SP		18.5–20: Orange brown fine to medium SAND, medium dense, wet	07/09/08	0 ppm	brown staining
19					07/09/08	0 ppm	
		SP				0 ppm	
20	62			20–25: Orange brown and red brown laminated fine to medium SAND, wet	07/09/08	0 ppm	
						0 ppm	
21						0 ppm	
				21.4–21.7: Dark brown fine SAND, wet		0 ppm	
22				21.7–25: Orange brown and red brown laminated fine to medium SAND, wet		0 ppm	
		SP				0 ppm	
23						0 ppm	
24							
25	58			25–30: Yellow brown fine to medium SAND, wet	07/09/08	0 ppm	
						0 ppm	
26						0 ppm	
						0 ppm	
27						0 ppm	
		SP				0 ppm	
28							

Project Name: Former Patchogue MGP	Site Id: PASB-41
Township/Range:	Coordinate X: 1255319.48
Logged By: T. Fowler	Coordinate Y: 219262.75
Drilling Method: Geoprobe	Total Depth: 30.00'
	Date Started: 07/09/08
Remarks:	Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
29							29–29.2: dark brown staining 29.5: black staining
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							

	Project Name: Former Patchogue MGP	Site Id: PASB-42
	Township/Range:	Coordinate X: 1255156.06
	Logged By: T. Fowler	Coordinate Y: 219305.00
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 07/08/08
Remarks:		Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	68				07/08/08		
		SM		0-1: Dark grey silty SAND		0 ppm	PASB-42-0-0.2
1				1-1.5: Weathered concrete and gravel, some silt, moist	07/08/08	0 ppm	and PASB-42-0-0.5:
		Fl		1.5-2: Weathered dark brown wood fragments	07/08/08	0 ppm	VOC, SVOC,
2		Fl		2-3: Dark brown silty SAND, some gravel, peat lens	07/08/08	0 ppm	CN, TOC
		SM				0 ppm	
3				3-3.8: Dark brown silty SAND, brick and concrete fragments	07/08/08	0 ppm	
		Fl		3.8-4.2: Dark brown to black organic silt, wood shavings, wet			3.8-4.2: black
4				4.2-5: Dark brown silty SAND, brick and concrete fragments, wet	07/08/08 07/08/08		staining
		Fl					
5	58			5-7: Orange brown fine to coarse SAND, some gravel, medium dense to dense, red brown color from 6.5 to 7 feet	07/08/08	0 ppm	
						0 ppm	
6		SP				0 ppm	
						0 ppm	
7				7-10: Yellow brown fine to medium SAND, medium dense, wet	07/08/08	0 ppm	
						0 ppm	
8							
		SP					
9							
10	46			10-15: Light grey brown fine to medium SAND, trace gravel, wet	07/08/08	0 ppm	
						0 ppm	
11						0 ppm	
						0 ppm	
12						0 ppm	
		SP					
13							13-13.1: brown
							staining
14							

	Project Name: Former Patchogue MGP	Site Id: PASB-42
	Township/Range:	Coordinate X: 1255156.06
	Logged By: T. Fowler	Coordinate Y: 219305.00
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 07/08/08
Remarks:		Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	48			15–20: Grey brown fine to medium SAND, medium dense, wet	07/08/08		
16							
17							
18		SP					
19							
20	52			20–25: Light brown fine to medium SAND, medium dense, wet	07/08/08	0 ppm	
21						0 ppm	
22						0 ppm	
23		SP				0 ppm	PASB-42-23-25: VOC, SVOC, CN, TOC
24						0 ppm	
25						0 ppm	
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-43
Township/Range:	Coordinate X: 1255146.17
Logged By: T. Fowler	Coordinate Y: 219281.14
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/08/08
Remarks:	Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	60				07/08/08	0 ppm	
				0-2: Dark brown silty SAND, some gravel		0 ppm	PASB-43-0-0.2 and
1		SP				0 ppm	PASB-43-0-0.5:
						0 ppm	VOC, SVOC
2				2-3: Brown silty SAND, brick and concrete fragments	07/08/08	0 ppm	CN, TOC
		FI				0 ppm	
3				3-5: Brown silty SAND, brick fragments, wet	07/08/08	0 ppm	
4		FI					
5	40			5-6.5: Brown fine to medium silty SAND, little gravel, wet	07/08/08	0 ppm	
		SM				0 ppm	
6						0 ppm	
				6.5-10: Fine to medium SAND, medium dense, wet	07/08/08	0 ppm	
7						0 ppm	
8		SP					
9							
10	52			10-15: Light grey brown fine to coarse SAND, little gravel, medium dense, wet	07/08/08	0 ppm	
						0 ppm	
11						0 ppm	11: dark brown
						0 ppm	staining
12						0 ppm	
		SP				0 ppm	
13							PASB-43-13-15:
							VOC, SVOC
14							CN, TOC

Project Name: Former Patchogue MGP	Site Id: PASB-43
Township/Range:	Coordinate X: 1255146.17
Logged By: T. Fowler	Coordinate Y: 219281.14
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/08/08
Remarks:	Date Completed: 07/08/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	64			15-20: Light brown fine to medium SAND, medium dense, wet	07/08/08	0 ppm	14.0-14.3: dark brown staining
16						0 ppm	
						0 ppm	
17						0 ppm	
		SP				0 ppm	
18						0 ppm	
19							19.0-19.1: brown staining
20	36			20-25: Light brown to orange brown fine to coarse SAND, wet	07/08/08	0 ppm	
21						0 ppm	
						0 ppm	
22						0 ppm	
		SP					
23							PASB-43-23-25: VOC, SVOC, CN, TOC
24							
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-44
	Township/Range:	Coordinate X: 1255344.89
	Logged By: T. Fowler	Coordinate Y: 219245.82
	Drilling Method: Geoprobe	Total Depth: 14.00'
		Date Started: 07/09/08
Remarks:		Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	100				07/09/08		
1				0-4: Grey brown silty SAND, wet at 4 feet bgs			0-4: Hand augered Slight petroleum-like odor
2		SP					
3							
4	66			4-6: Brown to grey brown fine to medium	07/09/08	0 ppm	
				SAND, medium dense, very thin 30-degree dark		0 ppm	
5		SP		brown strata at at 5 feet bgs, wet		0 ppm	
						0 ppm	
6				6-6.5: Dark grey fine to medium SAND, wet	07/09/08	0 ppm	
		SP		6.5-9: Light grey brown fine to medium	07/09/08	0 ppm	
7				SAND, some gravel, wet		0 ppm	
		SP					7.5-8: dark brown to black staining PASB44-7-9:
8							
9	62			9-11: Brown fine to coarse SAND, some	07/09/08	0 ppm	VOC, SVOC,
				gravel, wet		0 ppm	CN, TOC
10		SP				0 ppm	
						0 ppm	
11				11-14: Yellow brown fine to medium SAND,	07/09/08	0 ppm	
				medium dense, wet		0 ppm	
12						0 ppm	
		SP					
13							
14							

Project Name: Former Patchogue MGP	Site Id: PASB-45
Township/Range:	Coordinate X: 1255361.55
Logged By: T. Fowler	Coordinate Y: 219233.32
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 07/09/08
Remarks:	Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	100				07/09/08		
				0-5: silty SAND			0-5: Hand augered
1							
2							
		SP					
3							
4							
5	62			5-7: Dark grey brown to black silty SAND,	07/09/08	0 ppm	PASB45-5-7:
				some gravel, grading to peat, wet		0 ppm	VOC, SVOC,
6		SP				0 ppm	CN, TOC
						0 ppm	5-7: black
7				7-10: Grey brown fine to medium SAND,	07/09/08	0 ppm	staining
				some gravel, wet		0 ppm	
8						0 ppm	
		SP					
9							
10	78			10-11: Red brown coarse SAND, wet	07/09/08	0 ppm	
		SP				0 ppm	
11				11-14: Yellow brown fine to medium SAND,	07/09/08	0 ppm	
				medium dense, wet		0 ppm	
12						0 ppm	
		SP				0 ppm	
13						0 ppm	
						0 ppm	
14				14-14.5: Red brown coarse SAND, wet	07/09/08		

	Project Name: Former Patchogue MGP	Site Id: PASB-45
	Township/Range:	Coordinate X: 1255361.55
	Logged By: T. Fowler	Coordinate Y: 219233.32
	Drilling Method: Geoprobe	Total Depth: 20.00'
		Date Started: 07/09/08
Remarks:		Date Completed: 07/09/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	64	SP		14.5–15: Yellow brown fine to medium SAND, medium dense, wet	07/09/08		
					07/09/08	0 ppm	
16				15–20: Reddish brown fine to medium SAND, medium dense, wet		0 ppm	
						0 ppm	
17						0 ppm	
		SP				0 ppm	
18						0 ppm	
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

Project Name: Former Patchogue MGP	Site Id: PASB-46
Township/Range:	Coordinate X: 1255152.27
Logged By: T. Fowler	Coordinate Y: 219210.17
Drilling Method: Geoprobe	Total Depth: 25.00'
	Date Started: 07/10/08
Remarks:	Date Completed: 07/10/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	50				07/10/08	0 ppm	
				0-1.5: Dark grey SAND, some silt, brick		0 ppm	PASB-46-0-0.2 and
1				fragments, moist		0 ppm	PASB-46-0-0.5:
		SP		1.5-3: Grey brown fine to coarse SAND, some	07/10/08	0 ppm	VOC, SVOC,
2				silt, wet		0 ppm	CN, TOC
						0 ppm	
3				3-5: Dark grey brown fine to medium SAND,	07/10/08		
				little silt, trace gravel, medium dense, wet			
4		SP					
5	82			5-7: Grey brown to dark brown fine to medium SAND,	07/10/08	0 ppm	
				little peat, wet		0 ppm	
6		SP				0 ppm	PASB46-6-8:
						0 ppm	VOC, SVOC,
7				7-7.4: Brown PEAT, some sand, wet	07/10/08	0 ppm	CN, TOC
		PT		7.4-9.6: Brown fine to medium SAND, medium dense,	07/10/08	0 ppm	
8				peat lenses at 7.5 to 7.7 feet bgs, 8.5 to 8.8		0 ppm	
		SP		feet bgs, and 9.2 to 9.3 feet bgs, wet		0 ppm	
9						0 ppm	
				9.6-10: Brown PEAT, wet	07/10/08		
10		PT					
	66			10-11.5: Light brown fine to coarse SAND, some	07/10/08	0 ppm	
		SP		gravel, medium dense, wet		0 ppm	
11						0 ppm	
				11.5-15: Light brown fine to medium SAND,	07/10/08	0 ppm	
12				medium dense, wet		0 ppm	
						0 ppm	
13						0 ppm	
		SP					
14							

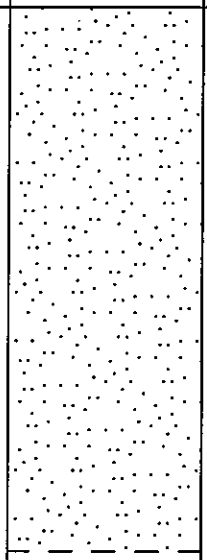
	Project Name: Former Patchogue MGP	Site Id: PASB-46
	Township/Range:	Coordinate X: 1255152.27
	Logged By: T. Fowler	Coordinate Y: 219210.17
	Drilling Method: Geoprobe	Total Depth: 25.00'
		Date Started: 07/10/08
Remarks:		Date Completed: 07/10/08

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	58			15–20: Light brown fine to medium SAND, medium dense, wet	07/10/08	0 ppm	
16						0 ppm	
						0 ppm	
17						0 ppm	
		SP				0 ppm	
18							
19							
20	30			20–25: Light brown fine to medium SAND, medium dense, wet	07/10/08	0 ppm	
21						0 ppm	
						0 ppm	
22						0 ppm	
		SP					
23							
24							
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-47
	Township/Range:	Coordinate X: 1255436.87
	Logged By: C. DeCarlo	Coordinate Y: 219236.43
	Drilling Method: Geoprobe	Total Depth: 20.00'
		Date Started: 11/23/09
Remarks: Due to moisture, the PID was not functioning properly for the end of this boring.		Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	46				11/23/2009	0 ppm	
1				0–1.6: Dark grayish brown SILT, with some medium Sand, and shell fragments.		0 ppm	
2				1.6–4.8: Black SILT with trace medium Sand and organic plant material, wet at 2.5 feet.	11/23/2009	50.5 ppm	Petroleum–like odor present.
3		ML					
4						7.1 ppm	
5	44			4.8–5: Dark brown f SAND, wet. 5–6.3: Dark brown f SAND, wet.	11/23/2009	2.5 ppm	
6		SP				1.9 ppm	
7				6.3–10: Dark brown f–c GRAVEL, wet.	11/23/2009	2.7 ppm	
8		GW					
9							
10	70			10–15: Yellowish red f SAND, red mottling, wet.	11/23/2009		
11							
12							
13							
14							

Project Name: Former Patchogue MGP	Site Id: PASB-47
Township/Range:	Coordinate X: 1255436.87
Logged By: C. DeCarlo	Coordinate Y: 219236.43
Drilling Method: Geoprobe	Total Depth: 20.00'
	Date Started: 11/23/09
Remarks: Due to moisture, the PID was not functioning properly for the end of this boring.	Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	0	SP		15-20: Yellowish red f SAND, red mottling, wet.	11/23/2009		
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-48
	Township/Range:	Coordinate X: 1255420.16
	Logged By: C. DeCarlo	Coordinate Y: 219186.62
	Drilling Method: Geoprobe	Total Depth: 20.00'
		Date Started: 11/23/09
Remarks:		Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
	64					1 ppm	
1				0–2.3: Dark reddish brown SILT, trace f Sand, with organic matter.			
2		ML		2.3–4: Dark reddish brown SILT, trace f Sand, with organic matter, Gravel and coal fragments, wet at 2.5 feet.	11/23/2009	0 ppm 30.5 ppm	Petroleum-like odor present at 2.5 feet.
3							
4				4–5: Black f SAND with trace Gravel, wet.	11/23/2009	7.6 ppm	
5	100			5–7.4: Dark reddish brown f SAND, trace Silt, wet.	11/23/2009	0 ppm	
6		SP					
7							
8		GW		7.4–9.3: Reddish brown f–c GRAVEL with f–c Sand, wet.	11/23/2009	0 ppm	
9							
				9.3–10: Reddish brown f SAND, wet.	11/23/2009	0 ppm	
10	78			10–13.5: Very pale brown f SAND, wet.	11/23/2009	0 ppm	
11						0 ppm	
12						0 ppm	
13							
				13.5–15: Yellowish red f SAND, with red mottling, wet.	11/23/2009	0 ppm	
14							

	Project Name: Former Patchogue MGP	Site Id: PASB-48
	Township/Range:	Coordinate X: 1255420.16
	Logged By: C. DeCarlo	Coordinate Y: 219186.62
	Drilling Method: Geoprobe	Total Depth: 20.00'
		Date Started: 11/23/09
Remarks:		Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	64	SP		15–20: Yellowish red f SAND, with red mottling, wet.	11/23/2009	0 ppm	
16						0 ppm	
17							
18						0 ppm	
19						0 ppm	
20							
21							
22							
23							
24							
25							
26							
27							
28							

	Project Name: Former Patchogue MGP	Site Id: PASB-49
	Township/Range:	Coordinate X: 1255369.56
	Logged By: C. DeCarlo	Coordinate Y: 219124.62
	Drilling Method: Geoprobe	Total Depth: 20.00'
		Date Started: 11/23/09
Remarks: Due to moisture, the PID was not functioning properly for the beginning of this boring.		Date Completed: 11/23/09

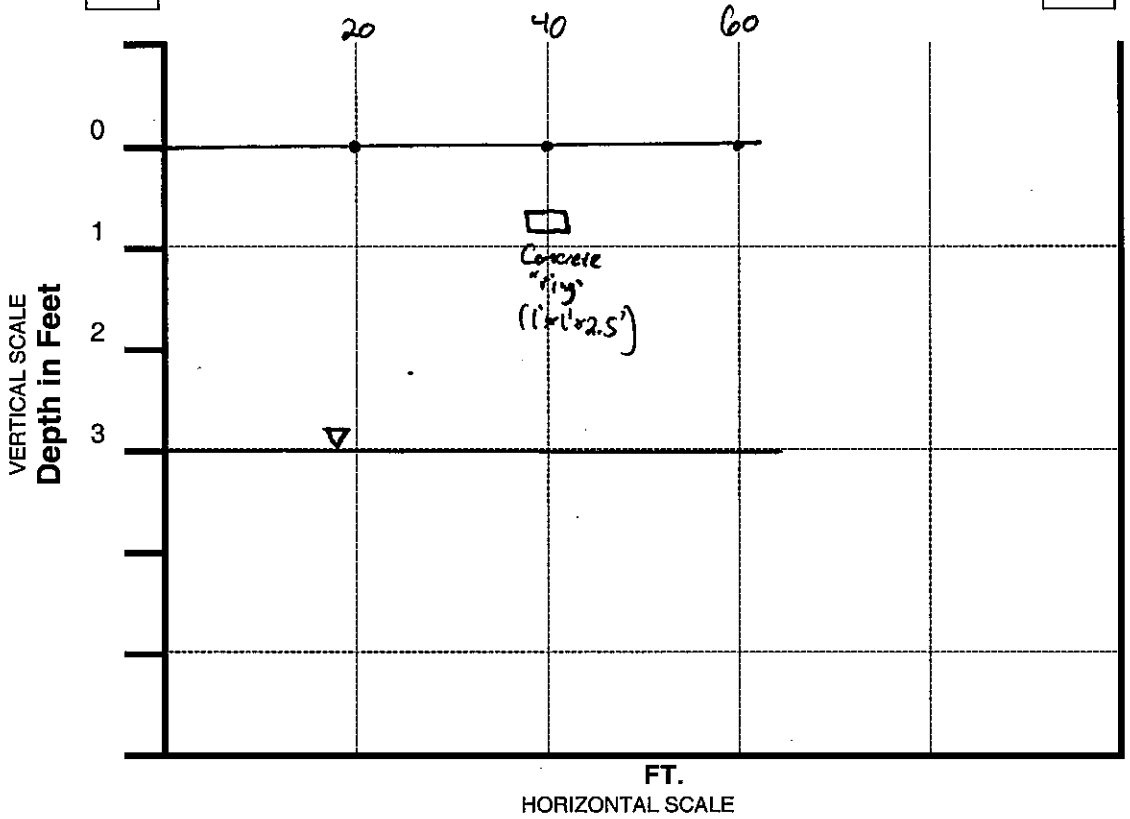
Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
1	64	ML		0–2.1: Very dark grayish brown SILT trace Sand with cinder and shell fragments.			
2					11/23/2009		
3				2.1–4.6: Brown f SAND, wet at 2.5'.			
4							
5	90	SP		4.6–5: Dark brown f SAND, trace Silt, wet.	11/23/2009		
6				5–7.1: Pale brown f SAND, trace gravel, wet.	11/23/2009		
7					11/23/2009		
8		GW		7.1–10: Yellowish brown f–c GRAVEL with c Sand, wet.			
9							
10	62			10–11.7: Pale brown f SAND, wet.	11/23/2009	0 ppm	
11						0 ppm	
12				11.7–15: Yellowish red f SAND with red banding, wet.	11/23/2009		
13						0 ppm	
14						0 ppm	

	Project Name: Former Patchogue MGP	Site Id: PASB-49
	Township/Range:	Coordinate X: 1255369.56
	Logged By: C. DeCarlo	Coordinate Y: 219124.62
	Drilling Method: Geoprobe	Total Depth: 20.00'
		Date Started: 11/23/09
Remarks: Due to moisture, the PID was not functioning properly for the beginning of this boring.		Date Completed: 11/23/09

Depth	Recovery %	USCS Code	Graphic Log	Material Description	Date	PID	Notes
15	68	SP		15-20: Yellowish red f SAND with red banding, wet.	11/23/2009	0 ppm	
16						0 ppm	
17						0 ppm	
18							
19						0 ppm	
20							
21							
22							
23							
24							
25							
26							
27							
28							

TETRA TECH EC, INC.
TEST PIT/TRENCH LOG

Project: Keyspan Patchogue
Test Pit No.: 1 Start Time: 11:10 End Time: 13:40 Weather: 70 Cloudy and Humid
Date 7/7/08 Final Length: 60' Surface Conditions: Vegetated
Geologist: Tom Fowler Final Depth: 3'
Pit Orientation: West-East Final Width:



Description of Material	PID/ FID	Sample Taken
0'-2.5- Gray fine to medium SAND, silt, some miscellaneous debris – brick and wood.	0-4 ppm	
2.5'-3' Light gray medium SAND. Water table at 3'.	0 ppm	

NOTES:

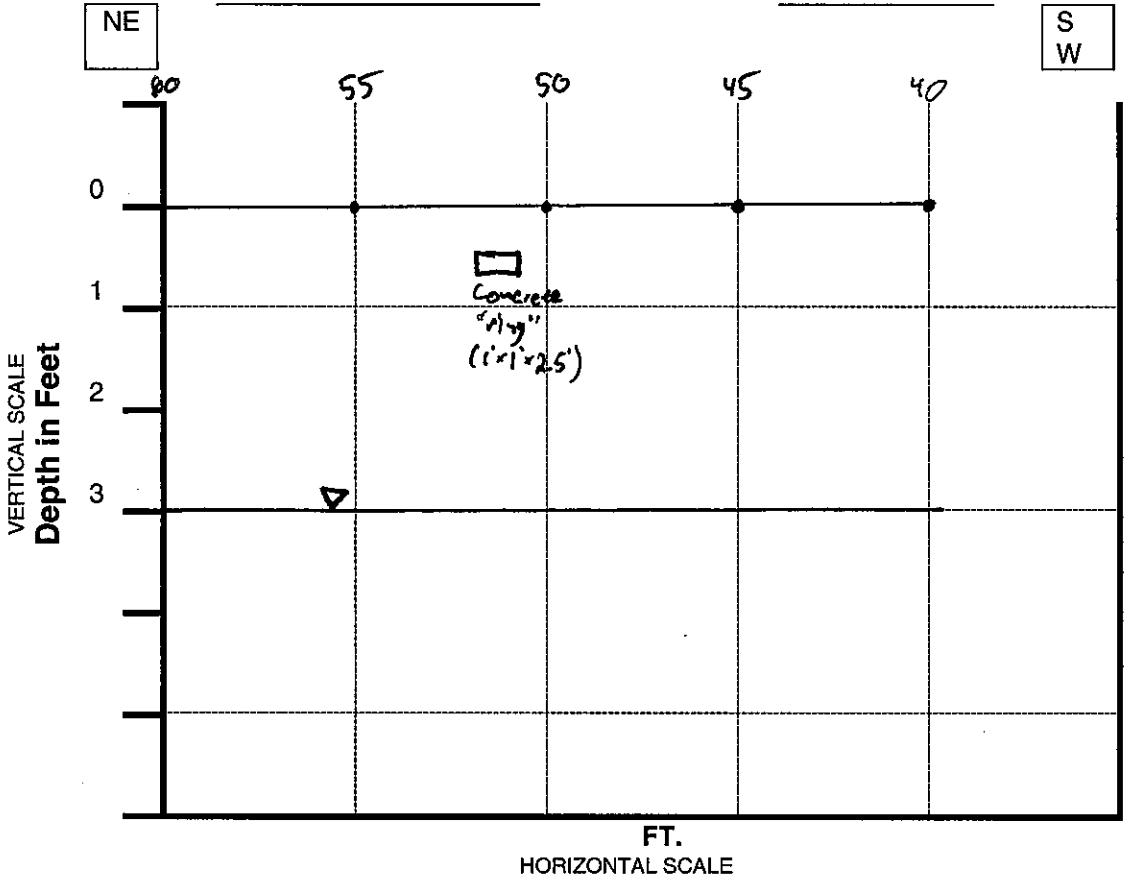
TETRA TECH EC, INC.
TEST PIT/TRENCH LOG

Project: Keyspan Patchogue
Test Pit No.: 2
Date 7/7/08
Geologist: Tom Fowler
Pit Orientation: Northeast-Southwest

Start Time: 14:15
Final Length: 20'
Final Depth: 3'
Final Width:

End Time: 15:10

Weather: 70 Cloudy and Humid
Surface Conditions: Vegetated

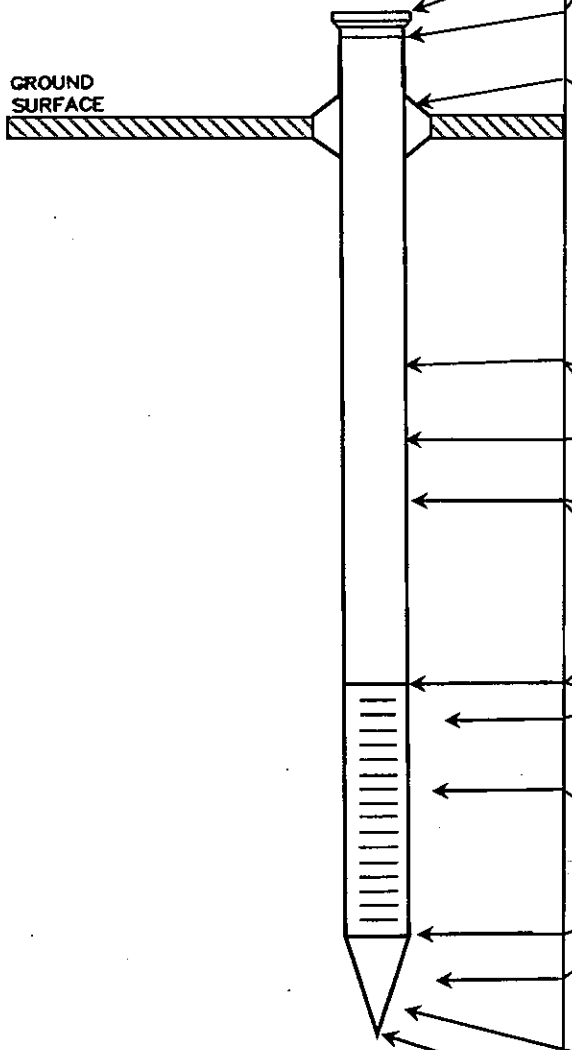


Description of Material	PID/ FID	Sample Taken
Dark gray SAND, silt, miscellaneous debris.		
Water table at 3'.		

NOTES:

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-1**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-1
BORING NUMBER:	MW-1	DATE COMPLETED:	01/28/08
ELEVATION (FT):	11.2300	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255132.53800
DRILLER:	Zebra	Y COORDINATE:	219674.03000
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	7.53
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



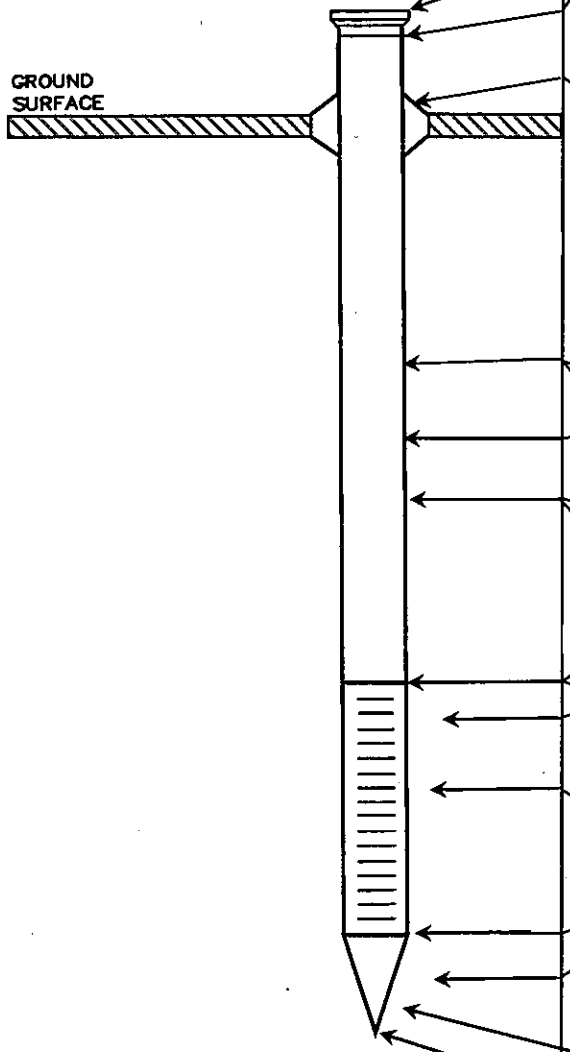
Elevation of Top of DP Wellpoint	11.7000
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	3.7
Elevation of Top of Riser Pipe (Ft)	11.2300
Height of Protective Outer Casing Above Ground Surface (Ft)	4.17
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	1
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	7
Elevation of Top of Screen	0.5300
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	12
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	12
Elevation of Bottom of Filter Pack	-4.4700
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	12
Elevation of Hole	-4.4700

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-2D**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-2D
BORING NUMBER:	MW-2D	DATE COMPLETED:	02/04/08
ELEVATION (FT):	8.2300	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255112.75500
DRILLER:	Zebra	Y COORDINATE:	219348.84200
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.12
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



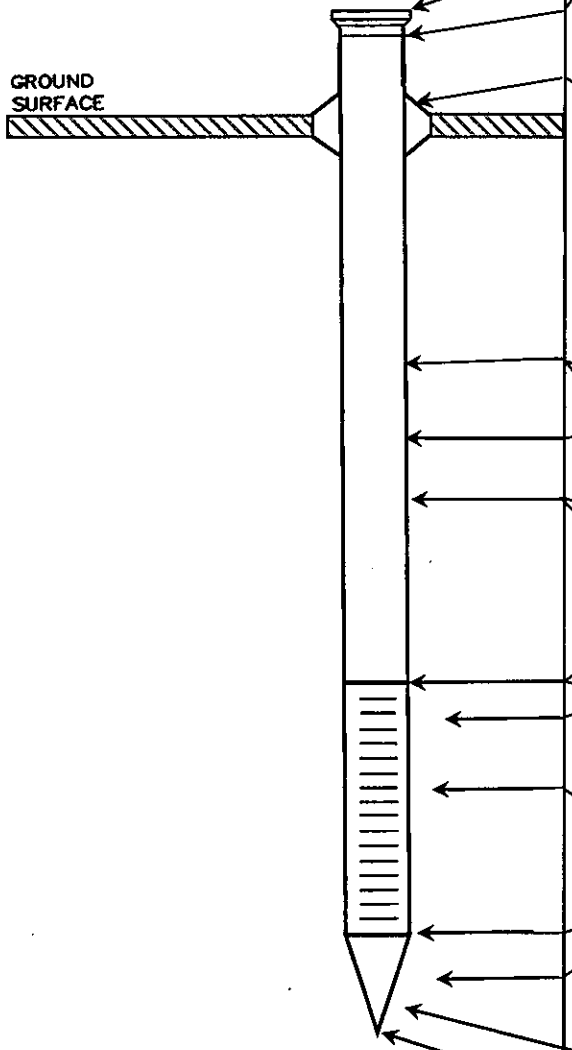
Elevation of Top of DP Wellpoint	8.9800
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	3.11
Elevation of Top of Riser Pipe (Ft)	8.2300
Height of Protective Outer Casing Above Ground Surface (Ft)	3.86
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	1
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	20
Elevation of Top of Screen	-14.8800
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	25
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	25
Elevation of Bottom of Filter Pack	-19.8800
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	25
Elevation of Hole	-19.8800

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-2S**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-2S
BORING NUMBER:	MW-2S	DATE COMPLETED:	01/28/08
ELEVATION (FT):	8.9700	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255107.89000
DRILLER:	Zebra	Y COORDINATE:	219370.35100
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.33
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



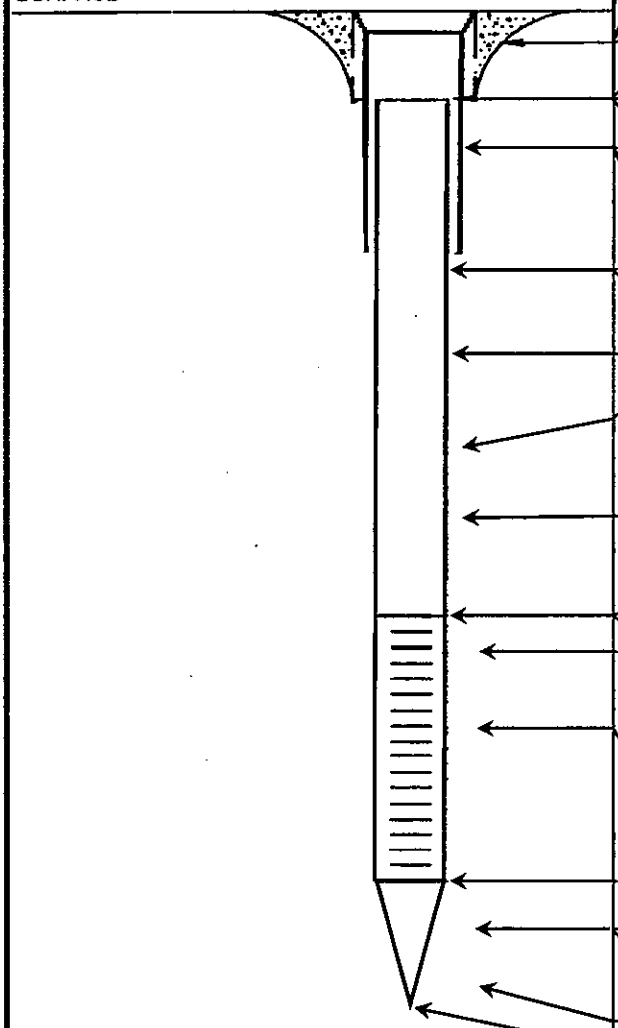
Elevation of Top of DP Wellpoint	9.0800
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	3.64
Elevation of Top of Riser Pipe (Ft)	8.9700
Height of Protective Outer Casing Above Ground Surface (Ft)	3.75
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	2
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	natural formation
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	5
Elevation of Top of Screen	0.3300
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	natural formation
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	10
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	10
Elevation of Bottom of Filter Pack	-4.6700
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	10
Elevation of Hole	-4.6700

TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-3**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-3
BORING NUMBER:	MW-3	DATE COMPLETED:	01/28/08
ELEVATION (FT):	5.3900	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255328.74200
DRILLER:	Zebra	Y COORDINATE:	219200.31200
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.42
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT): 0	METHOD TO MEASURE WELL DEPTH:	Casing/screen used



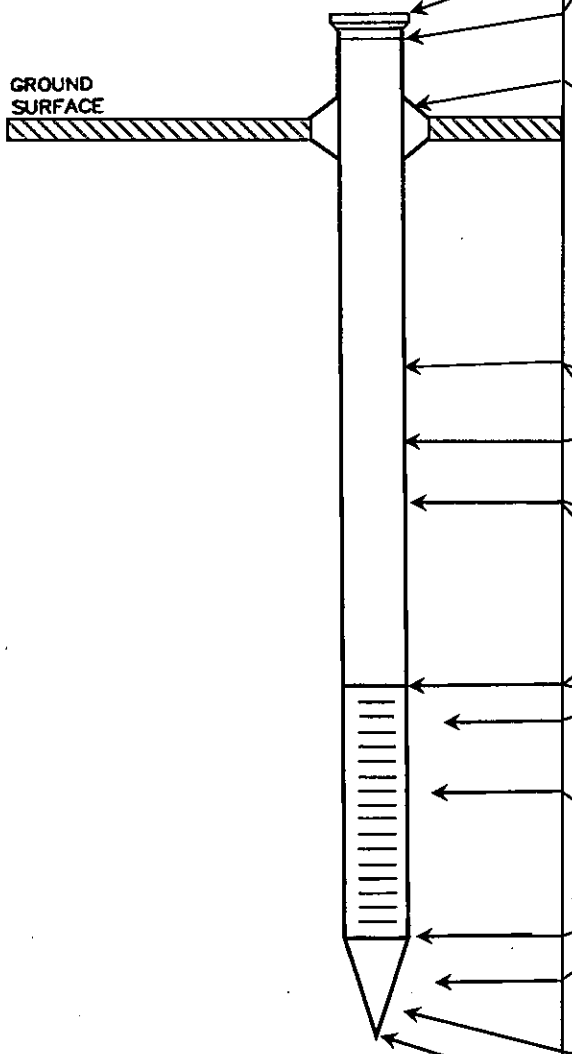
Elevation of Top of DP Wellpoint	5.5400
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	0.1
Diameter of Surface Plug (Ft)	2
DP Riser Pipe	
Elevation of Top of DP Riser Pipe	5.3900
Depth of Top of Riser Pipe (bgs in feet)	0.1500
I.D. of Surface Casing (Inches)	2
Type of Surface Casing	steel
Depth of Surface Casing (Ft)	1
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen (Ft)	5
Elevation of Top of Screen	0.4200
Type of Screen:	PVC sch 40
I.D. of Screen (Inches)	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen (Ft)	10
Depth of Bottom of Filter Pack (Ft)	10
Elevation of Bottom of Filter Pack	-4.5800
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint(Ft)	10
Elevation of Hole	-4.5800

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-4D**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-4D
BORING NUMBER:	MW-4D	DATE COMPLETED:	01/28/08
ELEVATION (FT):	7.5700	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255291.58300
DRILLER:	Zebra	Y COORDINATE:	219134.53100
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.36
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



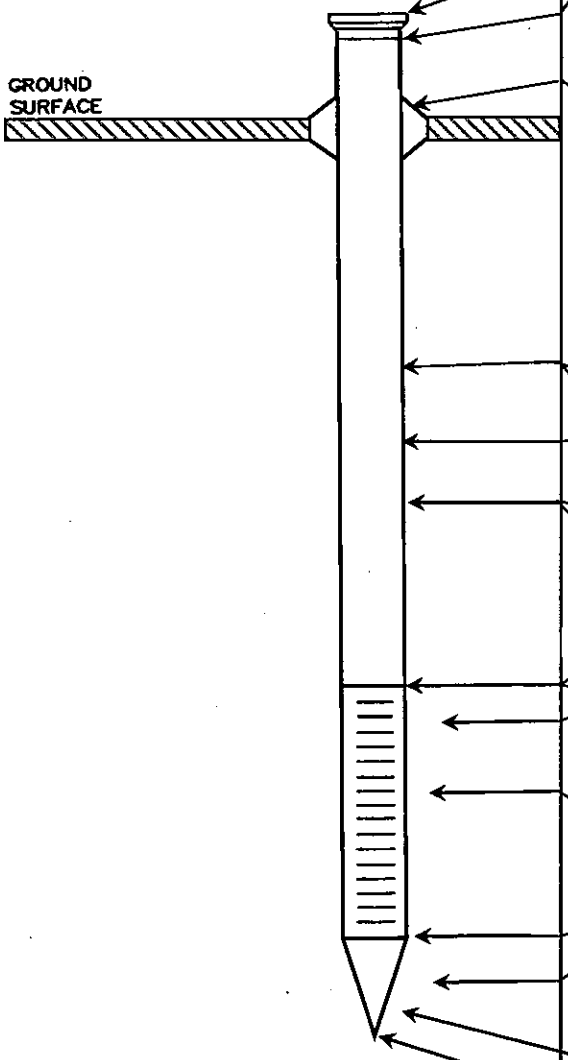
Elevation of Top of DP Wellpoint	8.0600
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	3.21
Elevation of Top of Riser Pipe (Ft)	7.5700
Height of Protective Outer Casing Above Ground Surface (Ft)	3.7
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	1
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	20
Elevation of Top of Screen	-15.6400
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	25
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	25
Elevation of Bottom of Filter Pack	-20.6400
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	25
Elevation of Hole	-20.6400

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-4S**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-4S
BORING NUMBER:	MW-4S	DATE COMPLETED:	01/28/08
ELEVATION (FT):	7.7400	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255290.45900
DRILLER:	Zebra	Y COORDINATE:	219131.47500
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.23
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



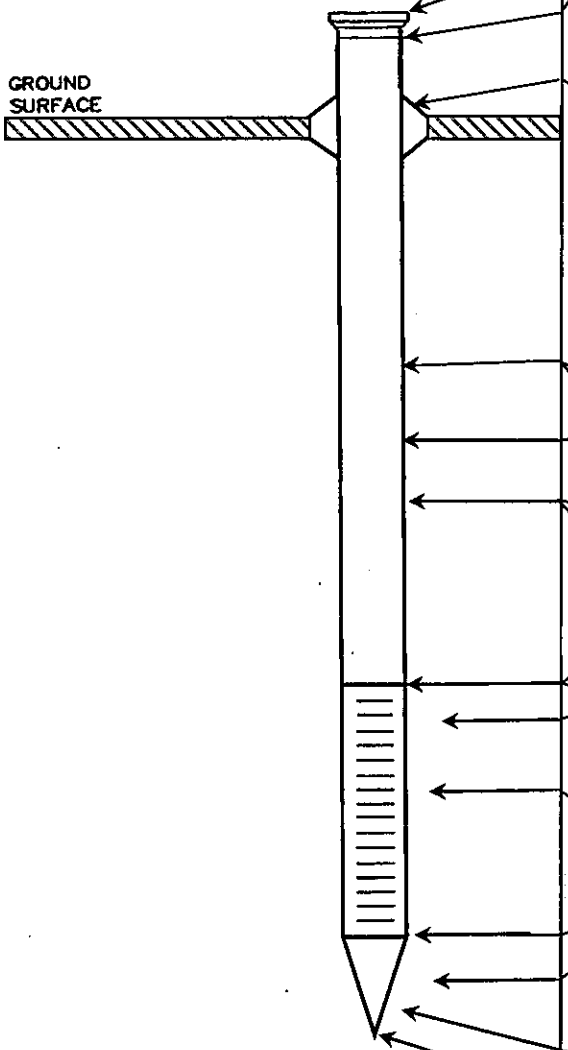
Elevation of Top of DP Wellpoint	8.0300
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	3.51
Elevation of Top of Riser Pipe (Ft)	7.7400
Height of Protective Outer Casing Above Ground Surface (Ft)	3.8
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	1
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	5
Elevation of Top of Screen	-0.7700
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	natural formation
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	10
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	10
Elevation of Bottom of Filter Pack	-5.7700
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	10
Elevation of Hole	-5.7700

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-5**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-5
BORING NUMBER:	MW-5	DATE COMPLETED:	02/04/08
ELEVATION (FT):	7.9300	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255217.39200
DRILLER:	Zebra	Y COORDINATE:	219284.88500
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.84
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



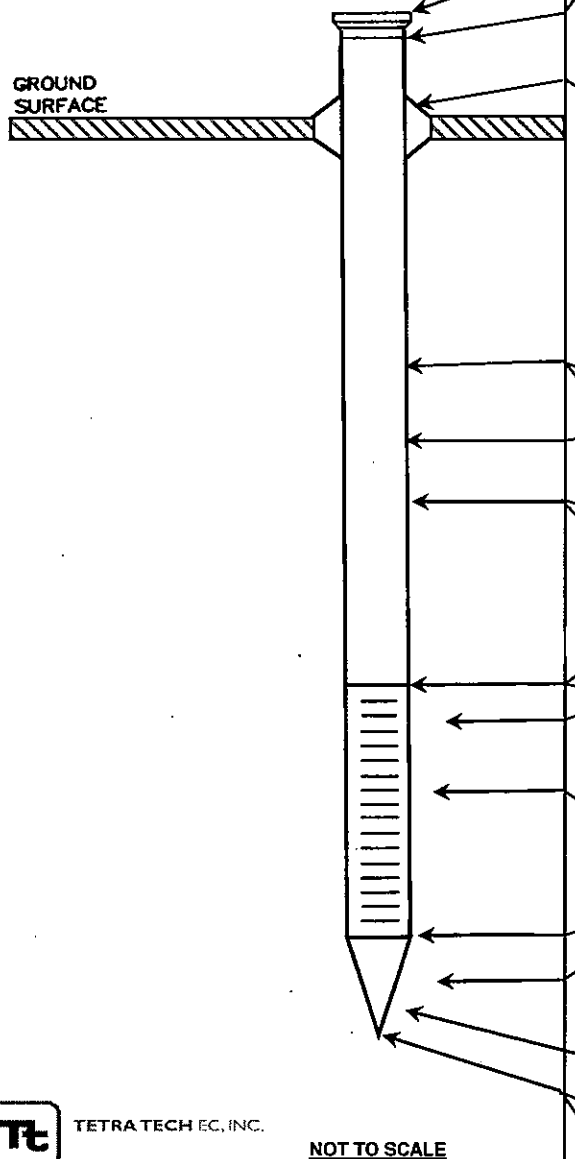
Elevation of Top of DP Wellpoint	8.3100
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	3.09
Elevation of Top of Riser Pipe (Ft)	7.9300
Height of Protective Outer Casing Above Ground Surface (Ft)	3.47
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	2
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	5
Elevation of Top of Screen	-0.1600
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	10
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	15
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	15
Elevation of Bottom of Filter Pack	-10.1600
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	15
Elevation of Hole	-10.1600

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-6**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-6
BORING NUMBER:	MW-6	DATE COMPLETED:	02/05/08
ELEVATION (FT):	8.0800	SURVEY DATE:	
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255188.62500
DRILLER:	Zebra	Y COORDINATE:	219365.02500
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.86
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



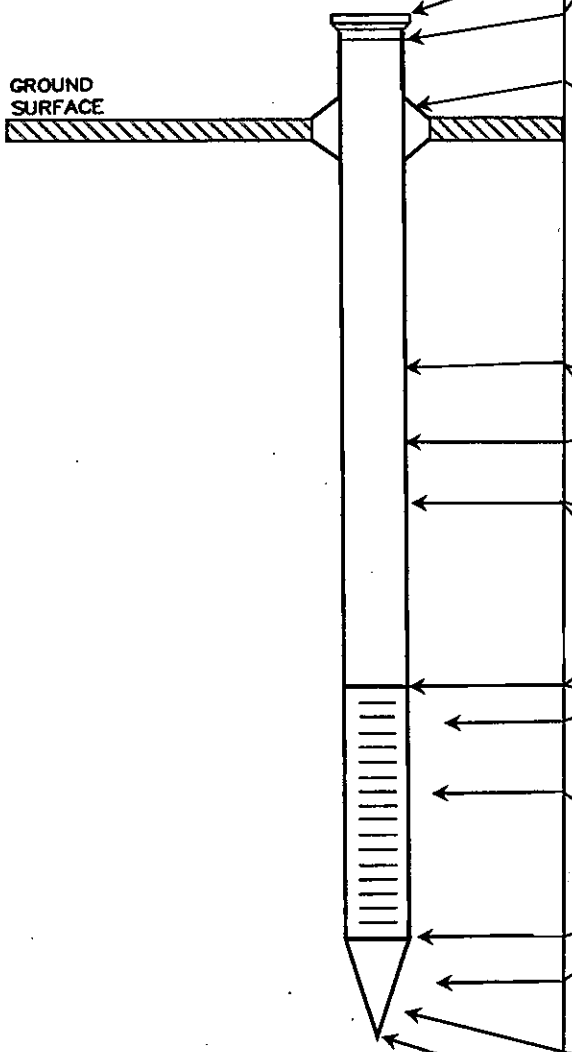
Elevation of Top of DP Wellpoint	8.3400
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	3.22
Elevation of Top of Riser Pipe (Ft)	8.0800
Height of Protective Outer Casing Above Ground Surface (Ft)	3.48
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	2
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	5
Elevation of Top of Screen	-0.1400
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	15
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	20
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	20
Elevation of Bottom of Filter Pack	-15.1400
Type of Backfill Below Filter Pack	sand pack
Depth of Hole to Tip of Wellpoint (Ft)	20
Elevation of Hole	-15.1400

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-7D**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-7D
BORING NUMBER:	MW-7D	DATE COMPLETED:	07/10/08
ELEVATION (FT):	8.0900	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255151.94300
DRILLER:	Zebra	Y COORDINATE:	219210.17890
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.2
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



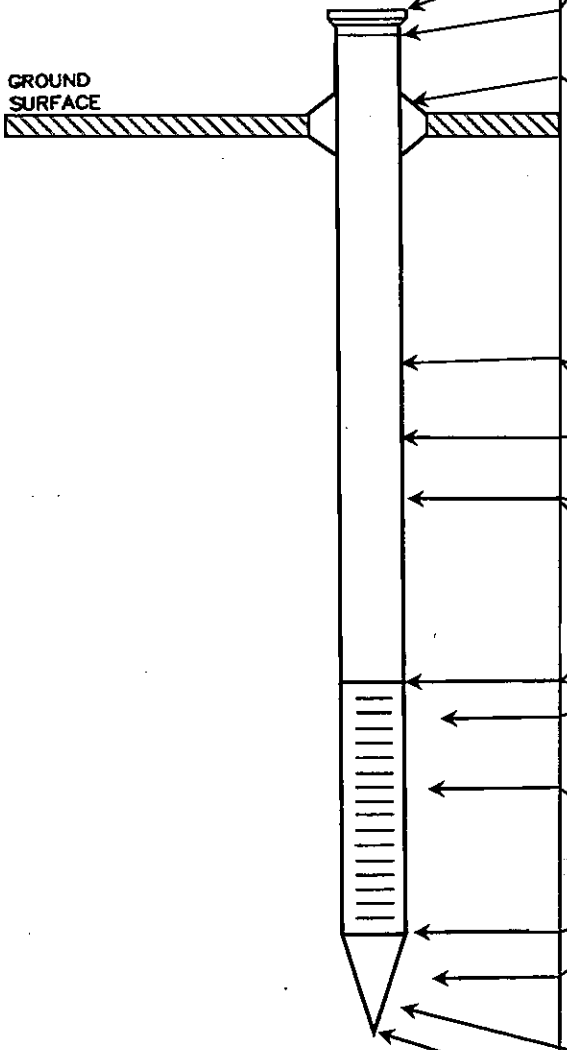
Elevation of Top of DP Wellpoint	8.5200
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	2.89
Elevation of Top of Riser Pipe (Ft)	8.0900
Height of Protective Outer Casing Above Ground Surface (Ft)	3.32
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	1
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	20
Elevation of Top of Screen	-14.8000
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	25
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	25
Elevation of Bottom of Filter Pack	-19.8000
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	25
Elevation of Hole	-19.8000

TETRA TECH EC, INC.

NOT TO SCALE

DIRECT PUSH WELLPOINT CONSTRUCTION DIAGRAM

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-7S**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-7S
BORING NUMBER:	MW-7S	DATE COMPLETED:	07/10/08
ELEVATION (FT):	8.2100	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255153.29900
DRILLER:	Zebra	Y COORDINATE:	219212.04600
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.37
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT):	METHOD TO MEASURE DEPTH OF WELL:	Casing/screen used



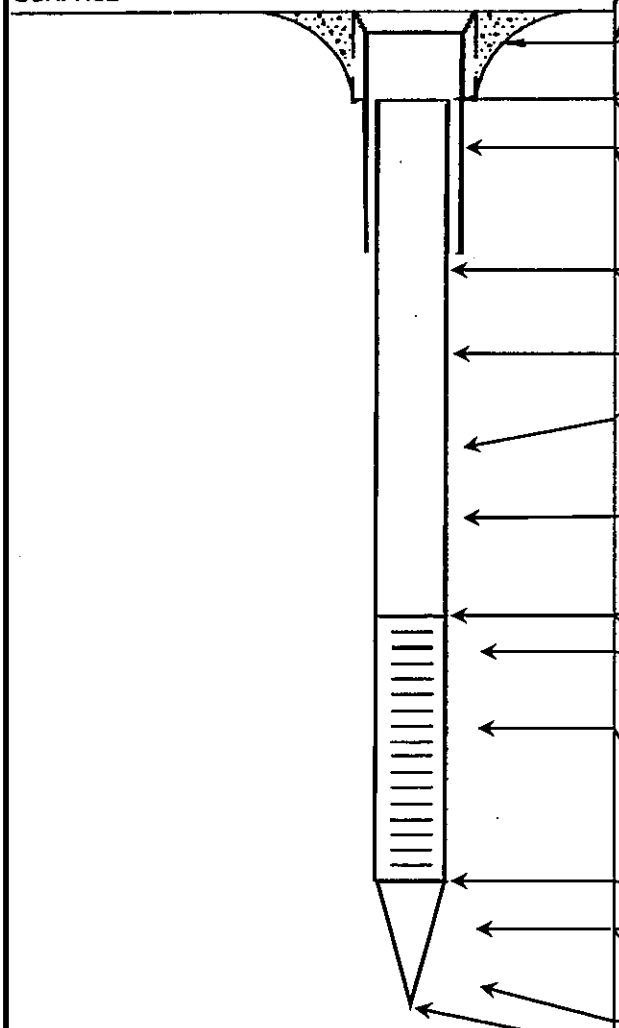
Elevation of Top of DP Wellpoint	8.5600
Stick-up DP Riser Pipe	
Height of DP Riser Pipe (Ft)	2.84
Elevation of Top of Riser Pipe (Ft)	8.2100
Height of Protective Outer Casing Above Ground Surface (Ft)	3.19
Surface Plug:	
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	1
Diameter of Surface Plug (Ft)	2.0
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen	4
Elevation of Top of Screen	1.3700
Type of Screen:	PVC sch 40
I.D. of Screen	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen	9
Filter Pack:	
Depth of Bottom of Filter Pack (Ft)	9
Elevation of Bottom of Filter Pack	-3.6300
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint (Ft)	9
Elevation of Hole	-3.6300

TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-8D**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-8D
BORING NUMBER:	MW-8D	DATE COMPLETED:	07/10/08
ELEVATION (FT):	4.7700	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255314.26700
DRILLER:	Zebra	Y COORDINATE:	219376.87200
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.04
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT): 0	METHOD TO MEASURE WELL DEPTH:	Casing/screen used



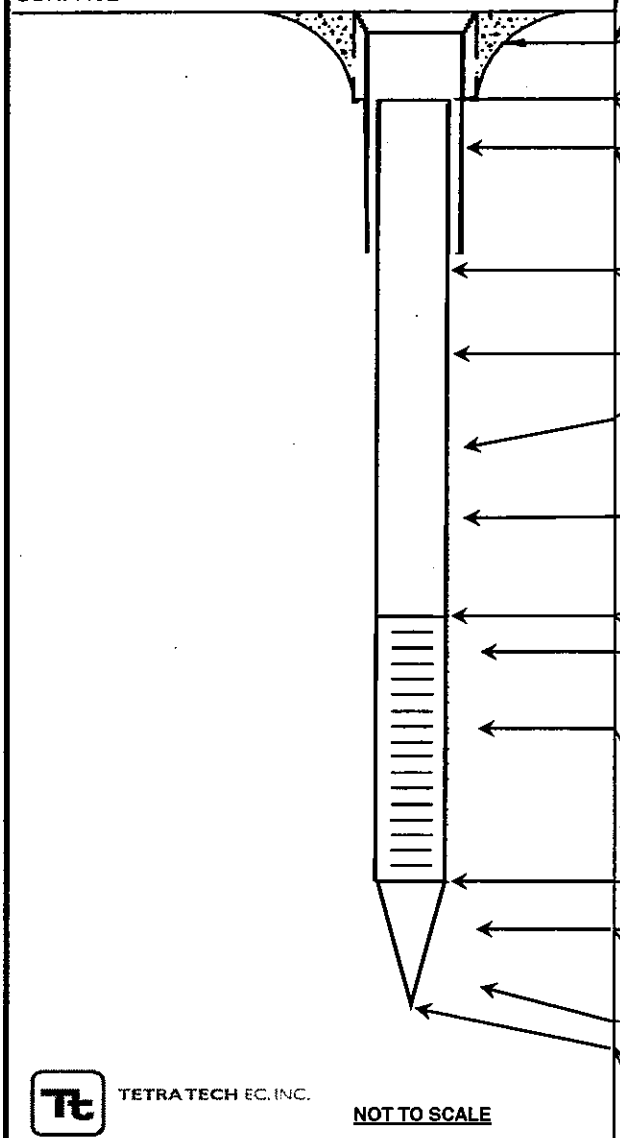
Elevation of Top of DP Wellpoint	5.0400
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	2.2
Diameter of Surface Plug (Ft)	2
DP Riser Pipe	
Elevation of Top of DP Riser Pipe	4.7700
Depth of Top of Riser Pipe (bgs in feet)	0.27
I.D. of Surface Casing (Inches)	4
Type of Surface Casing	steel
Depth of Surface Casing (Ft)	1
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen (Ft)	20
Elevation of Top of Screen	-14.9600
Type of Screen:	PVC sch 40
I.D. of Screen (Inches)	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen (Ft)	25
Depth of Bottom of Filter Pack (Ft)	25
Elevation of Bottom of Filter Pack	-19.9600
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint(Ft)	25
Elevation of Hole	-19.9600

TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-8S**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-8S
BORING NUMBER:	MW-8S	DATE COMPLETED:	07/10/08
ELEVATION (FT):	4.8600	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255313.69000
DRILLER:	Zebra	Y COORDINATE:	219375.89900
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	5.05
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT): 0	METHOD TO MEASURE WELL DEPTH:	Casing/screen used



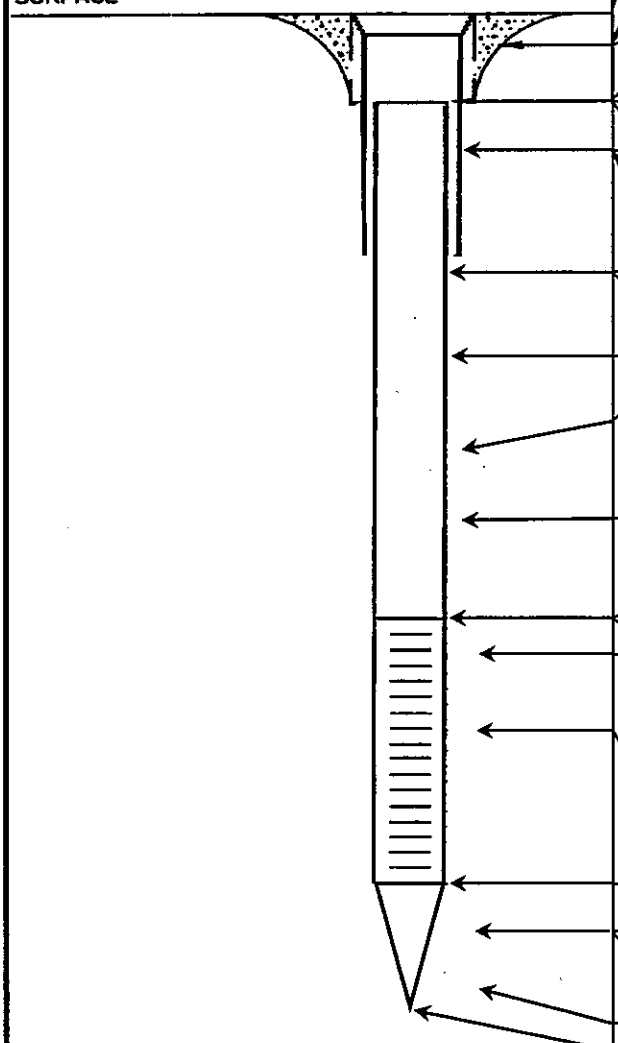
Elevation of Top of DP Wellpoint	5.0500
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	2.2
Diameter of Surface Plug (Ft)	2
DP Riser Pipe	
Elevation of Top of DP Riser Pipe	4.8600
Depth of Top of Riser Pipe (bgs in feet)	0.19
I.D. of Surface Casing (Inches)	4
Type of Surface Casing	steel
Depth of Surface Casing (Ft)	1
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen (Ft)	4
Elevation of Top of Screen	1.0500
Type of Screen:	PVC sch 40
I.D. of Screen (Inches)	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen (Ft)	9
Depth of Bottom of Filter Pack (Ft)	9
Elevation of Bottom of Filter Pack	-3.9500
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint(Ft)	9
Elevation of Hole	-3.9500

TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-9D**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-9D
BORING NUMBER:	MW-9D	DATE COMPLETED:	07/10/08
ELEVATION (FT):	4.6600	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255361.55200
DRILLER:	Zebra	Y COORDINATE:	219233.32860
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.69
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT): 0	METHOD TO MEASURE WELL DEPTH:	Casing/screen used



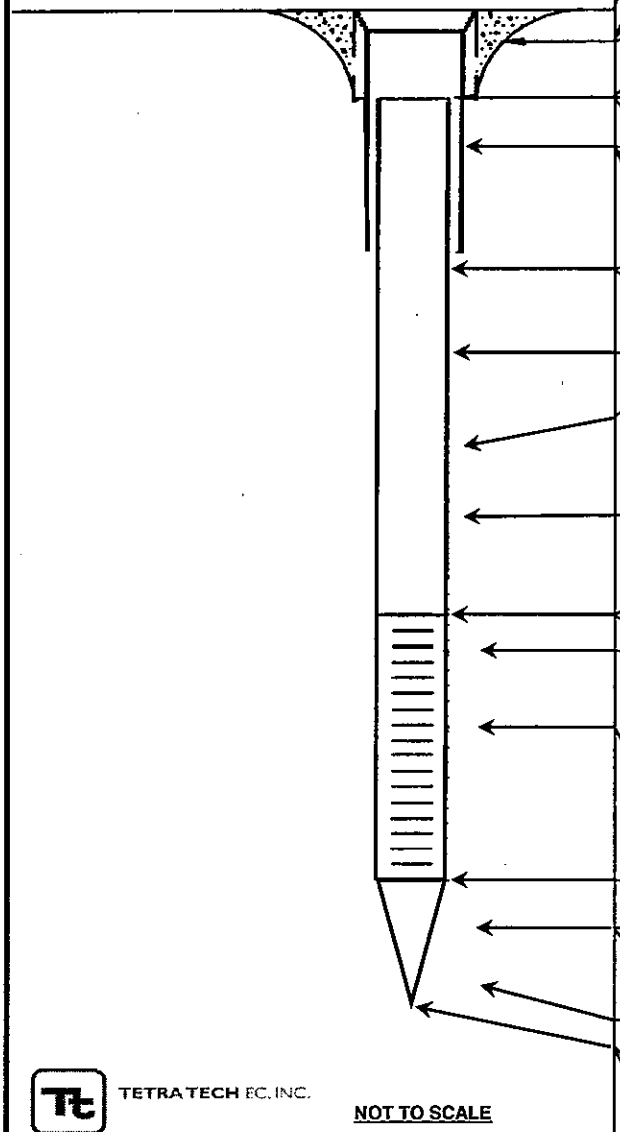
Elevation of Top of DP Wellpoint	4.7800
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	2.2
Diameter of Surface Plug (Ft)	2
DP Riser Pipe	
Elevation of Top of DP Riser Pipe	4.6600
Depth of Top of Riser Pipe (bgs in feet)	0.12
I.D. of Surface Casing (Inches)	4
Type of Surface Casing	steel
Depth of Surface Casing (Ft)	1
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen (Ft)	20
Elevation of Top of Screen	-15.3100
Type of Screen:	PVC sch 40
I.D. of Screen (Inches)	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen (Ft)	25
Depth of Bottom of Filter Pack (Ft)	25
Elevation of Bottom of Filter Pack	-20.3100
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint(Ft)	25
Elevation of Hole	-20.3100

TETRA TECH EC, INC.

NOT TO SCALE

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM (FLUSH MOUNT)

PROJECT:	Patchogue Former MGP	**WELL NUMBER:**	**MW-9S**
PROJECT NO.:	106-3599.0001.0030.00000	WELL LOCATION (STATION) ID:	MW-9S
BORING NUMBER:	MW-9S	DATE COMPLETED:	07/10/08
ELEVATION (FT):	4.4700	SURVEY DATE:	07/15/08
FIELD GEOLOGIST:	Tom Fowler	X COORDINATE:	1255360.27000
DRILLER:	Zebra	Y COORDINATE:	219232.12220
DRILLING METHOD:	Direct Push	DATUM:	NAVD88
DEVELOPMENT METHOD:	Submersible Pump	START DEPTH (FT):	4.70
SUMP INSTALLED?(Y/N):	N SUMP LENGTH (FT): 0	METHOD TO MEASURE WELL DEPTH:	Casing/screen used



Elevation of Top of DP Wellpoint	4.7400
Type of Surface Plug	concrete
Depth of Surface Plug (bgs in feet)	2.2
Diameter of Surface Plug (Ft)	2
DP Riser Pipe	
Elevation of Top of DP Riser Pipe	4.4700
Depth of Top of Riser Pipe (bgs in feet)	0.27
I.D. of Surface Casing (Inches)	4
Type of Surface Casing	steel
Depth of Surface Casing (Ft)	1
I.D. of Riser (Inches)	2
Type of Riser	PVC sch 40
Borehole Diameter (Inches)	3.4
Type of Backfill	bentonite slurry
Backfill - Tremied (Y or N)	N
Type of Seal:	bentonite slurry
Seal - Tremied (Y or N)	N
Depth of Top of Screen (Ft)	4
Elevation of Top of Screen	0.7000
Type of Screen:	PVC sch 40
I.D. of Screen (Inches)	2
Slot Size of Screen (Inches)	0.02
Length of Screen (Ft)	5
Type of Filter Pack:	sand pack
Filter Pack - Tremied (Y or N)	N
Well Construction Remarks:	
Depth of Bottom of Screen (Ft)	9
Depth of Bottom of Filter Pack (Ft)	9
Elevation of Bottom of Filter Pack	-4.3000
Type of Backfill Below Filter Pack	natural formation
Depth of Hole to Tip of Wellpoint(Ft)	9
Elevation of Hole	-4.3000

TETRA TECH EC, INC.

NOT TO SCALE

WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-1A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	8.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/21/12 - 3/21/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255177.4 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219314.6 ft.
			Ground Surface Elev: 6.3 ft.	TOC Elev: 8.1 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well (Stick Up)	ppm Readings (ppm)	Remarks
		SM	**FILL**	2-5-15-12			75.0	
	5	SC	Brown mf SAND, some Organics, little Silt. Pulverized concrete.					0.9-2' BGS: Moderate to strong odor.
		SW	Black mf SAND and mf GRAVEL (cinders & slag). Saturated w/ water @ 2.7'.	8-9-7-4			0.4	*0-1.5' BGS: Cement-bentonite grout*
		SM	Black mf SAND, trace Silt.					*1.5-2' BGS: Bentonite Plug*
		SM	Black mf SAND, some Silt.	6-5-6-6				*2-7.5' BGS: Filter pack (#1 Filpro Sand)*
5		MH	No Recovery.					*2.5-7.5' BGS: PVC Screen (0.020" Slot)*
	0	SP	Dark brown mfc SAND, trace Gravel (rounded granite and granite flakes).	7-9-11-15			0.0	

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-1B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/21/12 - 3/21/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255178.7 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219305.9 ft.
			Ground Surface Elev: 5.9 ft.	TOC Elev: 8.9 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well (Stick Up)	ppm Readings (ppm)	Remarks
	5	SW	**FILL**	19-10-10-5			0.0	
		SP	Brown-black mfc SAND, some Organics (roots, grass).					
		SM	Pulverized red-brown concrete.	2-4-3-7			0.0	
		SP	Reddish-black mf SAND, trace (-) Gravel. Pieces of red brick present. Mosit @ 1.7'.					
		GP	Black mf SAND, little Silt, trace Organics.	14-8-3-4				
5		SP	Saturated w/ water @ 3'.					
	0		Black c SAND and f Gravel (cinders and brick present).					*0-10' BGS: Cement-bentonite grout*
		SW		1-1-5-7			0.0	
		GP	Black mf SAND trace Gravel, trace (-) Silt. No recovery.					
		SW	**OUTWASH DEPOSITS**	17-12-8-11			0.0	
		GW	Brown mfc SAND, little (-) mf Gravel. Tan mfc SAND, little (+) Gravel (rounded qtz).					
10		SW		10-5-3-3			0.0	
	-5	GW	Brown mfc SAND, some Gravel (rounded qtz).					*10-12' BGS: Bentonite Plug*
		SP	Tan-orange mf SAND, trace (-) Gravel.	1-2-4-4			0.0	
		SP	Tan-grey mf SAND, trace (-) Gravel.					
				2-2-2-3			0.0	
15								*12-19' BGS: Filter pack (#1 Filpro Sand)*
	-10							
		SP	Tan-grey-beige mf SAND, trace Gravel. @ 17.1' BGS shell present w/ iron staining.	3-4-6-7			0.0	*14-19' BGS: PVC Screen (0.020" Slot)*
		SP	Tan-grey-beige mf SAND, little Gravel.	3-2-4-5			0.0	
		GP						
20								

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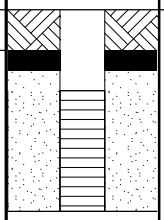
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-2A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:		
Shawn Miller	HSA	CME 1500	**Horiz Datum/Proj:** NYS Plane NAD83 **Vert Datum:** NAVD88 **Ground Surface Elev:** 5.8 ft.	**Easting:** 1255197.8 ft. **Northing:** 219330.2 ft. **TOC Elev:** 8.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well	ppm Readings (ppm)	Remarks
5	5		Refer to PZ-2B boring log for description of soil.								*0-1' BGS: Cement-bentonite grout.* *1-1.5' BGS: Bentonite seal.* *1.5-5' BGS: Filter pack.* *2-5' BGS: PVC Screen (0.020" Slot)*

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-2B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	18.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255209.7 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219332.1 ft.
			Ground Surface Elev: 5.3 ft.	TOC Elev: 8.3 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well	ppm Readings (ppm)	Remarks
		SP	**FILL** Brown mf SAND, little Organics (roots, grass), trace (-) Gravel. Specs of red brick present.	16-16-9-10			0.0	
		SP GP						
		SW	Pulverized concrete.	4-6-4-5			0.1	*0-6' BGS: Cement bentonite grout.*
		SM	Black mf SAND, some Gravel (cinders). Moist.					2.9-3.4' BGS: Slight tar-like odor.
		SP		2-3-2-1			72.1	4-4.3' BGS: Slight tar-like odor.
5	0	OH	Grey-beige mfc SAND, trace (-) Gravel (rounded qtz). Saturated w/ water @ 2.0'.					4.6-6' BGS: Black staining on some grains. Tar-like odor. Oily sheen on water.
		SW	**ALLUVIAL DEPOSITS**	1-1-3-3			7.0	*6-8' BGS: Bentonite seal.*
		SP	Grey-beige mfc SAND, little Silt, trace Organics, trace (-) Gravel (rounded qtz).					7' BGS: NAPL on surface of wood.
		SM	Color change to beige-tan @ 3.4'.	1-5-4-6			67.0	8-8.5' BGS: Black staining. Oily sheen on water.
		SP	Brown-biege mf SAND, trace Gravel.					8.5-10' BGS: Black staining. Moderate odor. NAPL coating on large grains.
		SW GP	Brown ORGANICS, little mf SAND.					*8-15' BGS: Filter pack.*
10	-5		Brown-beige mfc SAND.	3-3-3-5			7.0	*10-15' BGS: PVC Screen (0.020" Slot)*
		SP	Brown-beige mf SAND, trace (-) Organics (1" thick pcs of wood).					12-12.9' BGS: Oily sheen on grains and water. Tar-like odor.
			OUTWASH DEPOSITS	8-7-5-5			27.1	14-16' BGS: Slight odor. Slight staining.
			Black mf SAND, little Silt.					16-18' BGS: Black NAPL flecs w/ tacky, tar-like texture. Leaves residue on gloves. No odor.
		SW	Brown-beige mf SAND.					
		GP	Brown mfc SAND, some (-) Gravel.	7-3-3-4			13.0	
		SP	Brown-beige mf SAND. Mica flecs present.					
15	-10	GW	Brown-tan mfc SAND, some (-) Gravel.					
		SW	Brown-tan mc SAND and mfc GRAVEL (rounded qtz).	5-9-6-7			1.1	
			Tan-orange mfc SAND.					

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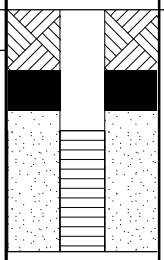
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-3A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
3/23/12 - 3/23/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255240.1 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219241.1 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 8.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well	ppm Readings (ppm)	Remarks
5	0		Refer to PZ-3B boring log for description of soil.								*0-1.5' BGS: Cement bentonite grout.* *1.5-2.5' BGS: Bentonite seal.* *2.5-6' BGS: Filter pack.* *3-6' BGS: PVC Screen (0.020" Slot)*

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-3B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255252.2 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219240.4 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 8.9 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well	ppm Readings (ppm)	Remarks
		SP	**FILL**	16-8-5-7			0.0	
		GP	Dark brown mf SAND, little Gravel, little Organics, little (-) Silt.					
		SP						
		GP	Crushed/pulverized concrete.	7-5-5-4			0.0	
		SP	Black fm SAND, some Gravel (red brick), little (-) Silt. Moist.					*0-9' BGS: Cement bentonite grout.*
		GP						
		SP	Grey-beige mc SAND, some m Gravel (angular).	2-2-2-2			0.0	4-6' BGS: Slight tar-like odor.
5	0	GP						
		SP	Black fmc SAND, little (+) m Gravel. Wet.					
		GP	Wood.	1-2-4-8			35.0	6-6.8' BGS: Black staining on grains. Sheen on spoon. Black/reddish-brown NAPL blebs (sand sized).
		SW	Grey-black mc SAND, little m Gravel (cinders). Wet to saturated. Saturated w/ water @ 4.0'.					
		SP		3-5-5-4			19.5	6.8' BGS: 1/2" NAPL lens across core.
		SW	**OUTWASH DEPOSITS**					8-8.6' BGS: Strong odor. Heavy, oily sheen on water in spoon.
		GW	Brown-beige mfc SAND.					
10	-5	SW	Grey-beige mf SAND, trace (-) mf Gravel (rounded qtz).	3-6-4-3			2.6	8.6-10' BGS: Heavy NAPL staining on largest grains. Strong odor.
		GP	Grey-beige mfc SAND and mfc GRAVEL.					*9-11' BGS: Bentonite seal.*
		SW	Grey-brown mfc SAND, some f Gravel.	5-5-5-4			4.5	10-10.1' BGS: Sheen on grains.
		GP	Tan-brown mfc SAND, some f Gravel (rounded qtz)					10.1' BGS: 1/2" Tacky/thick NAPL lens across core.
				13-5-6-4			3.0	10.7-12' BGS: Strong tar-like odor.
15	-10	SW	Tan-orange mfc SAND.					*11-18' BGS: Filter pack.*
		SW	Tan-orange mfc SAND, trace (-) Gravel (rounded).	10-5-7-6			4.7	14.8' BGS: Thin NAPL lens across core.
		SW	Tan-orange mfc SAND.	4-5-6-4			9.1	*13-18' BGS: PVC Screen (0.020" Slot)*
20	-15							18-20' BGS: Slight tar-like odor.

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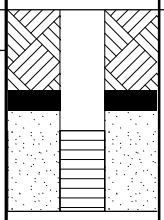
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-4A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
5/23/12 - 5/23/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255365.3 ft.
Chris Miglione	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219236.5 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 4.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well (Traffic Rated Vault Box)	ppm Readings (ppm)	Remarks
5	0		Refer to PASB-45 / MW-4D boring log soil description.								*0-2' BGS: Concrete well vault (flush mount).* *2-2.5' BGS: Bentonite seal.* *2.5-5' BGS: Filter pack.* *3-5' BGS: PVC Screen (0.020" Slot)*

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-101 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/18/10 - 5/18/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.	Easting: 1255243.5 ft. Northing: 219389.2 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**		1		0.4	*Borehole backfilled with bentonite chips.*
		SP	Brown mf SAND, trace Silt, trace Organics.					
		GP	Brown cmf SAND, little Gravel (Misc.					1.2-1.8' BGS: Black staining and slight tar-like odor.
		SP	Fill-brick, coal).					
		GP	Gray/Lt. Gray mfc SAND, little fc Gravel.					
		PT	**ALLUVIAL DEPOSITS**					
			ORGANICS (root material). Wet @ 3.3'					
	0							
5		SP	Gray/Brown mfc SAND, trace f Gravel.		2		0.4	
		GP						
		OL	Dk. Brown SILT & CLAY.					
		SP	**OUTWASH DEPOSITS**					
		GP	Brown/Tan cmf SAND, little fmc Gravel (rounded). Wet to saturated @ 8.0'.					
	-5							
10		SP	Tan/Lt. Brown mfc SAND, trace (+) fmc		3		0.4	
		GP	Gravel (rounded). Saturated.					
	-10							
15		SP	Tan/Lt. Brown mfc SAND, trace (-) fm		4		0.2	
		GP	Gravel (rounded), trace Silt. Saturated.					
	-15							
20								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-102 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/18/10 - 5/18/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.	Easting: 1255259.4 ft. Northing: 219304.1 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		SP SP GP	**FILL** Dk. Brown fm SAND, little (+) Silt, trace Organics (topsoil).		1					50.9	*Borehole backfilled with bentonite chips.*
		SP GP	Gray/Brown fm SAND, some (-) Gravel (angular).								
		SP GP	Brown/Black/Tan cmf SAND, some (-) Gravel (Misc. Fill-coal, cinders). Moist.								2.2-2.5' BGS: Black staining, moderate to strong tar-like odor.
	0		Gray/Brown mf SAND, trace (-) fm Gravel. Wet at 2.0'								2.5-3.0' BGS: Slight to faint tar-like odor.
5		SP GP	Lt. Brown/Black cmf SAND, little Gravel (Misc. Fill-brick, coal).		2					10.3	
		SP GP	**OUTWASH DEPOSITS** Brown/Gray cmf SAND, trace Gravel, trace Organics.								5.8' BGS: Slight tar-like odor.
		SP SP	Lt. Gray cmf SAND. Wet to saturated.								6.2-6.5' BGS: Rainbow sheen on soil grains, slight NAPL coating on grains. Moderate to strong tar-like odor.
	-5	SP GP	Gray/Black cmf SAND.								
10		SP GP	Brown/Orange/Multi-colored cmf SAND and cmf GRAVEL.		3					0.7	7.0-7.7' BGS: Black staining, moderate tar-like odor.
			Lt. Brown/Orange cmf SAND, trace (-) f Gravel, trace Silt. Saturated.								
	-10										
15		SP GP	Orange mfc SAND, trace (-) Gravel, trace Silt. Saturated.		4					0.7	
	-15										
20											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-103 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/18/10 - 5/18/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.	Easting: 1255261.3 ft. Northing: 219274.5 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**		1		36.2	*Borehole backfilled with bentonite chips.*
		SM	Brown/Dk. Brown fm SAND, little Silt, little Organics.					
		SP						
		GP	Gray mfc SAND, little (+) Gravel. Moist					2.1' BGS: Slight to moderate tar-like odor.
		SP	Dk. Brown fmc SAND, little Silt, trace Gravel.					
		SM						
		SP	Lt. Gray fmc SAND, wet.					3.7' BGS: Brown NAPL coating soil grains, rainbow sheen. Moderate to strong tar-like odor.
	0	SP	Gray c SAND.					
5		SP	Wood.		2		131	5.0-5.9' BGS: Black staining, slight tar-like odor.
		SP	Lt. Gray fmc SAND, moist.					5.9-6.5' BGS: Black stained, NAPL coating on soil grains. Brown NAPL on coarser material.
		GP	Black/Dk. Brown cmf SAND, some (+) mf Gravel (Misc. Fill-coal, brick).					
		SP						
		OL	Lt. Gray/Black cmf SAND.					
		SP	**ALLUVIAL DEPOSITS**					
	-5	SP	Brown Silty CLAY and ORGANICS (peat).					
10		GP	**OUTWASH DEPOSITS**		3		6.3	6.6-7.2' BGS: Black stained, slight NAPL coating on soil grains, moderate tar-like odor.
		SP	Black fmc SAND.					7.6-7.7' BGS: Black staining, sheen and tar-like odor.
		GP	Lt. Brown/Orange cmf SAND, little (+) Gravel (rounded).					7.8-9.0' BGS: Spots of sheen on coarser material.
		SP						
		SM	Orange/Brown cmf SAND, little (+) fmc Gravel (rounded). Saturated.					
			Lt. Brown/Orange fmc SAND, trace Silt, trace (-) Gravel.					
	-10							
15		SP	Lt. Brown/Orange fmc SAND, trace Silt, trace (-) Gravel.		4		3.1	
		SM						
	-15							
20								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-104 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/18/10 - 5/18/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.	Easting: 1255180.3 ft. Northing: 219252.1 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP/SM	**FILL** Brown fm SAND, little Silt, little Organics.		1		0.5	*Borehole backfilled with bentonite chips.*
		SP/GP	Dk. Brown/Red fmc SAND, little (+) Gravel, trace Silt (Misc. Fill- brick, wood, coal).					1.6' BGS: Slight tar-like odor.
		SP	Black/Gray cmf SAND. Moist.					
5	0		Dk. Brown fm SAND, little Silt, trace Organics. Fire brick @ 3.0'					
		SP	**ALLUVIAL DEPOSITS**		2		0.2	
		SP/SM	Dk. Brown fm SAND, little Silt, trace Organics.					
		SP/GP	Gray/Brown/Black fmc SAND, little (-) Silt, little Organics (layered).					7.1' BGS: Sporadic black staining, slight tar-like odor.
			OUTWASH DEPOSITS Tan/Orange cmf SAND, little (+) Gravel (rounded). Saturated.					
10	-5	SP/GP	Tan/Orange cmf SAND, little (-) fmc Gravel, trace Silt. Saturated.		3		0.2	
15	-10	SP/GP	Tan/Orange fmc SAND, trace (-) Gravel, trace Silt. Saturated.		4		0.0	
20	-15							

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-105 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/18/10 - 5/18/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.3 ft.	Easting: 1255136.0 ft. Northing: 219248.2 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP SM SP GP SP SM	**FILL** Dk. Brown fm SAND, little Silt, trace Organics (topsoil). Gray/Black/Red cmf SAND, little (+) Gravel (Misc. Fill-brick). **OUTWASH DEPOSITS** Brown/Tan fmc SAND, little (-) Silt, trace Gravel, Moist.		1		0.3	*Borehole backfilled with bentonite chips.* 1.5-3.0' BGS: Sporadic black staining, faint tar-like odor.
5	0	SP SM	Brown/Gray mfc SAND, trace Silt, Saturated.		2		0.4	
		SP SM	Lt. Tan/Beige fmc SAND, trace Silt. Saturated.					
10	-5	SP SM	Lt. Tan/Beige fmc SAND, trace Silt. Saturated.		3		0	
15	-10	SP SM	Lt. Tan/Beige fmc SAND, trace Silt. Saturated, Iron staining.		4		0	
20								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-106 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/19/10 - 5/19/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.7 ft.	Easting: 1255124.4 ft. Northing: 219284.9 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
0	0	SP SM SP GP OL SP SM SP SM	**FILL** Dk. Brown fm SAND, little (+) Silt, trace Organics, Moist. Dk. Brown/Brown cmf SAND, little Gravel (Misc. Fill-brick), little Silt. Dk. Brown SILT & CLAY, litle (+) Organics (peat). Dk. Brown/Tan mfc SAND, little Silt, trace (+) Gravel (Misc. Fill-coal), Moist.		1		0.6	*Borehole backfilled with bentonite chips.* 0.2-1.1' BGS: Minor black staining, faint tar-like odor.
5	-5	SP GP	**OUTWASH DEPOSITS** Beige/Tan mfc SAND, trace Silt, Wet. Beige/Tan/Multi-colored cmf SAND, little (-) fm Gravel (rounded), trace Silt. Iron staining. Wet to saturated.		2		0.3	
10	-10	SP GP	Beige/Tan/Multi-colored cmf SAND, little (-) fm Gravel (rounded), trace Silt. Iron staining. Wet to saturated.		3		0.3	
15	-15	SP GP	Beige/Tan/Multi-colored cmf SAND, little (-) fm Gravel (rounded), trace Silt. Iron staining. Wet to saturated.		4		0.2	
20								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-107 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/19/10 - 5/19/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.8 ft.	Easting: 1255122.4 ft. Northing: 219320.7 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP SM SP GP SP SM SP SM	**FILL** Dk. Brown mf SAND, little Silt, little Organics. Dk. Brown/Brown cmf SAND, little Gravel, Moist. Brown/Dk. Brown fmc SAND, little Silt, trace f Gravel.		1		2.1	*Borehole backfilled with bentonite chips.* 0.2-0.9' BGS: Faint tar-like odor
5	0	SP SM	**OUTWASH DEPOSITS** Tan/Beige mfc SAND, trace Silt, Wet. Tan/Beige/Orange fmc SAND, little (-) Silt, trace mf Gravel. Wet to saturated. Iron staining.		2		0.3	
10	-5	SP SM	Beige mfc SAND, little Silt, trace (-) f Gravel. Wet to saturated.		3		0.2	
15	-10	SP SM	Beige mfc SAND, little Silt, trace mf Gravel. Wet to saturated.		4		0.2	
20	-15							

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-108 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/19/10 - 5/19/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255108.6 ft.
Luke Caballero	Direct-push	Geoprobe® 6600	Vert Datum: NAVD88	Northing: 219358.8 ft.
			Ground Surface Elev: 5.4 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
5	0	SP GP SP GP SP SM SP GP SP GP GP SP	**FILL** Brown fmc SAND, little (+) Gravel, trace Silt, Moist. White/Beige fmc SAND, little (+) Gravel (pulverized). Brown mfc SAND, little Silt, trace Gravel, Wood chips. Brown fmc SAND, little Silt, little Gravel, trace Organics. Moist to wet. Brown fmc SAND, little Silt, little Gravel, trace Organics. Moist to wet. Lt. Gray/White mf GRAVEL (pulverized concrete), little (+) Sand. Wet.		1 2		4.3 0.4	*Borehole backfilled with / bentonite chips.* 2.5-2.6' BGS: Minor black staining, slight tar-like odor. Geoprobe refusal @ 6.0' BGS. Move over to location SB-108A.

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-108A **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/19/10 - 5/19/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255108.6 ft.
Luke Caballero	Direct-push	Geoprobe® 6600	Vert Datum: NAVD88	Northing: 219364.2 ft.
			Ground Surface Elev: 5.3 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
5		SP SP GP SP GP GP SP	**FILL** Brown fmc SAND, little Organics. Brown/Dk. Brown cmf SAND, little (+) Gravel, trace Silt, trace Organics. Brown/Lt. Brown cmf SAND, little (-) Gravel, trace Silt. Moist to wet. Lt. Gray/White mf GRAVEL (pulverized concrete), little (+) Silt.		1					27.3	*Borehole backfilled with bentonite chips.* 1.75-1.9' BGS: Black hardened tar, moderate tar-like odor. 2.5-2.6' BGS: NAPL coating soil grains, sheen and NAPL blebs on liner. Moderate to strong tar-like odor. Geoprobe refusal @ 5.0' BGS.

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-109 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/19/10 - 5/19/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.1 ft.	Easting: 1255322.4 ft. Northing: 219280.0 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	Asphalt		1		1.2	*Borehole backfilled with bentonite chips.*
		GP	**FILL** Dk. Brown/Black fm SAND, little (-) Gravel (Misc. Fill-cinders, brick).					
		SP	Brown/Tan fm SAND, little (-) Silt, trace Gravel.					1.7-2.5' BGS: Faint petroleum-like odor.
		SM						
		SP						
		GP	Red/Brown/Purple fmc SAND, little Gravel (Misc. Fill) little Silt. Moist.					
5	0	SP						
		GP	**ALLUVIAL DEPOSITS**		2		0.3	3.6-3.8' BGS: Minor black staining, hardened tar, moderate tar-like odor.
		SP	Red/Purple/Brown fmc SAND, little (+) f Gravel (shells). Moist.					
		GP						
		PT	Red/Purple/Brown fmc SAND, little (+) f Gravel (shells). Moist.					
		SP						
		SM	Dk. Brown/Brown SILT & CLAY and ORGANICS (peat) . Moist to wet.					
		SP						
10	-5	SM	**OUTWASH DEPOSITS**		3		1.0	
		SP	Tan/Beige fmc SAND, little (-) Silt.					
		GP						
		SP	Dk. Brown fmc SAND, little (+) Silt, trace (+) Organics.					
		GP						
			Tan/Beige cmf SAND, little (+) fmc Gravel. Wet to saturated.					
			Tan/Beige cmf SAND, little (+) fmc Gravel, trace Silt. Saturated.					
15	-10	SP	Tan/Beige cmf SAND, trace Gravel, trace Silt. Saturated. Iron staining.		4		0.2	
		GP						
20								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-110 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/19/10 - 5/19/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.	Easting: 1255337.0 ft. Northing: 219225.5 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP	Asphalt **ALLUVIAL DEPOSITS** Dk. Brown cmf SAND, little (+) mf Gravel (rounded), Moist.		1		0.4	*Borehole backfilled with bentonite chips.*
		SP	Lt. Brown cmf SAND.					
		SP	Brown fm SAND, little Silt, little Organics.					
5	0	SM	Shells @ 3.65-3.7'.		2		0.5	
		SP	Beige mfc SAND.					
		SP	Beige mfc SAND.					
		PT	Dk. Brown f SAND, little Silt & Clay, little Organics (peat).					
		SP SM	**OUTWASH DEPOSITS**					
		SP GP	Lt. Brown/Tan mfc SAND, little (-) Silt, trace (-) Gravel (rounded), Wet.					
10	-5	SP GP	Tan cmf SAND, little (+) fmc Gravel (rounded) trace Silt, wet.		3		0.1	
			Tan/Orange cmf SAND, little (-) fm Gravel (rounded), trace Silt. Saturated. Iron staining.					
15	-10	SP GP	Tan/Lt. Brown cmf SAND, trace f Gravel, trace Silt, Saturated.		4		0.0	
20								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-111 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
10/4/10 - 10/4/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.5 ft.	Easting: 1255112.6 ft. Northing: 1255112.0 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5	SP GP SP GP SP GP	**FILL** Lt. Gray fmc SAND, little Gravel (pulverized concrete/rock). Lt. brown fmc SAND, trace (+) fm Gravel. Wet. Beige fmc SAND, litte (-) fmc Gravel. Wet.		1		1.6	*Borehole backfilled with bentonite chips.* 0.5-1.7' BGS: Sporadic spots of black staining.
5	0	SP GP	Beige/tan mfc SAND, little (-) fm Gravel. Wet to saturated.		2		23.4	Sample SB-111-7-9 collected and submitted for laboratory analysis. 7.1-7.3' BGS: Band of NAPL saturated soils (tacky), moderate tar-like odor. 7.3-8.2' BGS: Sheen extending from saturated soils and within soil core when broken apart.
10	-5	SP GP	Beige mfc SAND, trace (-) fm Gravel.		3		0.2	
15	-10	SP GP	Beige mfc SAND, trace (-) fm Gravel.		4		0.0	Sample SB-111-15-17 collected and submitted for laboratory analysis.
20	-15	SP GP	Beige mcf SAND, trace (+) fm Gravel. Iron staining throughout.		5		0.0	
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-112 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
10/4/10 - 10/4/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.4 ft.	Easting: 1255112.0 ft. Northing: 219353.8 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6600		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5	SP GP SP GP SP GP	**FILL** Brown fmc SAND, some (-) fmc Gravel, trace Organics. Wet. Brown mfc SAND, trace (+) fm Gravel. Wet. Beige mfc SAND, trace (+) fm Gravel. Wet.		1		0.9	*Borehole backfilled with bentonite chips.* 1.4-1.5' BGS: Black staining, faint tar-like odor. Sample SB-112-1-3 collected and submitted for laboratory analysis.
5	0	SP GP	Beige/tan mfc SAND, trace (+) f Gravel. Wet/saturated. Iron staining.		2		0.7	
10	-5	SP GP	Beige mfc SAND, trace (-) f Gravel. Wet/saturated. Iron staining.		3		0.7	Sample SB-112-10-12 collected and submitted for laboratory analysis.
15	-10	SP GP	Beige mfc SAND, trace (-) f Gravel. Wet/saturated. Iron staining.		4		0.4	
20	-15	SP GP	Beige mfc SAND, trace (-) f Gravel. Wet/saturated. Iron staining.		5		0.0	
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-113 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/30/10 - 9/30/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.	Easting: 1255160.0 ft. Northing: 219341.6 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**		1		0.0	*Borehole backfilled with bentonite chips.*
		SP GP	Brown fmc SAND, trace Gravel, trace Organics.					
		SP	Gray fmc SAND, some Gravel (angular).					
		GP	Black/brown fmc SAND, trace (+) fm Gravel.					Sample SB-113-1-3 collected and submitted for laboratory analysis.
		SP						1-2.4' BGS: Black staining, faint tar-like odor
		GP	Brown fmc SAND, trace (+) fm Gravel.					
5	0	SP	Orange cmf SAND, trace f Gravel. Iron staining.		2		0.0	3.1-3.3' BGS: Black staining, faint tar-like odor
		SP GP	**OUTWASH DEPOSITS** Tan/orange cmf SAND, little (+) fm Gravel. Wet.					
10	-5	SP GP	Tan/beige fmc SAND, little (-) fm Gravel. Wet.		3		0.0	
15	-10	SP GP	Lt/ brown/tan mfc SAND, trace (+) fm Gravel. Wet.		4		0.0	
20	-15	SP GP	Lt/ brown/tan mfc SAND, trace (+) fm Gravel. Wet.		5		0.0	Sample SB-113-20-22 collected and submitted for laboratory analysis.
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-114 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/30/10 - 9/30/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.7 ft.	Easting: 1255172.0 ft. Northing: 219327.9 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
	5	SP SP GP SP GP	**FILL** Brown fmc SAND, trace Gravel, trace Organics. Gray/Brown fmc SAND, some fmc Gravel. Brown fmc SAND, little (-) fm Gravel. Moist to wet.	--	1					1.6	*Borehole backfilled with bentonite chips.* 0.9-2.2' BGS: Black staining, faint tar-like odor. Sample SB-114-1-3 collected and submitted for laboratory analysis.
5	0	SP GP	**OUTWASH DEPOSITS** Tan/Orange mfc SAND, little (+) fm Gravel. Wet. Iron staining throughout.	--	2					0.6	
10	-5	SP	Beige/Tan fmc SAND, trace (-) f Gravel. Iron staining.	--	3					1.8	
15	-10			--	4					0.4	
20	-15	SP	Beige/Tan fmc SAND. Wet. Iron staining.	--	5					0.0	Sample SB-114-20-22 collected and submitted for laboratory analysis.
25											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-115 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/30/10 - 9/30/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255181.0 ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 219315.3 ft.
			Ground Surface Elev: 5.6 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5	SP GP SP GP SP GP	**FILL** Brown fmc SAND, little (-) Gravel, trace Organics. Gray fmc SAND, some (+) mf Gravel. Brown/Gray/Black fmc SAND, little (-) Gravel. Moist.	--	1		0.5	*Borehole backfilled with bentonite chips.* 1.3' BGS: Black staining, slight/moderate tar-like odor. 2-2.5' BGS: Soils slightly coated with NAPL.
5	0	SP SP	Dk. Brown/Gray fmc SAND, trace mf Gravel. Wet. Brown/Tan mfc SAND, trace (+) fmc Gravel. Wet. Piece of wood.	--	2		0.2	5-5.7' BGS: Faint tar-like odor. Sample SB-115-10-12 collected and submitted for laboratory analysis.
10	-5	SP GP	**OUTWASH DEPOSITS** Tan/Orange mfc SAND, little fm Gravel. Wet.	--	3		13.5	10.85 and 11.45' BGS: Band of soil coated with tacky NAPL, sheen, faint tar-like odor.
15	-10	SP	Tan mfc SAND, trace Gravel. Dk. Red Iron staining.	--	4		0.4	15-20' BGS sample interval: Sheen observed at bottom of acetate liner.
20	-15	SP	Tan mfc SAND, trace Gravel.	--	5		0.0	20' BGS: Few small specks of NAPL.
25	-20	SP	Beige/Tan fmc SAND, trace (-) f Gravel.	--	6		0.0	Sample SB-115-25-27 collected and submitted for laboratory analysis.
30								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-116 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/30/10 - 9/30/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.7 ft.	Easting: 1255185.6 ft. Northing: 219299.3 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
	5	SP GP	**FILL** Brown fmc SAND, little (-) fm Gravel, trace Organics.	--	1					1.0	*Borehole backfilled with bentonite chips.*
5	0	NR	No recovery.	--	2					3.2	5-10' BGS: Minimal sample recovery, sheen and black staining observed on acetate liner.
10	-5	SP GP	**OUTWASH DEPOSITS** Brown/Tan fmc SAND, little (+) fm Gravel. Wet to saturated.	--	3					9.7	Sample SB-116-11-13 collected and submitted for laboratory analysis. 11' BGS: Black staining. 11.6-11.7' BGS: Black staining. 11.9' BGS: Band of soils coated with NAPL, sheen. 12-12.2' BGS: Black staining.
15	-10	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet.	--	4					1.4	12.2' BGS: Band of soils coated with NAPL, sheen, faint/moderate tar-like odor.
20	-15			--	5					0.0	20.5' BGS: Very few specks of tacky NAPL. Sample SB-116-21-23 collected and submitted for laboratory analysis.
25											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-117 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/30/10 - 9/30/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.	Easting: 1255181.2 ft. Northing: 219263.2 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	Topsoil.	--	1		5.2	*Borehole backfilled with bentonite chips.*
		SM	**FILL**					
		SP	Black/Gray/Red cmf SAND, some (-) fmc					
		GP	Gravel (Misc. Fill - brick, cinders). Wet.					
		ML	Dk. Brown SILT and CLAY, little Organics.					1.9-2.9' BGS: Black staining, faint tar-like odor.
		CL	Brown/Black fmc SAND, little (-) Gravel					2.6-2.7' BGS: Soils coated with NAPL.
		SP	(Misc. Fill).					
	0	GP	**OUTWASH DEPOSITS**					
5		SP	Gray cmf SAND, little (+) Gravel	--	2		0.4	Sample SB-117-2-3 collected and submitted for laboratory analysis.
		GP	(rounded).					
		SP	Gray/Dk. Gray mfc SAND, trace Gravel,					
		SP	trace Organics.					
		GP	Tan/Gray cmf SAND, some (+) fmc Gravel. Wet.					
	-5							
10		SP	Tan/Orange mfc SAND, trace (+) fm Gravel. Wet. Iron staining.	--	3		0.3	
	-10							
15				--	4		0.4	
	-15							
20		SP	Tan fmc SAND, trace (-) f Gravel. Wet.	--	5		0.0	Sample SB-117-20-22 collected and submitted for laboratory analysis.
	-20							
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-118 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/27/10 - 9/27/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.	Easting: 1255191.0 ft. Northing: 219349.2 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP SP GP	**FILL** Brown fmc SAND, little Gravel, trace Silt, trace Organics. Gray fm SAND, little (+) mf Gravel (angular). Brown fm SAND, little (-) Gravel (Misc. Fill - brick, cinders). Green/Blue tinge mf SAND, little Gravel (pieces of pulverized quartz).	--	1		202	*Borehole backfilled with bentonite chips.* 2.3-3.2' BGS: Black stained and NAPL coated soils, moderate tar odor. 3.2' BGS: Blue-green stained material, sulfur-like odor.
5	0	SP GP	**ALLUVIAL DEPOSITS** Black fmc SAND, little (-) fmc Gravel. Moist to wet.	--	2		62.7	5-10' BGS: NAPL coated sand grains, moderate/strong tar-like odor.
10	-5	SP SP	Black fm SAND. **OUTWASH DEPOSITS** Tan/Brown fm SAND. Wet.	--	3		9.9	10-10.4' BGS: Black stained soils, moderate tar-like odor. 11.3' BGS: Lens of NAPL coated soils. 11.6' BGS: Lens of NAPL coated soils (more viscous than observed at 11.3').
15	-10	SP	Tan fmc SAND. Wet to saturated.	--	4		9.7	15-15.5' BGS: Thin band of black viscous NAPL coated soils, moderate tar-like odor. 15.5-16' BGS: Sheen extending from saturated soil grains. Sample SB-118-15-17 collected and submitted for laboratory analysis.
20	-15			--	5		0.0	Sample SB-118-22-24 collected and submitted for laboratory analysis.
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-119 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/28/10 - 9/28/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.	Easting: 219364.5 ft. Northing: 1255201.5 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		SP GP SP SP GP SP	**FILL** Brown/Gray fmc SAND, little (-) fmc Gravel (Misc. Fill - brick, cinders). Black f SAND and SILT. Black fm SAND, trace f Gravel. Green/White cmf GRAVEL (pulverized rock - quartz), little (-) Sand.	--	1					89.2	*Borehole backfilled with bentonite chips.* 1.1-1.3' BGS: NAPL coated soils 1.3-3' BGS: NAPL coating/NAPL saturated, moderate tar-like odor.
5	0	SP SM ML SP GP SP	**ALLUVIAL DEPOSITS** Brown mf SAND, trace Organics. Dk. Brown SILT and f SAND, little Organics. Gray/Dk. Gray fmc SAND. **OUTWASH DEPOSITS** Tan/Beige SAND and GRAVEL. Wet @ 7.4'.	--	2					19.6	5-5.9' BGS: Black stained/NAPL coated soils. 6.8' BGS: Sheen extending from saturated soils, sporadic specks/blebs of NAPL. 7.4' BGS: Band/lens of NAPL.
10	-5	SP	Tan/Orange fm SAND, trace fm Gravel. Wet.	--	3					9.0	10.7' BGS: Black staining, sheen and NAPL coating on gravel. 10.8' BGS: Band/lens of tacky NAPL within coarser grained material, moderate tar-like odor.
15	-10	SP	Tan fmc SAND, trace f Gravel. Wet. Iron staining.	--	4					0.0	Sample SB-119-11-13 collected and submitted for laboratory analysis.
20	-15	SP	Tan/Orange fmc SAND, trace (-) f Gravel. Wet. Iron staining.	--	5					0.0	20-25' BGS: Spots of sheen on water within acetate liner, but not within soil core when broken apart. Sample SB-119-22-24 collected and submitted for laboratory analysis.
25	-20										

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-120 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/27/10 - 9/27/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.	Easting: 219356.2 ft. Northing: 1255219.7 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**	--	1		139	*Borehole backfilled with bentonite chips.*
		GP	Brown/Gray fmc SAND, little Gravel.					
		GP	Red SAND, little Gravel (Misc. Fill -					1.7-3' BGS: Black staining, moderate tar-like odor.
		SP	pulverized brick/fire brick).					3'-3.1 BGS: NAPL coating, blebs/sheen extending from saturated soil grains.
		SP	Brown/Gray fm SAND.					
		SP	Lt. Gray fm SAND, little (+) fmc					
		GP	GRAVEL, trace Silt. Compact.					
5	0							
		SP	Gray/Brown fmc SAND, little f Gravel	--	2		136	3.1-3.7' BGS: moderate tar-like odor.
		GP	(Misc. Fill - brick). Saturated.					5-6.7' BGS: NAPL coating/saturated, moderate tar-like odor.
		SP	**ALLUVIAL DEPOSITS**					6.7-8.3' BGS: Black stained soils, sheen throughout, moderate tar-like odor.
			Gray/Black fm SAND, trace Organics.					
		GP	**OUTWASH DEPOSITS**					8.3-9.5' BGS: Sheen extending from saturated soils, moderate tar-like odor.
		SP	Brown/Tan cmf SAND and fmc GRAVEL.					
10	-5							10-10.7' BGS: Bands of black staining/NAPL coated soils, sheen, moderate tar-like odor.
		SP	Tan fmc SAND. Saturated.	--	3		31.9	10.7-11.3; BGS: Sheen extending from saturated soils.
15	-10							11.3-11.4' BGS: Black staining, NAPL (tacky to touch).
		SP	Tan/Orange fmc SAND.	--	4		17.9	12.2-12.3' BGS: Lens of NAPL (tacky to touch).
								15.9-16.1' BGS: NAPL saturated (tacky to touch), moderate to strong tar-like odor.
20	-15							16.1-16.8' BGS: Sheen extending from saturated soils, moderate tar-like odor.
				--	5		0.0	16.5' BGS: Lens of tacky NAPL.
								Sample SB-120-15-17 collected and submitted for laboratory analysis.
25	-20							Sample SB-120-22-24 collected and submitted for laboratory analysis.

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-121 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/28/10 - 9/28/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.1 ft.	Easting: 219340.4 ft. Northing: 1255204.7 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP	**FILL** Brown fmc SAND, little (+) Gravel, trace Organics. Brown/Gray/Black cmf SAND, little Gravel (Misc. Fill - brick). Dk. Brown/Black fm SAND, little (-) f Gravel.	--	1		85.2	*Borehole backfilled with bentonite chips.* Sample SB-121-2-4 collected and submitted for laboratory analysis. 2.4-2.9' BGS: NAPL coating soil, moderate tar-like odor.
5	0	SP ML CL GP SP	**ALLUVIAL DEPOSITS** Brown fmc SAND. Dk. Brown SILT and CLAY. **OUTWASH DEPOSITS** Brown/Tan fmc SAND and GRAVEL. Moist to wet.	--	2		10.5	2.4, 2.7' BGS: Sand with blue tinge, faint sulfur-like odor. 5-5.4' BGS: NAPL coating on soil grains, moderate tar-like odor. 5.8-7' BGS: Slight tar-like odor.
10	-5	SP GP	Tan/Beige mfc SAND, little (+) fm Gravel. Wet. Iron staining.	--	3		2.4	7-7.4' BGS: Sheen extending from saturated soil grains, slight tar-like odor 11.5-11.7' BGS: Globules of viscous NAPL (tacky to touch). 11.7' BGS: Lens of NAPL.
15	-10	SP	Tan/Orange mcf SAND, trace (-) f Gravel. Iron staining. Wet to saturated.	--	4		6.7	Sample SB-121-15-17 collected and submitted for laboratory analysis. 15.2-17' BGS: Lenses of tacky NAPL concentrated around coarser grained material, sheen throughout, moderate tar-like odor.
20	-15	SP	Orange/Tan mf SAND, trace (-) f Gravel. Wet to saturated.	--	5		0.0	Sample SB-121-22-24 collected and submitted for laboratory analysis.
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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-122 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	28.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/28/10 - 9/28/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.	Easting: 219354.3 ft. Northing: 1255200.9 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**	--	1		210	*Borehole backfilled with bentonite chips.*
		SP	Brown mf SAND, trace Gravel, trace Organics.					
		GP						
		CL	Gray/Brown fmc SAND, little (+) Gravel (Misc. Fill - brick).					2.2-3.9' BGS: NAPL coating soil grains, moderate/strong tar-like odor.
		SP						
		GP	Red CLAY.					
		SP	Brown/White fmc SAND, little (+) Gravel (pulverized rock).					
5	0	GP						
		SP	Brown mf SAND, trace f Gravel. Moist.	--	2		386	5-5.7' BGS: NAPL saturated, strong tar-like odor.
		GP	Green/White GRAVEL (pulverized quartz).					5.7-6.9' BGS: NAPL coating on soil grains, sheen throughout.
		SP	Brown/Black fmc SAND, trace Gravel.					5.9-6, 6.2-6.4, 6.6-6.7' BGS: NAPL saturated.
		SP	Tan/Beige SAND and GRAVEL.					6.9-7.4': Sheen extending from saturated soil grains.
			ALLUVIAL DEPOSITS Black fm SAND. Wet to saturated.					
10	-5	SP	**OUTWASH DEPOSITS**	--	3		52.4	
		GP	Tan/Beige mfc SAND, little (+) f Gravel. Wet to saturated.					10.8-10.9' BGS: Tacky NAPL coating on soils, sheen.
								11.2-11-5' BGS: NAPL saturated (tacky).
								11.7, 11.8' BGS: Lenses of tacky NAPL.
15	-10	SP	Tan/Orange mfc SAND. Wet to saturated.	--	4		7.0	11.8 to 12.3': Sheen extending from saturated soil grains.
								15.9' BGS: Black stained soils.
								16.05-16.1' BGS: Lenses of tacky NAPL, moderate tar-like odor.
20	-15	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet to saturated.	--	5		10.1	Sample SB-122-20-22 collected and submitted for laboratory analysis.
								20.65-20.75' BGS: Lenses/bands of NAPL coated soils, moderate tar-like odor.
25	-20	SP	Tan/Beige mcf SAND. Wet.	--	6		0.0	Sample SB-122-25-27 collected and submitted for laboratory analysis.

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-123 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/28/10 - 9/28/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.1 ft.	Easting: 219315.0 ft. Northing: 1255222.3 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP SP	**FILL** Brown cmf SAND, little (-) Gravel, trace Organics. Gray fmc SAND, little (+) Gravel. Brown/Black fmc SAND, little (-) Gravel (Misc. Fill - brick), trace Organics. Gray/Brown fm SAND, trace (-) Gravel.	--	1		236	*Borehole backfilled with bentonite chips.* 1.1-1.9' BGS: Black stained soils, moderate tar-like odor. 1.9-3.2' BGS: NAPL coating on soil grains. 1.9-2.2' BGS: NAPL saturated, moderate tar-like odor.
5	0	SP	Gray/Brown fm SAND, trace (-) Gravel., trace Organics.	--	2		36.7	5-6.1' BGS: NAPL coating on soil grains, moderate tar-like odor. 6.1- 8.1' BGS: Sporadic blebs of NAPL and sheen concentrated around gravel.
		GP SP	**OUTWASH DEPOSITS** Tan cmf SAND and fmc GRAVEL. Wet.					
10	-5	SP	Tan/Orange fmc SAND, trace (+) fmc Gravel. Wet.	--	3		4.7	Sample SB-123-15-17 collected and submitted for laboratory analysis. 11.2' BGS: Few NAPL blebs on coarse grained material. 11.9-12, 12.6' BGS: Bands of black staining, slight NAPL coating, sheen, moderate tar-like odor.
15	-10	SP	Orange/Tan fm SAND, trace Gravel.	--	4		24.9	15-15.6' BGS: Sheen, sporadic black staining. 15.6-16' BGS: NAPL coating, sheen, moderate tar-like odor. 16-16.5' BGS: NAPL saturated.
20	-15	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet.	--	5		0.0	16.5-16.9' BGS: Sheen. 16.9-17.2' BGS: NAPL saturated. Sample SB-123-20-22 collected and submitted for laboratory analysis.
25	-20			--	6		0.0	
30								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-124 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/27/10 - 9/27/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.7 ft.	Easting: 219314.8 ft. Northing: 1255246.9 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP	**FILL** Gray/Brown cmf SAND, some Gravel.	--	1		11.9	0.7-1.7' BGS: Slight tar-like odor. *Borehole backfilled with bentonite chips.* 2.1-2.2' BGS, 3.3'-3.9' BGS: Black staining, moderate to strong tar-like odor. Sample SB-124-2-4 collected and submitted for laboratory analysis.
		SP GP	Black cmf SAND, little (+) fm Gravel (Misc. Fill - cinders). Moist.					
		SP GP	Brown/Tan mfc SAND, trace f Gravel. Moist to wet.					
	0							
5		SP GP	**OUTWASH DEPOSITS** Lt. Gray fm SAND, little fm Gravel.	--	2		4.2	6-7' BGS: Sporadic black staining. Moderate/faint tar-like odor.
		GP	Lt. Gray/Tan cmf SAND and GRAVEL.					
		SP SP GP	Lt. Tan/Beige cm SAND, little (-) fm Gravel. Wet.					
	-5							
10		SP GP	Orange/Tan mcf SAND, little (-) f Gravel. Wet to saturated.	--	3		0.2	
	-10							12.9' BGS: Few NAPL blebs and sheen on soil grains. Moderate tar-like odor.
15		SP	Orange/Tan fmc SAND. Wet to saturated.	--	4		0.0	
	-15							
20				--	5		0.0	Sample SB-124-22-24 collected and submitted for laboratory analysis.
	-20							
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-125 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/30/10 - 9/30/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.	Easting: 219279.0 ft. Northing: 1255206.5 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP	**FILL** Brown fmc SAND, little (-) Gravel, trace Organics. Gray fmc SAND, some (+) Gravel. Dk. Brown/Black cmf SAND, little (+) Gravel (Misc. Fill - brick, cinders).	--	1					1.3	*Borehole backfilled with bentonite chips.* 0-5' BGS: Faint tar-like odor.
5	0	SP	Brown mfc SAND, trace (+) mf Gravel. Wet.	--	2					0.1	5-6' BGS: Sheen on soil grains and on water, faint tar-like odor.
10	-5	SP	**OUTWASH DEPOSITS** Tan/Orange mfc SAND, trace (+) fm Gravel. Wet. Iron staining.	--	3					0.3	12-12.4' BGS: Faint tar-like odor.
15	-10	SP	Tan/Orange mfc SAND, trace (-) f Gravel. Wet.	--	4					0.3	15.4-15.8' BGS: Very few spots of NAPL coated soils (tacky), faint tar-like odor.
20	-15	SP	Tan/Brown fmc SAND, trace (-) f Gravel.	--	5					9.5	20.7-20.8' BGS: Band of soils coated with tacky NAPL. 20.8-21.2' BGS: Sheen extending from saturated soils, but not within soil core when broken apart.
25	-20	SP	Tan/Orange mfc SAND, trace (+) f Gravel. Wet. Fe staining.	--	6					0.0	Sample SB-125-20-22 collected and submitted for laboratory analysis. Sample SB-125-25-27 collected and submitted for laboratory analysis.
30	-25										

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-126 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/27/10 - 9/27/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.5 ft.	Easting: 219284.2 ft. Northing: 1255240.4 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP	**FILL** Gray/Brown cmf SAND, some Gravel, trace Organics. Dk. Brown/Black fmc SAND, little (+) fmc Gravel (Misc. Fill - brick, cinders, wood). Moist.	--	1		152	*Borehole backfilled with bentonite chips.* 1.9-2.4' BGS: Sheen, moderate tar-like odor. 1.9-2.4' BGS: Sheen on grains, moderate tar-like odor.
	0							
5		SP GP	Brown mfc SAND, little (+) f Gravel.	--	2		324	2.9-3' BGS: NAPL coating sand and gravel, tacky to touch, moderate to strong tar-like odor. 5-6.8' BGS: NAPL coated/saturated, moderate tar-like odor. 8.1' BGS: NAPL saturated. 8.1-8.3' BGS: Black stained soils.
	-5	GP SP	**OUTWASH DEPOSITS** Tan/Brown SAND and GRAVEL. Moist to wet.					
10		SP GP	Tan/Brown cmf SAND, little (+) fmc Gravel. Wet.	--	3		18.5	8.3' BGS: Sporadic sheen and black staining throughout, moderate tar-like odor. 11.7, 11.9-12.1, 12.2-12.4' BGS: Spots of sheen and black staining, moderate tar-like odor.
	-10							
15		SP	Orange/Tan fmc SAND. Wet.	--	4		0.0	15-20' BGS: Spots of sheen on sides of core, but not inside core when broken apart. Sample SB-126-5-7 collected and submitted for laboratory analysis.
	-15							
20		SP	Tan/Beige fmc SAND, trace f Gravel. Wet to saturated.	--	5		0.0	Sample SB-126-22-24 collected and submitted for laboratory analysis.
	-20							
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-127 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/27/10 - 9/27/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.8 ft.	Easting: 219268.1 ft. Northing: 1255247.6 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP	**FILL** Lt. Brown/Gray fmc SAND, little (+) cmf Gravel, trace Organics. Brown/Dk. Brown fmc SAND, little Gravel (Misc. Fill - brick, cinders, glass).	--	1		28.3	*Borehole backfilled with bentonite chips.* 1.8-3.1' BGS: Faint to moderate tar-like odor. 2.8-3.1' BGS: Sheen (especially surrounding coarser grained material).
5	0	SP	Dk. Brown/Gray cmf SAND, trace (+) Gravel (Misc. Fill - cinders, brick).	--	2		76.1	5-5.7' BGS: Sheen, moderate tar-like odor. 5.7'-6 BGS: NAPL saturated, moderate tar-like odor. 6-6.6' BGS: Sporadic sheen, black stained soils. 6.8' BGS: Sheen on outside of soil core, but not inside core when broken apart.
		SP SP SM GP SP	**ALLUVIAL DEPOSITS** Beige fmc SAND. Wet. Brown fm SAND, little Silt. **OUTWASH DEPOSITS** Beige/Tan SAND and GRAVEL.					
10	-5	SP	Tan fm SAND. Wet to saturated.	--	3		2.3	10-15' BGS: Sporadic spots of sheen extending from saturated soils Sample SB-127-5-7 collected and submitted for laboratory analysis.
15	-10	SP	Tan/Orange fmc SAND. Saturated.	--	4		0.0	15-20' BGS: Spots of sheen on outside of soil core, but not inside core when broken apart.
20	-15			--	5		0.0	Sample SB-127-22-24 collected and submitted for laboratory analysis.
25	-20							

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-128 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/29/10 - 9/29/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.	Easting: 219245.1 ft. Northing: 1255247.0 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP	**FILL** Gray/Brown fmc SAND, little (+) Gravel, trace Organics. Black/Gray fmc SAND, little (+) Gravel (Misc. Fill - brick, cinders). Moist to wet. Tan/Brown fm SAND, trace (+) fm Gravel. Wet.	--	1					6.9	*Borehole backfilled with bentonite chips.* 2-3' BGS: Minor black staining, faint tar-like odor.
5	0	SP GP	Black/Gray fmc GRAVEL (pulverized rock), little (-) Sand. Wet. Gray/Black cmf SAND, little (-) Gravel.	--	2					60.3	5-6' BGS: Black stained soils, slight tar-like odor.
		ML CL SP GP GP	**ALLUVIAL DEPOSITS** Dk. Brown SILT and CLAY, little Organics. Lt. Gray fmc SAND, little (+) Gravel (rounded). Spots of tidal marsh @ 7.0 and 7.1'.								6.9' BGS: Soils heavily coated with NAPL. 7.9' BGS: Sheen extending from saturated soils, faint tar-like odor.
10	-5	SP SP	**OUTWASH DEPOSITS** Gray SAND and GRAVEL. Wet. Tan/Lt. Brown mfc SAND, trace (-) f Gravel.	--	3					17.5	10-10.4' BGS: Sheen. 11.1-11.2' BGS: Minor black staining, faint tar-like odor.
15	-10	SP	Tan/Lt. Brown mfc SAND, trace (-) fm Gravel. Wet to saturated.	--	4					19	15-15.4' BGS: Black stained soils, moderate tar-like odor. 15.8-16' BGS: Black stained soils. 15.9-16' BGS: Bands of soil heavily coated with NAPL. 16-17.5' BGS: Sheen extending from saturated soils.
20	-15	SP	Tan/Orange mfc SAND, trace (+) fm Gravel. Wet.	--	5					10.9	20.2' BGS: Bands of soils coated with tacky NAPL, sheen, faint tar-like odor. Sample SB-128-20-22 collected and submitted for laboratory analysis.
25	-20	SP	Tan/Orange mfc SAND. Wet. Iron staining.	--	6					0.0	Sample SB-128-25-27 collected and submitted for laboratory analysis.
30	-25										

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-129 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/29/10 - 9/29/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.2 ft.	Easting: 219243.2 ft. Northing: 1255226.9 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP SP GP	**FILL** Brown fm SAND, little Gravel, trace Organics. Gray fm SAND, little Gravel. Gray/Black fmc SAND, little (+) Gravel (Misc. Fill - brick, cinders). Gray/Tan mfc SAND, little Gravel.	--	1		282	*Borehole backfilled with bentonite chips.* 3.6' BGS: Sheen, slight tar-like odor.
5	0	SP GP	Black cmf SAND, little (+) mf Gravel (Misc. Fill - cinders). Wet.	--	2		40.2	5-5.3' BGS: Sheen, slight tar-like odor. 6' BGS: NAPL coated soils. 6.2-6.4' BGS: NAPL saturated soils. 6.4-7.5' BGS: Sheen and NAPL blebs throughout. 6.8' BGS: Soils heavily coated with NAPL.
			ALLUVIAL DEPOSITS					
		SP SM	Brown f SAND and SILT, trace Organics. Brown fm SAND, trace f Gravel. Wet.					
		SP	**OUTWASH DEPOSITS**					
		GP SP	Tan/Beige cmf SAND and GRAVEL.					
10	-5	SP GP	Tan/Orange mfc SAND, little (-) fm Gravel. Wet to saturated.	--	3		45.6	
15	-10	SP GP	Tan fmc SAND, little (+) fm Gravel. Wet.	--	4		132	15.7-16' BGS: Bands and spots of NAPL coated soils (tacky), moderate tar-like odor. 16-17.3' BGS: Sheen extending from saturated soils.
20	-15	SP	Tan/range fmc SAND. Wet. Iron staining.	--	5		65.8	22.05' BGS: Thin band of stringy NAPL with sheen surrounding it, faint tar-like odor.
25	-20			--	6		0.0	Sample SB-129-22-24 collected and submitted for laboratory analysis. Sample SB-129-26-28 collected and submitted for laboratory analysis.
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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-130 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/29/10 - 9/29/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.4 ft.	Easting: 219256.9 ft. Northing: 1255207.7 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**	--	1		3	*Borehole backfilled with bentonite chips.*
		GP	Brown fmc SAND, little Gravel, trace Organics.					
		SP						
		GP	Gray cmf SAND, some fmc Gravel. Moist.					
		SP	Black/Red/Gray fmc SAND, little (+) Gravel (Misc. Fill - brick, cinders, pulverized rock). Moist.					2.3-2.6' BGS: Minor black staining, faint tar-like odor.
		GP						
		SP						
5	0		Gray/Brown mf SAND, trace f Gravel.	--	2		73.1	5-5.6' BGS: Minor black staining, faint tar-like odor.
		GP	Black/Gray fm GRAVEL, little (-) Sand.					5.6-6' BGS: Soils heavily coated with NAPL.
		SP	**ALLUVIAL DEPOSITS**					6.2-7.9' BGS: Sheen and spots of black staining, slight to moderate tar-like odor.
		ML	Dk. Brown SILT and CLAY, little Organics.					
		CL	**OUTWASH DEPOSITS**					
		SP	Tan/Gray mfc SAND, trace fm Gravel.					
		SP	Tan/Lt. Brown cmf SAND, some (+) fmc Gravel. Wet.					
10	-5	GP						
		SP	Tan/Orange mfc SAND, trace (+) fm Gravel. Wet.	--	3		6.7	10-15' BGS: Faint tar-like odor.
15	-10	SP	Tan/Orange fmc SAND, trace (-) f Gravel.	--	4		6.7	15.9' BGS: Lens/band of black stained soil, slightly coated with NAPL. Sample SB-130-16-18 collected and submitted for laboratory analysis.
20	-15	SP	Tan/Orange mfc SAND. Wet.	--	5		0.0	17.2' BGS: Thin band of tacky NAPL. 17.2-17.8' BGS: Sheen extending from saturated soils. Sample SB-130-20-22 collected and submitted for laboratory analysis.
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-131 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/29/10 - 9/29/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.9 ft.	Easting: 219265.3 ft. Northing: 1255226.0 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP	**FILL** Brown/Gray fmc SAND, little (+) fm Gravel, trace Organics. Gray/Dk. Gray cmf SAND, little (+) cmf Gravel (Misc. Fill - brick, cinders). Moist to wet. Gray/Brown fm SAND, little (-) f Gravel.	--	1		59.7	*Borehole backfilled with bentonite chips.* 1.2-2' BGS: Slight NAPL coating on soil grains, slight tar-like odor. 2-5.4' BGS: Heavy NAPL coating on soils, moderate tar-like odor.
5	0	ML CL SP ML CL	**ALLUVIAL DEPOSITS** Brown SILT & CLAY, little (+) Organics. Tan/Beige mfc SAND. Wet. Brown SILT & CLAY, little (+) Organics. **OUTWASH DEPOSITS**	--	2		3.8	5.6-6.4' BGS: Sheen. 5.6-8.1' BGS: Slight sheen, faint tar-like odor.
10	-5	SP GP SP GP	Tan/Beige cmf SAND, some (+) fmc Gravel. Wet to saturated, Tan/Orange cmf SAND, some (+) fmc Gravel. Tan/Orange mfc SAND, little (+) fmc Gravel. Wet.	--	3		60.4	10.95' BGS: Band of tacky NAPL. 11.3, 11.6, 11.65 and 11.8' BGS: Spots of NAPL coated soils and sheen.
15	-10	SP	Tan/Orange mfc SAND, trace f Gravel. Wet to saturated.	--	4		14.7	15.6-15.75' BGS: Band of NAPL coated soils, slight tar-like odor. 5.75-16.3' BGS: Sheen. 16.3-16.4' BGS: Band of NAPL saturated soils. 16.4-17.3' BGS: Sheen.
20	-15	SP	Tan/Beige mfc SAND. Wet to saturated.	--	5		11.9	20.95-21' BGS: Bands of soils heavily coated with NAPL. Sample SB-131-21-23 collected and submitted for laboratory analysis.
25	-20	SP	Tan/Orange mfc SAND. Wet.	--	6		0.0	21.55-21.7' BGS: NAPL saturated soils. 21.85' BGS: Band of soil heavily coated with NAPL. 22' BGS: Spots of NAPL coated soils. 22.2-22.3' BGS: Spots of NAPL coated soils, sheen. Sample SB-131-25-27 collected and submitted for laboratory analysis.
30	-25							

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-132 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	30.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/29/10 - 9/29/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 5.0 ft.	Easting: 219258.0 ft. Northing: 1255223.9 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	ppm Readings (ppm)	Remarks
		SP GP SP GP SP GP	**FILL** Brown fmc SAND, little (+) Gravel, trace Organics. Gray/Black cmf SAND, little (+) Gravel (Misc. Fill - brick, cinders). Moist. Brown mf SAND. Black fmc GRAVEL, little Sand.	--	1					11.9	*Borehole backfilled with bentonite chips.* 1.9-2.4' BGS: Sporadic black staining, faint tar-like odor. 2.4-2.6' BGS: Soils slightly coated with NAPL.
5	0	GP SP ML CL SP GP	Black fmc GRAVEL, little Sand, trace Organics. Tan/Beige mfc SAND, trace f Gravel. **ALLUVIAL DEPOSITS** Brown SILT & CLAY, little Organics. **OUTWASH DEPOSITS** Tan/Orange cmf SAND, little (+) fmc Gravel. Wet.	--	2					104	5-5.4' BGS: NAPL saturated soils. 5.4-6.1' BGS: Sheen throughout, few bands of soils coated with NAPL. 6.3-7.9' BGS: Sheen, few spots of black staining.
10	-5	SP GP	Tan/Orange mfc SAND, little (+) fmc Gravel. Wet.	--	3					1.3	
15	-10	SP	Tan fmc SAND, trace (+) f Gravel. Wet.	--	4					13.1	15.7' BGS: Band of soils coated with NAPL, sheen, moderate tar-like odor. 15.7-17.5' BGS: Sheen. 17.5' BGS: Slight tar-like odor.
20	-15	SP SP	Tan/Orange fmc SAND, trace (+) fmc Gravel. Orange/Tan cmf SAND, trace fmc Gravel. Wet.	--	5					17.5	21.6-21.7' BGS: NAPL saturated soils (slightly tacky). 21.7-22.4' BGS: Sheen extending from saturated soils, several NAPL blebs extending from soils.
25	-20	SP	Tan/Orange mf SAND. Wet.	--	6					0.0	Sample SB-132-21-23 collected and submitted for laboratory analysis. Sample SB-132-25-27 collected and submitted for laboratory analysis.
30	-25										

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-133 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	25.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
9/28/10 - 9/28/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD88 Ground Surface Elev: 4.3 ft.	Easting: 219380.1 ft. Northing: 1255207.8 ft. TOC Elev: N/A ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**	--	1		2.8	*Borehole backfilled with bentonite chips.*
		GP	Brown cmf SAND, little Gravel (Misc. Fill - brick, cinders), trace Organics.					0.9-2.8' BGS: Faint tar-like odor.
		GP						
		SP	Gray fm GRAVEL, little c Sand.					
		SP	Brown/Tan cmf SAND, trace Gravel, trace Silt, trace Organics.					
	0							
5		SP	Brown/Lt. Brown mfc SAND, little (-) fm Gravel. Wet.	--	2		0.7	
		GP						6.1-6.65' BGS: Spots of sheen on grains, faint tar-like odor.
		SP	**OUTWASH DEPOSITS**					
		GP	Brown/Lt. Brown mfc SAND, some (-) fm Gravel. Wet.					
		SP						
	-5	GP	Brown/Lt. Brown mfc SAND, little (-) fm Gravel. Wet.					
10		SP	Beige/Tan mfc SAND, trace (-) fmc Gravel. Wet.	--	3		0.0	
	-10							
15		SP	Tan/Orange fmc SAND, trace f Gravel. Wet.	--	4		0.9	15' BGS: Small spots of sheen.
								16-3.16.8' BGS: Slight sheen on saturated soils.
								Sample SB-133-15-17 collected and submitted for laboratory analysis.
	-15							
20		SP	Tan/Beige mfc SAND, trace f Gravel. Wet.	--	5		0.0	
								Sample SB-133-22-24 collected and submitted for laboratory analysis.
	-20							
25								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-134 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	10.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
10/6/10 - 10/6/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 219342.7 ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 1255114.4 ft.
			Ground Surface Elev: 5.1 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
		SP	**FILL**		1		0.0	*Borehole backfilled with bentonite chips.*
		SP	Dk. Brown fmc SAND, little (+) Gravel, trace Organics. Wet.					
		SP	Brown mfc SAND, little (-) fm Gravel. Moist to wet.					
			Beige mfc SAND, little (-) fm Gravel. Moist to wet. Iron staining.					
5	0	SP	Beige mfc SAND, trace fm Gravel. Wet to saturated.		2		0.0	Sample SB-134-5-7 collected and submitted for laboratory analysis.
10								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-135 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	10.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
10/6/10 - 10/6/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 219363.5 ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 1255105.7 ft.
			Ground Surface Elev: 5.4 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5	SP	**FILL**		1		0.0	*Borehole backfilled with bentonite chips.*
		SP	Dk. Brown fm SAND, little Organics.					
		GP	Brown/tan mfc SAND, trace (+) fm Gravel.					
		SP						
		GP	Beige mfc SAND, little (+) fm Gravel. Wet.					
5	0	SP	Beige/tan mfc SAND, little (-) fm Gravel. Wet.		2		0.0	Sample SB-135-5-7 collected and submitted for laboratory analysis.
		GP						
10								

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:** N/A	**Boring No.** SB-136 **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
C. Mino/Allendale, NJ	JLM	3"	NA	N/A"	10.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
10/6/10 - 10/6/10	Zebra Env. Corp.	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 219374.5 ft.
Luke Caballero	Direct-push	Geoprobe® 6620DT	Vert Datum: NAVD88	Northing: 1255120.6 ft.
			Ground Surface Elev: 5.6 ft.	TOC Elev: N/A ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	ppm Readings (ppm)	Remarks
	5	SP	**FILL** Dk. Brown fm SAND, trace Gravel, tace Organics.		1		0.0	*Borehole backfilled with bentonite chips.*
		SP	Brown fmc SAND, trace fm Gravel, trae (-) Organics. Wet.					
		SP	Beige fmc SAND, trace fm Gravel, trae (-) Organics. Wet.					
5	0	SP GP	Tan/beige mfc SAND, little (-) fm Gravel. Wet.		2		0.0	Sample SB-136-5-7 collected and submitted for laboratory analysis.
10								

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-1A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	8.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/21/12 - 3/21/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255177.4 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219314.6 ft.
			Ground Surface Elev: 6.3 ft.	TOC Elev: 8.1 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well (Stick Up)	ppm Readings (ppm)	Remarks
		SM	**FILL**	2-5-15-12			75.0	
	5	SC	Brown mf SAND, some Organics, little Silt. Pulverized concrete.					0.9-2' BGS: Moderate to strong odor.
		SW	Black mf SAND and mf GRAVEL (cinders & slag). Saturated w/ water @ 2.7'.	8-9-7-4			0.4	*0-1.5' BGS: Cement-bentonite grout*
		SM	Black mf SAND, trace Silt.					*1.5-2' BGS: Bentonite Plug*
		SM	Black mf SAND, some Silt.	6-5-6-6				*2-7.5' BGS: Filter pack (#1 Filpro Sand)*
5		MH	No Recovery.					*2.5-7.5' BGS: PVC Screen (0.020" Slot)*
	0	SP	Dark brown mfc SAND, trace Gravel (rounded granite and granite flakes).	7-9-11-15			0.0	

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-1B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/21/12 - 3/21/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255178.7 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219305.9 ft.
			Ground Surface Elev: 5.9 ft.	TOC Elev: 8.9 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well (Stick Up)	ppm Readings (ppm)	Remarks
	5	SW	**FILL**	19-10-10-5			0.0	
		SP	Brown-black mfc SAND, some Organics (roots, grass).					
		SM	Pulverized red-brown concrete.	2-4-3-7			0.0	
		SP	Reddish-black mf SAND, trace (-) Gravel. Pieces of red brick present. Mosit @ 1.7'.					
		GP	Black mf SAND, little Silt, trace Organics.	14-8-3-4				
5		SP	Saturated w/ water @ 3'.					
	0		Black c SAND and f Gravel (cinders and brick present).					*0-10' BGS: Cement-bentonite grout*
		SW		1-1-5-7			0.0	
		GP	Black mf SAND trace Gravel, trace (-) Silt. No recovery.					
		SW	**OUTWASH DEPOSITS**	17-12-8-11			0.0	
		GW	Brown mfc SAND, little (-) mf Gravel. Tan mfc SAND, little (+) Gravel (rounded qtz).					
10		SW		10-5-3-3			0.0	
	-5	GW	Brown mfc SAND, some Gravel (rounded qtz).					*10-12' BGS: Bentonite Plug*
		SP	Tan-orange mf SAND, trace (-) Gravel.	1-2-4-4			0.0	
		SP	Tan-grey mf SAND, trace (-) Gravel.					
				2-2-2-3			0.0	
15								*12-19' BGS: Filter pack (#1 Filpro Sand)*
	-10							
		SP	Tan-grey-beige mf SAND, trace Gravel. @ 17.1' BGS shell present w/ iron staining.	3-4-6-7			0.0	*14-19' BGS: PVC Screen (0.020" Slot)*
		SP	Tan-grey-beige mf SAND, little Gravel.	3-2-4-5			0.0	
		GP						
20								

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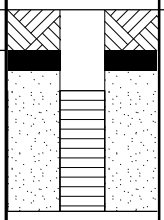
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-2A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:		
Shawn Miller	HSA	CME 1500	**Horiz Datum/Proj:** NYS Plane NAD83 **Vert Datum:** NAVD88 **Ground Surface Elev:** 5.8 ft.	**Easting:** 1255197.8 ft. **Northing:** 219330.2 ft. **TOC Elev:** 8.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well	ppm Readings (ppm)	Remarks
5	5		Refer to PZ-2B boring log for description of soil.								*0-1' BGS: Cement-bentonite grout.* *1-1.5' BGS: Bentonite seal.* *1.5-5' BGS: Filter pack.* *2-5' BGS: PVC Screen (0.020" Slot)*

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-2B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	18.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255209.7 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219332.1 ft.
			Ground Surface Elev: 5.3 ft.	TOC Elev: 8.3 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well	ppm Readings (ppm)	Remarks
		SP	**FILL** Brown mf SAND, little Organics (roots, grass), trace (-) Gravel. Specs of red brick present.	16-16-9-10			0.0	
		SP GP						
		SW	Pulverized concrete.	4-6-4-5			0.1	*0-6' BGS: Cement bentonite grout.*
		SM	Black mf SAND, some Gravel (cinders). Moist.					2.9-3.4' BGS: Slight tar-like odor.
		SP		2-3-2-1			72.1	4-4.3' BGS: Slight tar-like odor.
5	0	OH	Grey-beige mfc SAND, trace (-) Gravel (rounded qtz). Saturated w/ water @ 2.0'.					4.6-6' BGS: Black staining on some grains. Tar-like odor. Oily sheen on water.
		SW	**ALLUVIAL DEPOSITS**	1-1-3-3			7.0	*6-8' BGS: Bentonite seal.*
		SP	Grey-beige mfc SAND, little Silt, trace Organics, trace (-) Gravel (rounded qtz).					7' BGS: NAPL on surface of wood.
		SM	Color change to beige-tan @ 3.4'.	1-5-4-6			67.0	8-8.5' BGS: Black staining. Oily sheen on water.
		SP	Brown-biege mf SAND, trace Gravel.					8.5-10' BGS: Black staining. Moderate odor. NAPL coating on large grains.
		SW GP	Brown ORGANICS, little mf SAND.					*8-15' BGS: Filter pack.*
10	-5		Brown-beige mfc SAND.	3-3-3-5			7.0	*10-15' BGS: PVC Screen (0.020" Slot)*
		SP	Brown-beige mf SAND, trace (-) Organics (1" thick pcs of wood).					12-12.9' BGS: Oily sheen on grains and water. Tar-like odor.
			OUTWASH DEPOSITS	8-7-5-5			27.1	14-16' BGS: Slight odor. Slight staining.
			Black mf SAND, little Silt.					16-18' BGS: Black NAPL flecs w/ tacky, tar-like texture. Leaves residue on gloves. No odor.
		SW	Brown-beige mf SAND.					
		GP	Brown mfc SAND, some (-) Gravel.	7-3-3-4			13.0	
		SP	Brown-beige mf SAND. Mica flecs present.					
15	-10	GW	Brown-tan mfc SAND, some (-) Gravel.					
		SW	Brown-tan mc SAND and mfc GRAVEL (rounded qtz).	5-9-6-7			1.1	
			Tan-orange mfc SAND.					

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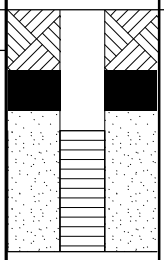
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-3A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
3/23/12 - 3/23/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255240.1 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219241.1 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 8.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well	ppm Readings (ppm)	Remarks
5	0		Refer to PZ-3B boring log for description of soil.								*0-1.5' BGS: Cement bentonite grout.* *1.5-2.5' BGS: Bentonite seal.* *2.5-6' BGS: Filter pack.* *3-6' BGS: PVC Screen (0.020" Slot)*

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WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-3B** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	20.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
3/22/12 - 3/22/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255252.2 ft.
Shawn Miller	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219240.4 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 8.9 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Well	ppm Readings (ppm)	Remarks
		SP	**FILL**	16-8-5-7			0.0	
		GP	Dark brown mf SAND, little Gravel, little Organics, little (-) Silt.					
		SP						
		GP	Crushed/pulverized concrete.	7-5-5-4			0.0	
		SP	Black fm SAND, some Gravel (red brick), little (-) Silt. Moist.					*0-9' BGS: Cement bentonite grout.*
		GP						
		SP	Grey-beige mc SAND, some m Gravel (angular).	2-2-2-2			0.0	4-6' BGS: Slight tar-like odor.
5	0	GP						
		SP	Black fmc SAND, little (+) m Gravel. Wet.					
		GP	Wood.	1-2-4-8			35.0	6-6.8' BGS: Black staining on grains. Sheen on spoon. Black/reddish-brown NAPL blebs (sand sized).
		SW	Grey-black mc SAND, little m Gravel (cinders). Wet to saturated. Saturated w/ water @ 4.0'.					
		SP		3-5-5-4			19.5	6.8' BGS: 1/2" NAPL lens across core.
		SW	**OUTWASH DEPOSITS**					8-8.6' BGS: Strong odor. Heavy, oily sheen on water in spoon.
		GW	Brown-beige mfc SAND.					
10	-5	SW	Grey-beige mf SAND, trace (-) mf Gravel (rounded qtz).	3-6-4-3			2.6	8.6-10' BGS: Heavy NAPL staining on largest grains. Strong odor.
		GP	Grey-beige mfc SAND and mfc GRAVEL.					*9-11' BGS: Bentonite seal.*
		SW	Grey-brown mfc SAND, some f Gravel.	5-5-5-4			4.5	10-10.1' BGS: Sheen on grains.
		GP	Tan-brown mfc SAND, some f Gravel (rounded qtz)					10.1' BGS: 1/2" Tacky/thick NAPL lens across core.
				13-5-6-4			3.0	10.7-12' BGS: Strong tar-like odor.
15	-10	SW	Tan-orange mfc SAND.					*11-18' BGS: Filter pack.*
		SW	Tan-orange mfc SAND, trace (-) Gravel (rounded).	10-5-7-6			4.7	14.8' BGS: Thin NAPL lens across core.
		SW	Tan-orange mfc SAND.	4-5-6-4			9.1	*13-18' BGS: PVC Screen (0.020" Slot)*
20	-15							18-20' BGS: Slight tar-like odor.

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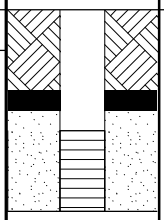
WELL LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 138893 **Project Location:** Patchogue, NY	**Permit Number:**	**Well No.** **PZ-4A** **Page** 1 **of** 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
N. Batarags/Allendale, NJ	RLO	8"	2" PVC	0.020"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: No Sampling	Development Method:
5/23/12 - 5/23/12	ADT	Hammer Type: 140lb Auto	Surge and Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255365.3 ft.
Chris Miglione	HSA	CME 1500	Vert Datum: NAVD88	Northing: 219236.5 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: 4.8 ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Well (Traffic Rated Vault Box)	ppm Readings (ppm)	Remarks
5	0		Refer to PASB-45 / MW-4D boring log soil description.								*0-2' BGS: Concrete well vault (flush mount).* *2-2.5' BGS: Bentonite seal.* *2.5-5' BGS: Filter pack.* *3-5' BGS: PVC Screen (0.020" Slot)*

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-201 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	3"	NA	NA"	10.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/8/14 - 5/8/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255313.3 ft.
C. Migliore	Direct-Push	Geoprobe® 7720DT	Vert Datum: NAVD 88	Northing: 219241.8 ft.
			Ground Surface Elev: 5.0 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
0		SW	Asphalt	N/A						2.3	*Boring backfilled with bentonite.*
		SP	**FILL** Discolored black cmf SAND, some (-) mf Gravel (including coal/coke material). Dry.								1.8-3.5' BGS: Slight to moderate organic-like odor.
		SW	**ALLUVIAL DEPOSITS** Discolored black/dark brown mf SAND, some Silt, some (-) Organic (wood debris). Moist.	N/A						7.2	3.5-4.5' BGS: Slight organic-like odor. 4.5-4.8' BGS: Black stringy, tacky viscous, tar-like material. Moderate naphthalene-like odor. Slight sheen on acetate liner.
5		SW SP	Discolored black cmf SAND, some Silt, some (+) Organics (wood debris). Moist to Saturated at 3.5' BGS.								4.8-5.8' BGS: Slight organic-like odor.
		SP	Discolored black cmf SAND, some Silt, some (+) Organics (wood debris). Saturated.								
		SW	Brown mf SAND, little (-) Silt. Saturated.								
		GP	Discolored black ORGANICS (wood debris). Saturated.								
10			Light brown/grey mf SAND, trace Silt. Saturated.								
			OUTWASH DEPOSITS Brown/red brown cmf SAND and mf GRAVEL, trace (-) Silt. Saturated.								
15											
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-202 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	3"	NA	NA"	17.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/8/14 - 5/8/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255290.1 ft.
C. Migliore	Direct-Push	Geoprobe® 7720DT	Vert Datum: NAVD 88	Northing: 219242.9 ft.
			Ground Surface Elev: 4.9 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
		SW	Asphalt	NA						1.6	*Boring backfilled with bentonite.*
		SP	**FILL** Discolored black cmf SAND, some (+) mf Gravel (includes coal/coke material). Dry.								1.8-3.0' BGS: Slight organic-like odor.
		SP	**ALLUVIAL DEPOSITS** Discolored black mf SAND, little (+) mf Gravel, little (-) Organics (wood debris). Moist.	NA						18.9	4.0-5.1' BGS: Slight naphthalene-like odor.
5	0	SW	Discolored black mf SAND, some (-) Organics (wood debris (soft material)), little (-) mf Gravel. Moist to Saturated @ 3.5' BGS.								5.3-5.5' BGS: Black viscous, tacky, stringy tar-like material partially coating sand grains. Moderate naphthalene-like odor.
			Same as above.								5.8-6.1' BGS: Black viscous, tacky, stringy tar-like material partially coating sand grains. Moderate naphthalene-like odor.
		SW	Discolored black Organics (wood debris), little mf SAND, trace f Gravel. Saturated.	NA						2.8	9.0-9.3' BGS: Sporadic sheen visible on sand grains within soil core and on acetate liner.
10	-5	SW/GW	Brown cmf SAND, little mf Gravel, trace Silt. Saturated.								
			Same as above.								
			OUTWASH DEPOSITS								
		SP	Brown cmf SAND and cmf GRAVEL. Saturated.	NA						1.3	
			Brown/red brown mf SAND, trace (-) f Gravel. Saturated.								
15	-10										
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-203 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	3"	NA	NA"	13.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/8/14 - 5/8/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255335.8 ft.
C. Migliore	Direct-Push	Geoprobe® 7720DT	Vert Datum: NAVD 88	Northing: 219243.6 ft.
			Ground Surface Elev: 5.2 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
		SW	Asphalt	NA						1.7	*Boring backfilled with bentonite.*
			FILL Discolored black cmf SAND, some (+) mf Gravel (includes coke/coal material), trace Silt. Dry.								
		SP	**ALLUVIAL DEPOSITS**	NA						7.2	
		SP	Slightly discolored brown/black mf SAND,								
		SP	little (+) mf Gravel. Moist to Saturated @								3.8-4.0' BGS: Strong naphthalene-like odor. Slight sheen visible on gravel surfaces.
5	0	SP	3.0' BGS.								
		SW	Slightly discolored brown/black mf SAND, little (+) mf Gravel. Saturated.								4.0-4.3' BGS: Slight naphthalene-like odor.
			Discolored black mf SAND, some (+) mf Gravel. Saturated.								
		SW/GP	Brown mf SAND, little f Gravel. Saturated.	NA						1.2	
			Brown cmf SAND, little (+) f Gravel.								
10	-5		Saturated.								
			OUTWASH DEPOSITS Brown cmf SAND and mf GRAVEL, trace (-) Silt. Saturated.								
		SP	Brown mf SAND, trace (-) Gravel. Saturated.								
15											
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-204 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	3"	NA	NA"	9.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/8/14 - 5/8/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255343.1 ft.
C. Migliore	Direct-Push	Geoprobe® 7720DT	Vert Datum: NAVD 88	Northing: 219260.3 ft.
			Ground Surface Elev: 5.1 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
		SP	Asphalt **FILL** Discolored black mf SAND, some (+) cmf Gravel (includes coke/coal, brick, glass). Dry.	NA						1.3	*Boring backfilled with bentonite.* No visible observations or odor indicative of MGP-related materials. 3.0-4.9' BGS: Slight organic-like odor.
		SP	Discolored black f SAND, some (-) Silt, little Organics (wood debris), trace f Gravel. Lime-like material @ 3.2' BGS. Moist to Saturated @ 3.8' BGS.	NA						1.6	
5	0	SP	**ALLUVIAL DEPOSITS** Discolored black ORGANICS (wood debris), little (+) mf SAND. Soft material. Saturated.								
		GW/SW	Brown/grey mf SAND, trace f Gravel. Saturated.								
10			**OUTWASH DEPOSITS** Grey/brown cmf GRAVEL and cmf SAND. Saturated.								
15											
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-205 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	3"	NA	NA"	8.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/8/14 - 5/8/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255346.7 ft.
C. Migliore	Direct-Push	Geoprobe® 7720DT	Vert Datum: NAVD 88	Northing: 219273.2 ft.
			Ground Surface Elev: 5.5 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
	5		Asphalt.	NA						0.4	*Boring backfilled with bentonite.* No visible observations or odor indicative of MGP-related materials.
		SW	**FILL** Discolored black cmf SAND, some (-) mf Gravel (included coal/coke, brick). Moist to Saturated @3.0' BGS.								
		SW	Discolored black cmf SAND, some (-) mf Gravel (included coal/coke, brick). Saturated @3.0' BGS.	NA						0.5	3.8-4.4' BGS: Slight decomposing organic-like odor.
5	0	SW	**ALLUVIAL DEPOSITS** Discolored black ORGANICS (root matter). Saturated.								
			Brown cmf SAND, little (-) f Gravel. Saturated.								
			Brown cmf SAND, some (+) mf Gravel. Saturated.								
10											
15											
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-206 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	3"	NA	NA"	12.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Macrocore®	Development Method:
5/8/14 - 5/8/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255337.8 ft.
C. Migliore	Direct-Push	Geoprobe® 7720DT	Vert Datum: NAVD 88	Northing: 219236.1 ft.
			Ground Surface Elev: 5.6 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
	5		Asphalt	NA						0.4	*Boring backfilled with bentonite.*
		SP	**FILL** Brown/discolored black mf SAND, some (+) mf Gravel (includes brick). Dry.	NA						11.7	
			Brick (refusal)								
		SP	Discolored black mf SAND, little (+) f Gravel, trace Silt. Moist to Saturated @ 2.9' BGS.								3.5-4.0' BGS: Black tacky, viscous, stringy tar-like material partially coating wood and sand grains. Moderate naphthalene-like odor. Moderate sheen.
5	0		**ALLUVIAL DEPOSITS** Discolored black ORGANICS (wood debris), some mf SAND. Saturated.								
		SP	Brown mf SAND, little (-) Organics (wood debris). Saturated.	NA						1.4	4.0-4.9' BGS: Slight naphthalene-like odor.
		SW/GP	Brown mf SAND. Saturated.								
			OUTWASH DEPOSITS Brown cmf SAND and mf GRAVEL. Saturated.								
10	-5										
15											
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-207 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	8"	NA	NA"	10.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
5/9/14 - 5/9/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255317.1 ft.
C. Migliore	Hollow Stem Auger	CME 85	Vert Datum: NAVD 88	Northing: 219233.6 ft.
			Ground Surface Elev: 4.8 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
0	4.8	SP	Asphalt	NA						0.0	*Boring backfilled with bentonite.*
			FILL Discolored black mf SAND, some (+) cmf Gravel (includes brick, coak/coal, glass). Dry to Moist.								
		SP	Brown/ discolored black mf SAND, little (+) f Gravel. Moist to Saturated @ 3.8' BGS.	1-H-1-H						1.2	4.4-5.0' BGS: Slight naphthalene-like odor. Slight sheen visible on sand grains.
5	0	SW									
		SW	**ALLUVIAL DEPOSITS** Black discolored cmf SAND, some (-) Organics (wood debris). Saturated.	2-4-6-4						0.0	5.0-5.2' BGS: Slight naphthalene-like odor.
		SP									
		SP/GP	Black discolored cmf SAND, some (-) Organic (wood debris). Saturated.								
		SP	Brown mf SAND, little (-) f Gravel. Saturated.	7-6-4-6						0.0	
	-5	SW/GP	Same as above.								
10			**OUTWASH DEPOSITS** Brown mf SAND and mf GRAVEL. Saturated. Brown/grey mf SAND, little (-) f Gravel. Saturated. Brown/red brown cmf SAND and mf Gravel. Saturated.								
15											
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-208 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	8"	NA	NA"	11.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
5/9/14 - 5/9/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255290.9 ft.
C. Migliore	Hollow Stem Auger	CME 85	Vert Datum: NAVD 88	Northing: 219234.1 ft.
			Ground Surface Elev: 4.9 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
		SP	Asphalt	NA						0.2	*Boring backfilled with bentonite.*
		SP	**FILL** Discolored black mf SAND, some (+) mf Gravel (includes coal/coke material). Dry to Saturated @ 3.0' BGS.								
		SP	**ALLUVIAL DEPOSITS**	1-2-1-4						1.2	3.0-3.7' BGS: Slight organic-like odor.
		SP	Discolored black mf SAND, some (+) Organics (wood debris). Saturated.								4.0-4.1' BGS: Strong organic-like odor.
5	0	SP	Brown mf SAND, little (-) Organic (wood debris). Saturated.	2-4-2-1						9.3	5.0-5.6' BGS: Slight organic-like odor.
		SP	Piece of wood.								5.6-5.8' BGS: Black stringy, tacky tar-like material partially coating sand grains and wood. Strong naphthalene-like odor.
		SW/GW	Brown mf SAND, little (-) Organics (wood debris). Saturated.	6-4-3-4						0.4	
			Discolored black mf SAND and ORGANICS (wood debris). Saturated.								
	-5	SW	**OUTWASH DEPOSITS**	7-4-6-5						0.0	
10			Brown cmf SAND and cmf GRAVEL. Saturated. Brown cmf SAND, some (-) mf Gravel. Saturated.								
15											
20											
25											
30											

P:\National_Grid\Patchogue\OffSite_Inv\Boring_Logs

BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-209 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	8"	NA	NA"	11.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
5/9/14 - 5/9/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255286.4 ft.
C. Migliore	Hollow Stem Auger	CME 85	Vert Datum: NAVD 88	Northing: 219327.3 ft.
			Ground Surface Elev: 5.2 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
		SP	Asphalt	NA						0.0	*Boring backfilled with bentonite.*
		SP	**FILL** Brown mf SAND, some (-) cmf Gravel (brick). Dry.								1.1-2.6' BGS: Slight treated wood (wood polish-like) odor
		SP	Discolored black mf SAND, some (-) cmf Gravel (coal/coak, brick, glass), some Organics (treated wood- possible railroad tie). Dry to Moist.	4-4-2-2						1.2	2.9' BGS: Specs of sheen on surface of water in borehole.
5	0	SP	Discolored black mf GRAVEL, some (-) mf Sand. Moist to Saturated @ 2.9' BGS.	2-4-2-2						0.4	3.0-3.3' BGS: Moderate naphthalene-like odor, moderate sheen on sand grains.
		SP	Discolored black mf GRAVEL, some (-) mf Sand. Saturated.	4-4-4-3						0.3	3.3-3.8' BGS: Slight naphthalene-like odor.
		SP	**ALLUVIAL DEPOSITS** Discolored black mf SAND, little (-) f Gravel. Saturated.	4-4-5-4						0.5	
10	-5	SP	Dark grey mf SAND. Saturated. Dark grey mf SAND. Saturated. Dark brown mf SAND, some (-) Organic (wood debris), little (+) f Gravel. Saturated. Same as above.								
			OUTWASH DEPOSITS Brown mf SAND, little f Gravel. saturated. Same as above.								
15											
20											
25											
30											

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BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-210 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	8"	NA	NA"	31.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
5/9/14 - 5/9/14	ADT, Inc.	Hammer Type: NA	NA

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83	Easting: 1255321.5 ft.
C. Migliore	Hollow Stem Auger	CME 85	Vert Datum: NAVD 88	Northing: 219257.4 ft.
			Ground Surface Elev: 5.2 ft.	TOC Elev: NA ft.

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	Readings (ppm)	Remarks
			Split-spoon samples not collected. Refer to PASB-41 boring log for description of soils.								*Boring backfilled with cement/bentonite grout. Boring hand cleared to 3.5' BGS.*
5	0										
10	-5										15-31' BGS: Soils recovered from 15-31' BGS had a slight napthalene-like odor likely due to the potential transport of impacted groundwater during drilling process from shallower intervals of the borehole.
15	-10	SW	Brown/red brown cmf SAND, trace (-) f Gravel. Saturated.	2-3-2-2						0.0	
		SW	Same as above.	3-4-2-2						0.0	
		SW	Brown cmf SAND. Saturated.	4-4-2-4						0.3	
20	-15	SW	Brown cmf SAND. Saturated.	5-6-7-5						0.1	
		SW	Same as above.	7-8-6-7						0.0	
		SW	Dark brown cmf SAND. Saturated.								
25	-20	SW	Brown cmf SAND, little (-) f Gravel. Saturated.	4-4-2-4						0.0	
			No Recovery.	2-4-5-7						--	
			No. Recovery.	4-2-3-4						--	
30	-25										

P:\National_Grid\Patchogue\OffSite_Inv\Boring_Logs

BORING LOG

Brown AND Caldwell	**Project Name:** Patchogue Former MGP Site **Project Number:** 142128 **Project Location:** Patchogue, NY	**Permit Number:** NA	**Boring No.** SB-211 **Page** 1 **of** 1

Inspector/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
BFT/Albany, NY	JLM	8"	NA	NA"	11.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: NA	Development Method:
5/9/14 - 5/9/14	ADT, Inc.		NA

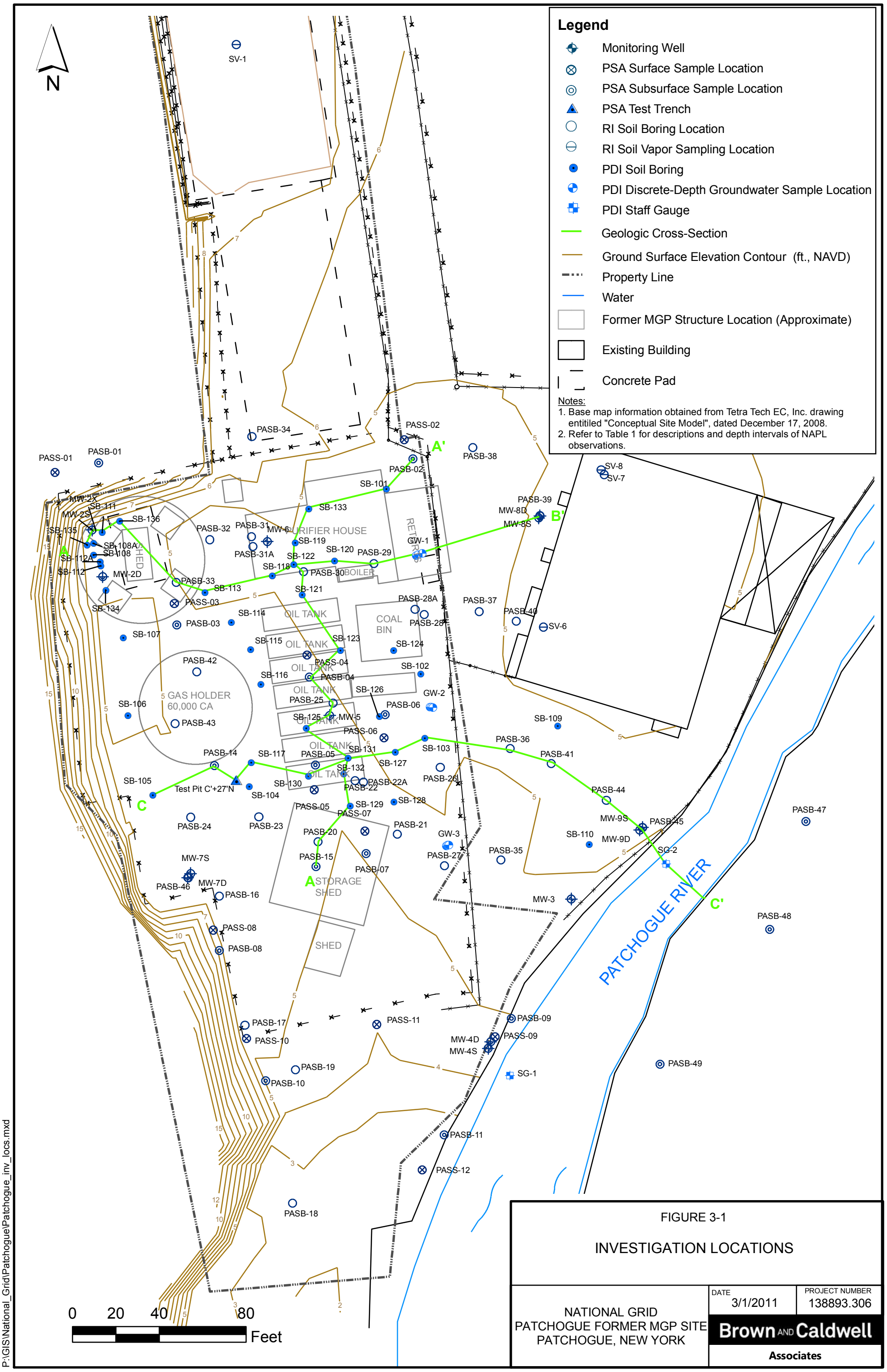
Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: NYS Plane NAD83 Vert Datum: NAVD 88 Ground Surface Elev: 5.6 ft.	Easting: 1255292.4 ft. Northing: 219222.3 ft. TOC Elev: NA ft.
C. Migliore	Hollow Stem Auger	CME 85		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	Readings (ppm)	Remarks
	5	SP	Asphalt	NA			0.0	*Boring backfilled with bentonite.*
			FILL Discolored black mf SAND, some (+) mf Gravel (includes coke/coal, glass, brick).					
		SP	Dry.					2.6-4.7' BGS: Slight naphthalene-like odor, slight organic-like odor.
			ALLUVIAL DEPOSITS Brown mf SAND, little (-) f Gravel, little (-) Organics (wood debris). Moist to Saturated @ 4.7' BGS.					
5	0	SP	Brown mf SAND, trace f Gravel, little Organics (wood debris). Saturated.	2-4-2-3			0.0	5.0-8.6' BGS: Slight naphthalene-like odor.
		SW	Brown cmf SAND, little (-) f Gravel. Saturated.	4-5-7-6			1.4	
		SW	Discolored black cmf SAND. Saturated.					
		SW	Brown cmf SAND. Saturated.	6-6-7-6			0.2	
10	-5	SW	**OUTWASH DEPOSITS** Brown cmf SAND and mf GRAVEL. Saturated.					
15								
20								
25								
30								

P:\National_Grid\Patchogue\OffSite_Inv\Boring_Logs

APPENDIX D

FOCUSED FEASIBILITY STUDY REFERENCE FIGURES


N
Legend
Monitoring Well
PSA Surface Sample Location
PSA Subsurface Sample Location
PSA Test Trench
RI Soil Boring Location
RI Soil Vapor Sampling Location
PDI Soil Boring
PDI Discrete-Depth Groundwater Sample Location
PDI Staff Gauge
Geologic Cross-Section
Ground Surface Elevation Contour (ft., NAVD)
Property Line
Water
Former MGP Structure Location (Approximate)
Existing Building
Concrete Pad
Notes:
1. Base map information obtained from Tetra Tech EC, Inc. drawing entitiled "Conceptual Site Model", dated December 17, 2008.
2. Refer to Table 1 for descriptions and depth intervals of NAPL observations.
SV-1
PASS-01
PASB-01
PASB-34
PASS-02
PASB-38
SV-8
SV-7
PASB-39
MW-8D
MW-8S
MW-2D
MW-2S
SB-111
SB-136
SB-135
SB-108A
SB-108
SB-112A
SB-112
SB-134
PASB-32
PASB-31
MW-6
PURIFIER HOUSE
SB-119
PASB-31A
SB-122
SB-120
PASB-29
GW-1
RETORT
SB-118
PASB-30
BOILER
SB-101
SB-133
PASB-33
SB-113
SB-121
PASS-03
PASB-03
SB-114
OIL TANK
COAL BIN
PASB-28A
PASB-28
PASB-37
PASB-40
SV-6
SB-107
SB-115
SB-123
SB-124
PASB-42
PASS-04
SB-116
PASB-04
SB-102
SB-126
GW-2
SB-106
GAS HOLDER 60,000 CA
PASB-43
PASB-25
PASB-06
SB-125
MW-5
SB-109
PASS-06
PASB-36
PASB-14
SB-117
PASB-05
SB-131
SB-103
PASB-41
SB-127
SB-132
PASB-26
SB-105
Test Pit C'+27'N
SB-130
PASB-22A
PASB-22
SB-104
PASB-44
PASS-05
SB-129
SB-128
PASS-07
PASB-47
PASB-24
PASB-23
PASB-20
PASB-21
MW-9S
PASB-45
SB-110
MW-9D
GW-3
PASB-15
PASB-27
PASB-35
SG-2
MW-7S
PASB-07
STORAGE SHED
PASB-46
MW-7D
PASB-16
MW-3
PASB-48
PASS-08
PASB-08
SHED
PASB-17
PASS-11
PASB-09
PASS-10
MW-4D
MW-4S
PASS-09
PASB-19
SG-1
PASB-49
PASB-10
PASB-11
PASS-12
PASB-18
A
A'
B
B'
C
C'
PATCHOGUE RIVER
0 20 40 80
Feet
FIGURE 3-1
INVESTIGATION LOCATIONS
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK
DATE
3/1/2011
PROJECT NUMBER
138893.306
Brown AND Caldwell
Associates
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N

Legend

- Monitoring Well
- PSA Surface Sample Location
- PSA Subsurface Sample Location
- PSA Test Trench
- RI Soil Boring Location
- RI Soil Vapor Sampling Location
- PDI Soil Boring
- PDI Discrete-Depth Groundwater Sample Location
- PDI Staff Gauge
- NAPL/Tar observed in soil
- Ground Surface Elevation Contour (ft., NAVD)
- Property Line
- Water
- Former MGP Structure Location (Approximate)
- Existing Building
- Concrete Pad
- (17.2) Deepest indicator of NAPL/Tar in soil (ft, BGS)

Notes:
1. Base map information obtained from Tetra Tech EC, Inc. drawing entitiled "Conceptual Site Model", dated December 17, 2008.
2. Refer to Table 1 for descriptions and depth intervals of NAPL observations.

SV-1
PASB-34
PASS-02
PASS-01
PASB-01
PASB-38
PASB-02
SV-8
SV-7
SB-101
MW-2X (5.8)
SB-111 (7.3)
MW-2S
SB-133 (2.0)
PASB-39
MW-8D
MW-8S
SB-136
SB-135
PASB-32
PASB-31
MW-6
PURIFIER HOUSE
SB-119 (10.9)
SB-120 (16.5)
GW-1
SB-108A (2.6)
PASB-31A
SB-122 (20.8)
PASB-29 (6.0)
RETORT
SB-112A
SB-108
SB-118 (15.5)
PASB-30 (9.6)
BOILER
SB-112
MW-2D
PASB-33
SB-113
SB-121 (17.0)
PASB-28A
PASB-37
PASB-40
SB-134
PASS-03
SB-114
OIL TANK
COAL BIN
PASB-28 (5.0)
SV-6
PASB-03
SB-107
SB-123 (17.2)
SB-115 (20.0)
OIL TANK
SB-124 (12.9)
PASB-42
SB-116 (20.5)
OIL TANK
PASS-04
PASB-04 (6.0)
SB-102 (6.5)
OIL TANK
SB-126 (8.1)
GW-2
GAS HOLDER 60,000 CA
SB-106
PASB-25
PASB-06 (12.0)
PASB-43
SB-125 (20.8)
OIL TANK
MW-5
SB-109 (3.8)
PASS-06
SB-103 (7.2)
PASB-36 (5.6)
SB-117 (2.7)
OIL TANK
SB-131 (22.3)
SB-127 (6.0)
PASB-41 (8.5)
PASB-14
PASB-05
SB-132 (22.4)
SB-130 (17.2)
OIL TANK
PASB-22A (8.8)
PASB-26 (5.0)
SB-105
Test Pit C'+27'N (3.5)
PASB-22
PASB-44
SB-104
PASS-05 (10)
SB-129 (22.1)
SB-128 (20.2)
PASB-47
PASB-24
PASB-23
PASS-07
PASB-21
MW-9S
PASB-45
PASB-20
GW-3
SB-110
MW-9D
PASB-15
PASB-27
PASB-35
SG-2
PASB-07
MW-7S
STORAGE SHED
PASB-46
MW-7D
PASB-16
MW-3
PASB-48
PASS-08
PASB-08
SHED
PATCHOGUE RIVER
PASB-17
PASS-11
PASB-09
PASS-10
MW-4D
MW-4S
PASS-09
PASB-19
PASB-49
PASB-10
SG-1
PASB-11
PASS-12
PASB-18

0 20 40 80 Feet

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

FIGURE 3-2

NAPL/TAR OBSERVATIONS

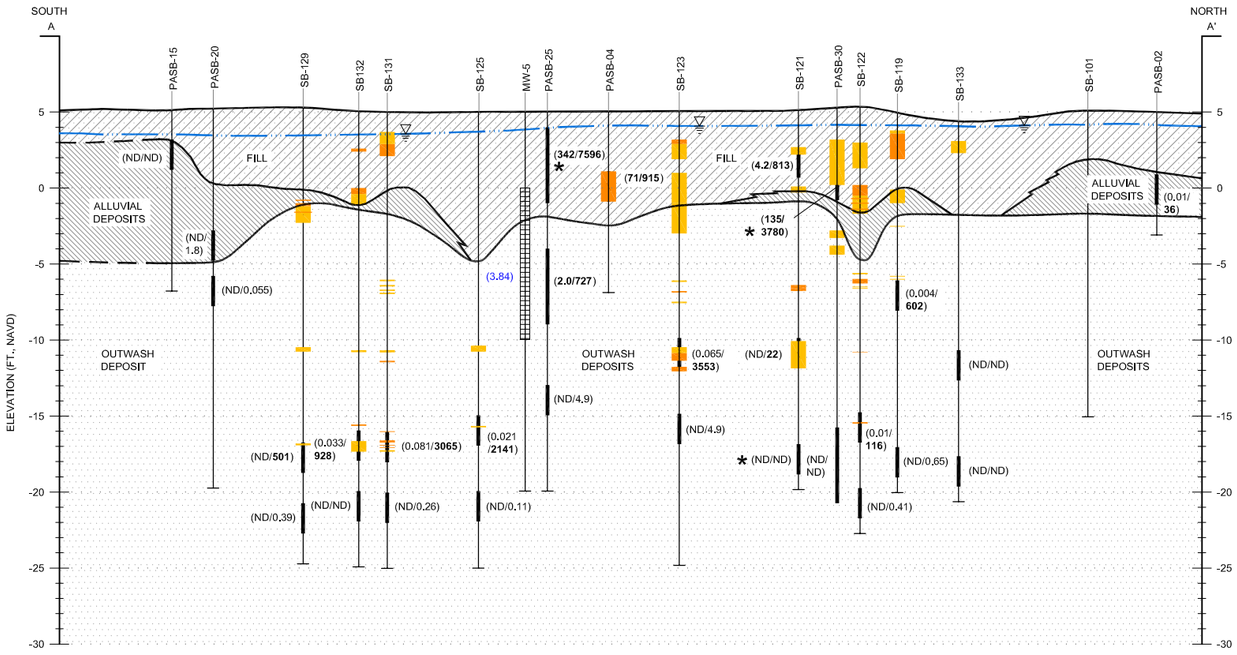
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
PATCHOGUE, NEW YORK

DATE 01/03/11

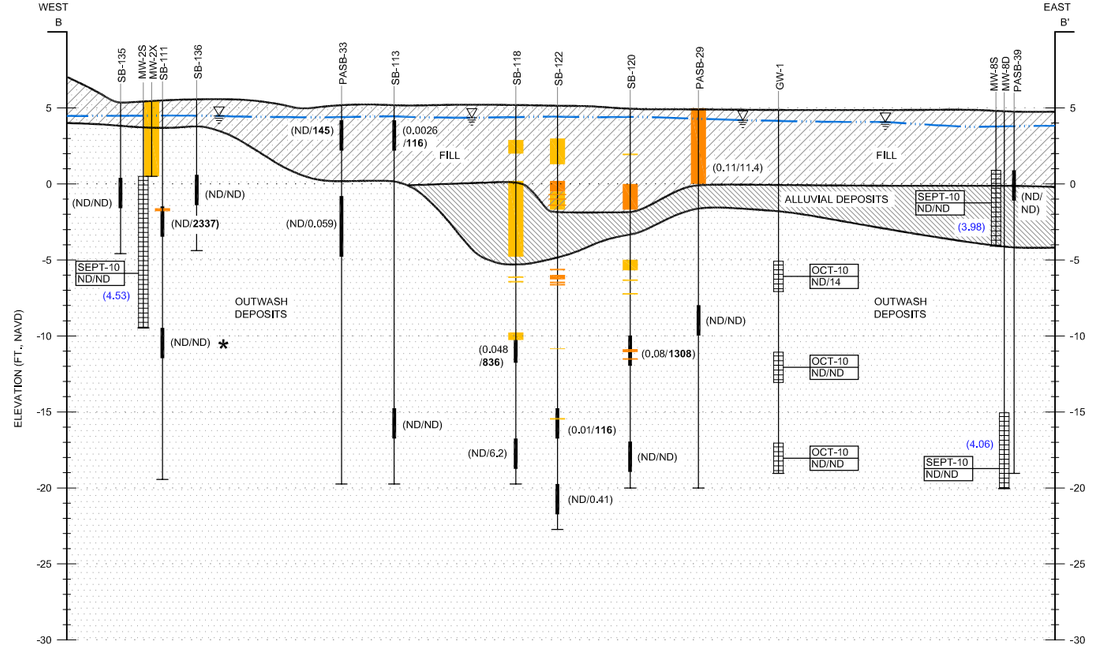
PROJECT NUMBER 138893.305

Brown AND Caldwell

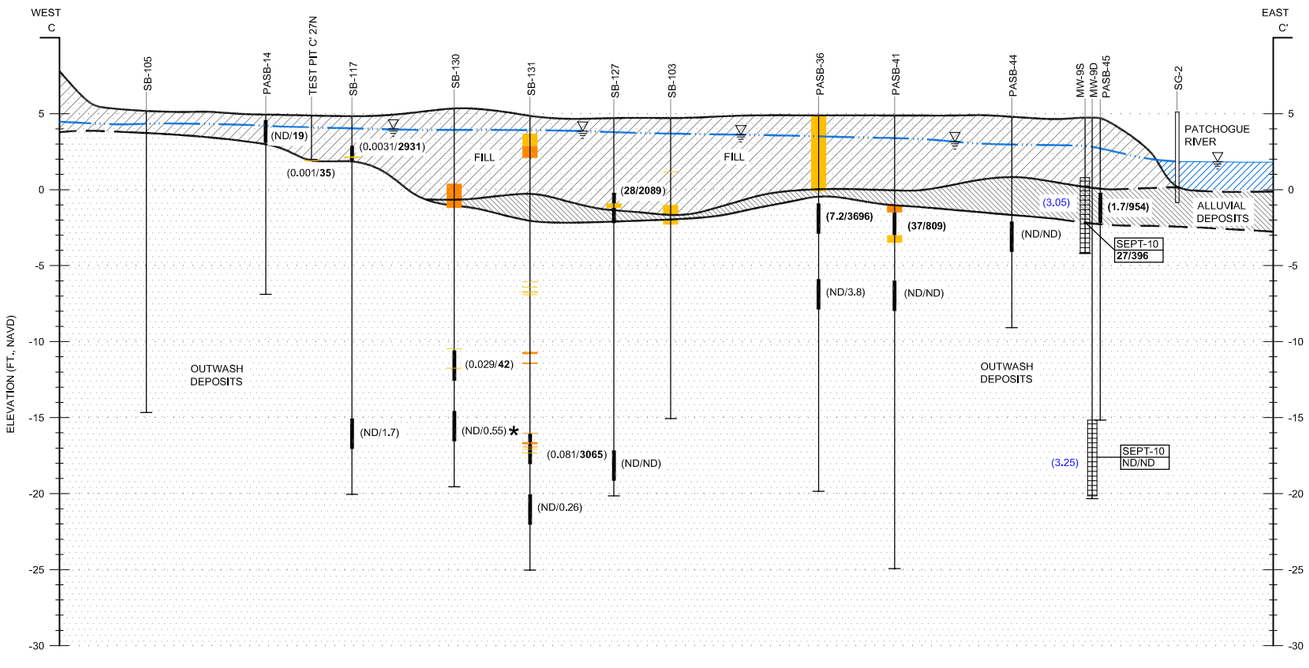
Associates



CROSS SECTION A-A'



CROSS SECTION B-B'



CROSS SECTION C-C'

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.

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

0 5 10
SCALE IN FEET
VERTICAL

0 40 80
SCALE IN FEET
HORIZONTAL

FIGURE 3-3
GEOLOGICAL CROSS SECTIONS

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

DATE: 5/11
PROJECT NUMBER: 138893.305

Brown AND Caldwell
ASSOCIATES
ALLENDALE, NEW JERSEY

P:\DRAFTING\NATIONAL_GRID\PATCHOGUE\138893-PATCHOGUE\2-SHEETS\B-GEOTECHNICAL\FIG_3-3_GEOLOGICAL CROSS SECTIONS.DWG 05/06/2011 02:10:04PM By:rjames XREFS: Basemap Layout: Layout1

138893.305

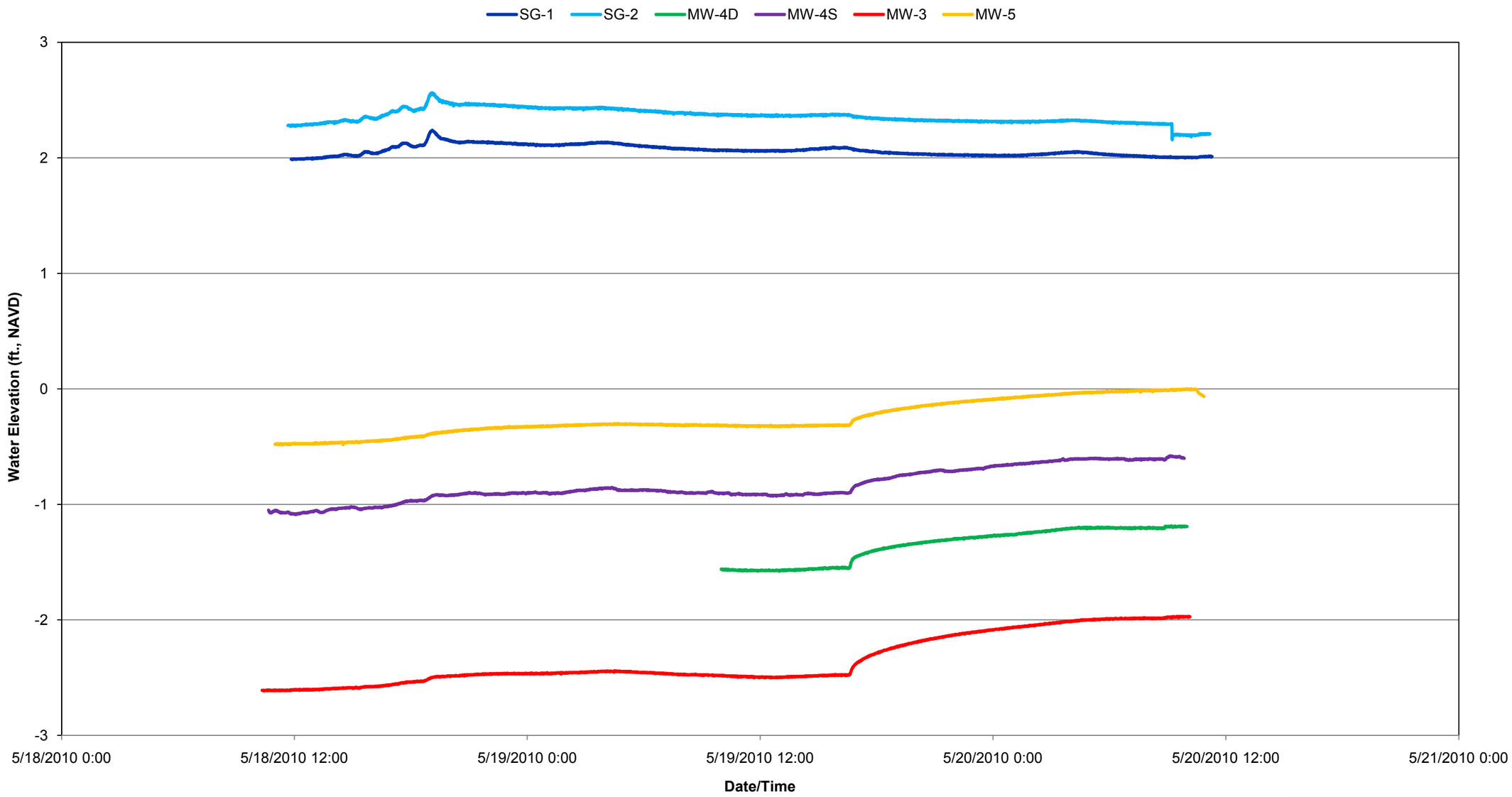


FIGURE 3-5

GROUNDWATER/ SURFACE WATER HYDROGRAPHS – CONTINUOUS MONITORING (MAY 18-20, 2010)

PATCHOGUE FORMER MGP SITE
PATCHOGUE NEW YORK

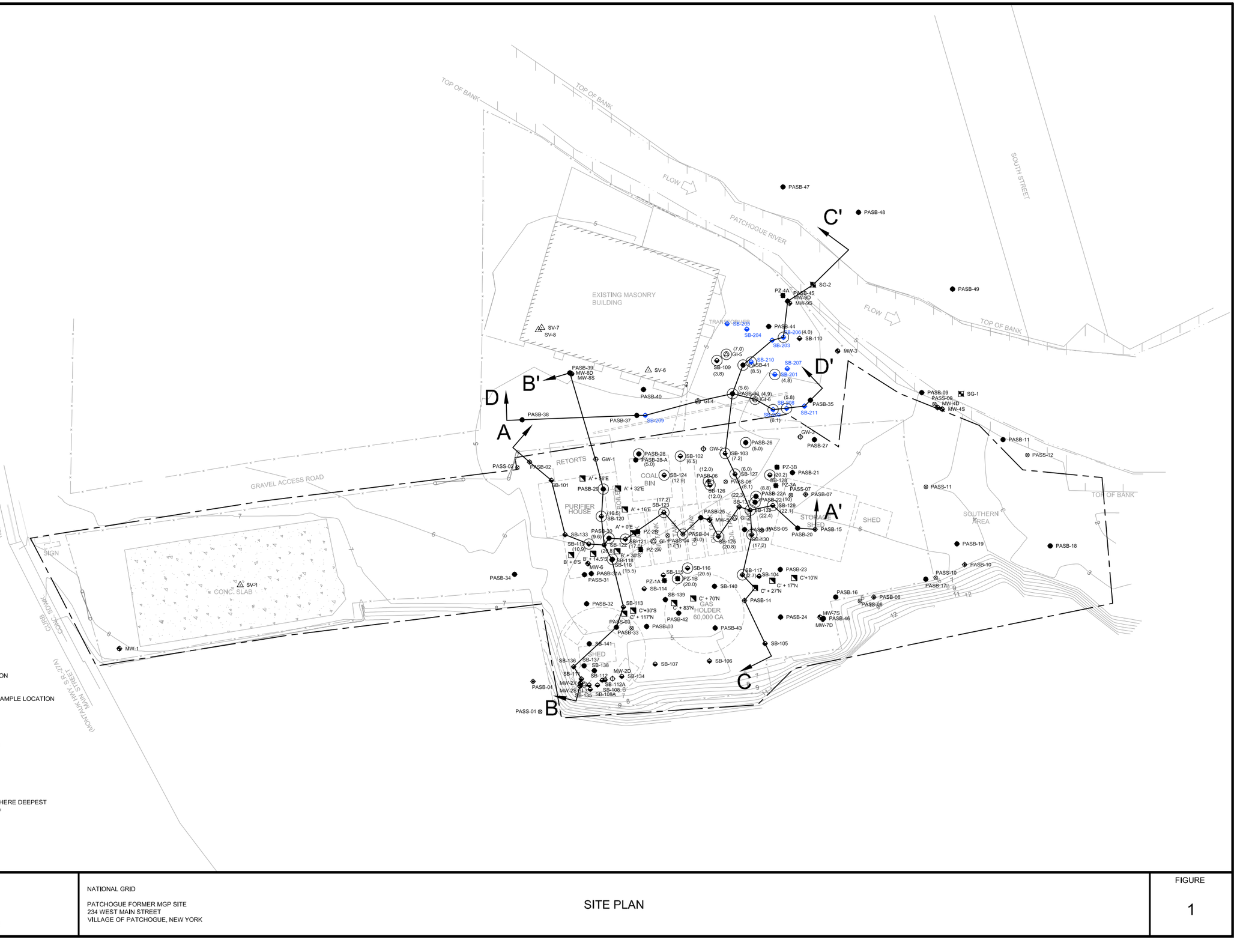
Brown AND Caldwell
Associates

\\BCALL01\projects\National_Grid\Patchogue\GW_Monitoring\WL_Monitoring\GW_SW_interaction.ppt

APPENDIX E

OFF-SITE INVESTIGATION REFERENCE FIGURES

0 30 60
SCALE IN FEET


TOP OF BANK
FLOW
PATCHOGUE RIVER
SOUTH STREET
EXISTING MASONRY BUILDING
TRANSFORMER
RETORTS
COAL BIN
PURIFIER HOUSE
GAS HOLDER 60,000 CA
STORAGE SHED
SHED
SOUTHERN AREA
GRAVEL ACCESS ROAD
WEST MAIN STREET
CONC. SLAB
CONC. SLAB
SIGN
(MONTAUK HWY. S.R. 27A) MAIN STREET
A
A'
B
B'
C
C'
D
D'
PASB-47
PASB-48
PASB-49
PASB-45
MW-9D
MW-9S
PZ-4A
SG-2
SB-208
SB-204
SB-206 (4.0)
SB-203
PASB-44
SB-110
MW-3
SB-210
SB-207
SB-201
(4.8)
PASB-39
MW-8D
MW-8S
SV-7
SV-8
SV-6
PASB-40
PASB-38
PASB-37
SB-209
PASB-35
SB-211
PASB-09
PASS-09
MW-4D
MW-4S
SG-1
PASB-11
PASS-12
PASS-11
PASB-26
(5.0)
PASB-27
GW-3
PASB-28
PASB-28-A
(5.0)
SB-102
(6.5)
SB-103
(7.2)
PZ-3B
PASB-21
PASS-07
PASB-07
PASB-22A
PASB-22
(10)
SB-123
(22.1)
SB-125
(20.8)
SB-130
(17.2)
PASB-15
PASB-20
PASB-19
PASB-18
PASB-10
PASS-10
PASB-17
PASB-16
PASB-08
PASB-23
SB-104
C'+10'N
C' + 17'N
C' + 27'N
PASB-14
PASB-24
MW-7S
MW-7D
PASB-46
SB-105
PASB-43
PASB-03
PASB-42
PASB-33
PASB-32
SB-113
C'+30'S
C' + 117'N
PASB-03A
SB-116
(20.5)
PZ-1B
(20.0)
PZ-1A
SB-114
SB-140
SB-139
C' + 70'N
C' + 83'N
SB-141
SB-136
SB-137
SB-138
SB-107
SB-106
MW-2D
SB-134
SB-112
SB-112A
SB-108
SB-108A
PASB-01
PASS-01
PASB-02
PASS-02
GW-1
A' + 16'E
A' + 32'E
A' + 0'E
B' + 14.5'S
B' + 30'S
B' + 0'S
PASB-28
PASB-28-A
(5.0)
SB-124
(12.9)
PASB-06
PASS-06
(6.1)
SB-126
(12.0)
SB-127
(20.2)
SB-128
(22.4)
PASB-22A
PASB-22
(10)
SB-123
(17.2)
PASB-25
MW-5
PASB-04
(6.0)
SB-121
(17.0)
PZ-2B
PZ-2A
GI-3
PASB-30
(9.6)
SB-133
(10.9)
SB-122
(17.0)
SB-120
(16.5)
SB-118
(15.5)
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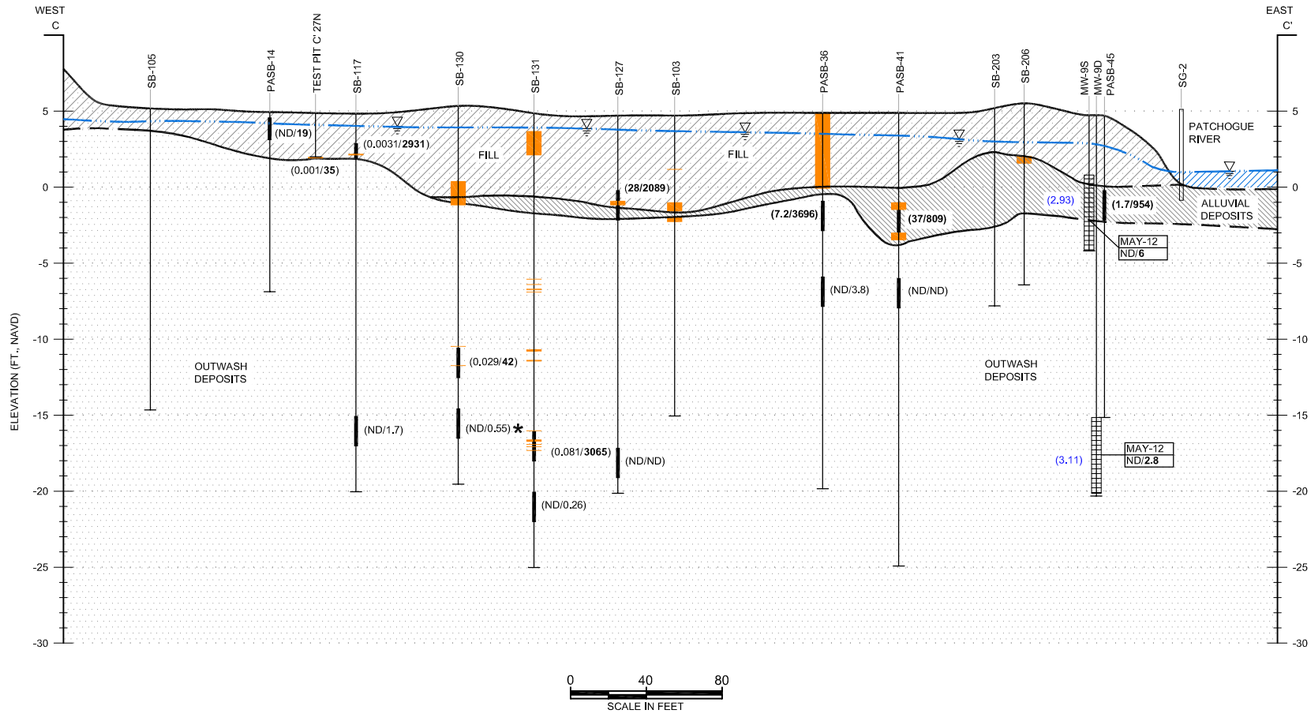

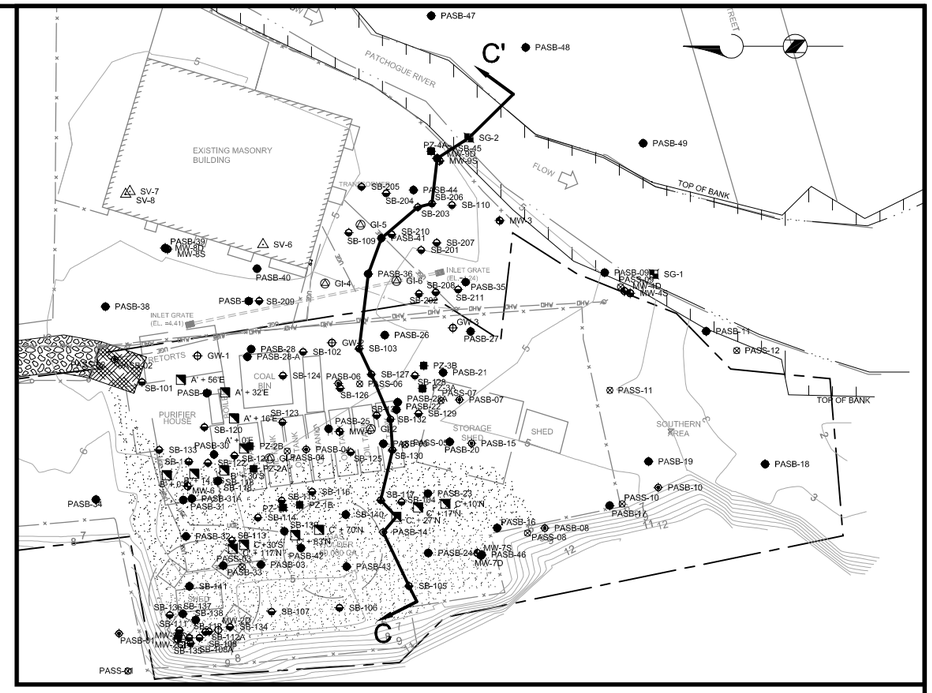
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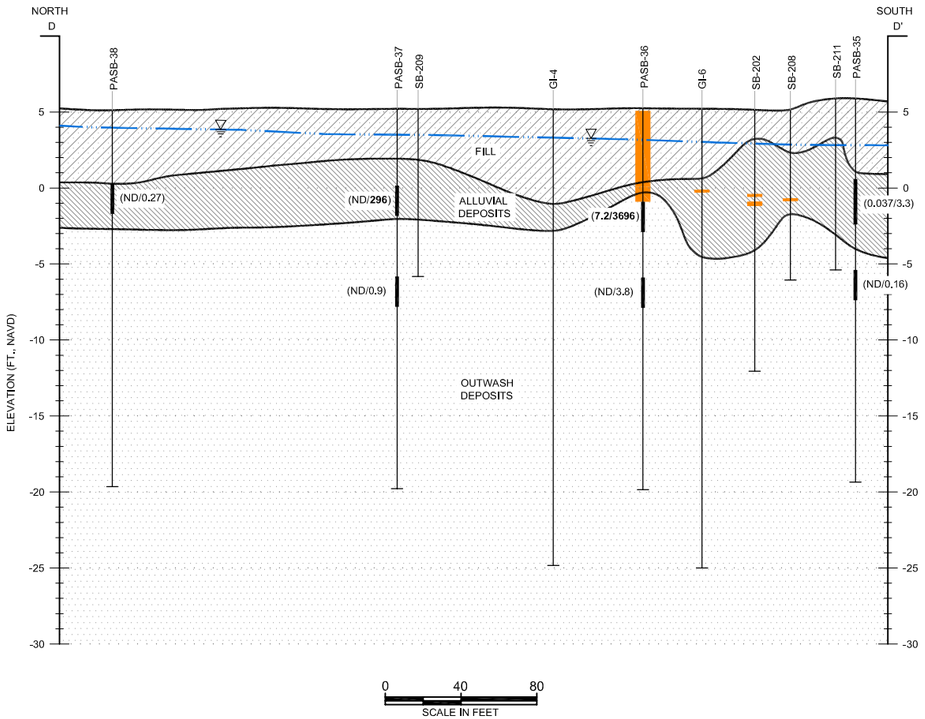

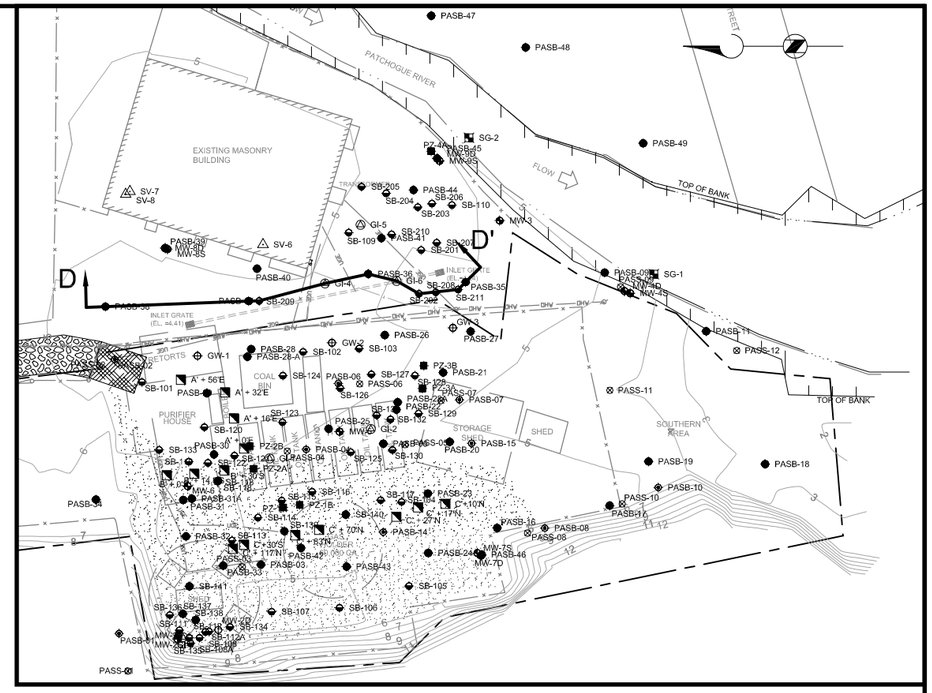
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APPENDIX F

EXCAVATION WORK PLAN

APPENDIX F – EXCAVATION WORK PLAN (EWP)

F-1 NOTIFICATION

At least 30 days prior to the start of any intrusive activity on the Site that is anticipated to encounter remaining MGP-related impacts, the Site owner or their representative will notify the NYSDEC. At least 30 days prior to the start of any intrusive activity to be conducted on the Off-Site Property, the Off-Site Property owner or their representative will notify National Grid. If an intrusive activity is to be conducted on the Site or the Off-Site Property that is not anticipated to encounter remaining MGP-related impacts (e.g., previously remediated area that has been restored with clean fill materials), notifications to NYSDEC are not required. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B.

Table 1: Notifications*

Name	Contact Information
Elizabeth Lukowski, NYSDEC Project Manager	(518) 402-9564; eblukows@gw.dec.state.ny.us
Sarah Aldridge, National Grid Project Manager	(516) 545-2568 sarah.aldridge@national grid.com

* Note: Notifications are subject to change and will be updated as necessary.

National Grid will generate the notification to NYSDEC via Notice of Intrusion Letter. This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for intrusive activities to be conducted on the Site or the Off-Site Property, re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;

- A detailed description of dewatering, proposed containment of dewatering liquids and planned disposal options for dewatering liquids, if applicable;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's HASP, in electronic format, if it differs from the HASP provided in Appendix G of this ISMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with required chemical testing results.

F-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a Qualified Environmental Professional contracted by National Grid to oversee invasive activities on the Site and the Off-Site Property during all excavations into known or potentially contaminated material (remaining MGP-related impacts). Soil screening will be performed when invasive work is done and will include excavation and invasive work into known or potentially contaminated material performed during development, such as excavations for foundations and utility work.

Soils excavated within areas where remaining MGP-related impacts may be potentially encountered will be segregated based on previous environmental data and screening results into material that requires off-site disposal at an off-site disposal facility that is licensed and permitted to accept the type of waste, material that can be returned to the subsurface, and material that can be used as cover soil. Soil potentially suitable for reuse that is stockpiled shall be sampled and analyzed (as described in Section F-7 of this EWP) to evaluate whether material can be (a) reused on the Site or the Off-Site Property; or (b) must be transported to a permitted licensed and permitted off-site disposal facility

for treatment and/or disposal.

F-3 SOIL STAGING METHODS

At a minimum, soil stockpiles will be placed on top of polyethylene sheeting or equivalent and continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points. If required by the NYSDEC, the soil stockpiles will be placed within an engineered staging area. Stockpiles will be kept covered with appropriately anchored polyethylene sheeting or equivalent. Stockpiles will be routinely inspected by National Grid's QEP and damaged polyethylene sheeting will be promptly replaced. Stockpiles will be inspected by National Grid's QEP at a minimum once each week and after storm events. Results of inspections will be recorded by National Grid's QEP in a logbook and maintained at the Site and available for inspection by the NYSDEC.

F-4 MATERIALS EXCAVATION AND LOAD-OUT

A QEP contracted by National Grid or person under their supervision will oversee invasive work into known or potentially contaminated material and the excavation and load-out of excavated material generated at the Site and the Off-Site Property.

The owner of the property and the Remedial Party/Respondent solely responsible for safe execution of invasive and other work performed under this EWP.

The presence of utilities and easements will be investigated by the QEP. It will be determined whether a risk or impediment to the planned work under this ISMP is posed by utilities or easements on the Site or the Off-Site Property.

Loaded vehicles leaving the Site/Off-Site Property will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and other applicable transportation requirements). The QEP contracted by National Grid will perform checks for compliance with these requirements.

When necessary, a truck wash will be operated on-site. The QEP contracted to National Grid will be responsible for ensuring and documenting that outbound trucks are washed (as necessary) at the truck wash before leaving the Site/Off-Site Property until the

intrusive activities into known or potentially impacted materials performed under this section are complete. Truck wash waters will be collected and disposed of at a licensed and permitted off-site disposal facility in an appropriate manner.

Locations where vehicles enter or exit the Site/Off-Site Property shall be inspected daily by National Grid's QEP for evidence of off-site soil tracking. The QEP will document that egress points for truck and equipment transport from the Site/Off-Site Property are clean of dirt and other materials derived from the Site/Off-Site Property during intrusive excavation activities into known or potentially contaminated materials (MGP-related impacts). Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials. National Grid will maintain responsibility for these activities whether associated with the Site or the Off-Site Property.

F-5 MATERIALS TRANSPORT TO PERMITTED OFF-SITE DISPOSAL FACILITIES

Transport of MGP-related impacted material will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. The QEP contracted by National Grid will maintain responsibility for this for activity whether conducted on the Site or the Off-Site Property.

Material transported by trucks exiting the Site/Off-Site Property will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used. The truck transport routes for trucks exiting the Site/Off-Site Property with material destined for off-site treatment and/or disposal are as follows:

- Proceed southwest on West Main Street toward River Avenue;
- Turn right onto Waverly Avenue;
- At the traffic circle, take the first exit and stay on Waverly Avenue;
- Continue onto Patchogue-Holbrook Road;
- Turn left onto Expressway Drive North/Long Island Expressway North Service Road to head towards I-495 West or turn right onto Expressway Drive

South/Long Island Expressway South Service Road to head towards I-495 East;

- Proceed to destination.

Trucks loaded with contaminated materials will exit the vicinity of the Site/Off-Site Property using only this approved truck route. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project Site/Off-Site Property. Queuing of trucks will be performed on the Site/Off-Site Property, as practical, in order to minimize off-site disturbance. Off-site queuing will be prohibited.

Egress points for truck and equipment transport from the Site/Off-Site Property will be kept clean of dirt and other materials during Site remediation and development.

F-6 MATERIALS DISPOSAL AT PERMITTED OFF-SITE DISPOSAL FACILITIES

Soil/fill/solid waste excavated and removed from known or potentially MGP-related impacted areas of the Site and the Off-Site Property will be treated as contaminated and regulated material and will be transported and disposed in accordance with local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from the Site/Off-Site Property is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from the Site and the Off-Site Property will not occur without formal NYSDEC or National Grid approval, respectively.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification made to the NYSDEC by National Grid's QEP. This will include estimated quantities and a breakdown by class of disposal facility if appropriate (i.e. waste disposal facility, treatment facility, construction/demolition recycling facility, etc.).

Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report (described in Section 7.7 of the ISMP) to be prepared and submitted by National Grid. This documentation will include: waste profiles, laboratory analytical test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off of the Site and the Off-Site Property will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

F-7 MATERIALS REUSE ON THE SITE AND THE OFF-SITE PROPERTY

Excavated materials outside potentially impacted areas on the Site and the Off-Site Property can be reused for fill on the respective properties, subject to NYSDEC requirements (currently DER-10, Table 5.4(e)4 Reuse of Soil). Excavated soil/fill from the Site/Off-Site Property that is free of visible stains and obvious odors shall be considered potentially suitable for reuse on the respective Site/Off-Site property. Material potentially suitable for reuse shall be placed on polyethylene sheeting. The stockpiled potentially reusable material shall be covered whenever soils are not actively being placed into or removed from the stockpile, during overnight/weekend hours, during periods of precipitation, or whenever dust action levels are exceeded. This material shall be covered using polyethylene sheeting to reduce potential infiltration of precipitation, migration of wind-blown dust, and direct contact exposures.

Stockpiled potentially reusable material from the Site/Off-Site Property shall be sampled and analyzed to evaluate if the material can be used as backfill on the property from which it was excavated or must be transported to a licensed and permitted off-site disposal. In accordance with DER-10 Table 5.4(e)10, a minimum of one (1) composite sample shall be collected for each 250 CY of potentially impacted soils and analyzed for TCL SVOCs, inorganics, PCBs and pesticides. In addition, four (4) discrete grab samples will be collected from the 250 CY stockpile and analyzed for VOCs. As indicated in the Generic QAPP included as Appendix H to the ISMP, one duplicate sample shall also be collected for every 20 samples, with a minimum of one duplicate per sample delivery group (SDG). Each composite sample shall be formed using individual grab samples

collected from five locations within each stockpile (i.e., five discrete grab samples per composite). The composite sample shall be formed by placing equal portions of soil from each of the five discrete grab sampling locations into a pre-cleaned, stainless steel bowl (or dedicated container). Per the Generic Field Sampling Plan (Generic FSP) included as Appendix J to the ISMP, the composite sample shall be thoroughly homogenized using a stainless steel scoop or trowel before being transferred into the sample containers provided by the laboratory. The filled sample containers shall be labeled and transported to the laboratory using a chain-of-custody form. Each sample (composite or grab) will be submitted for laboratory analysis for the constituents listed in Appendix 5 of DER-10. Material suitable for reuse on the Site/Off-Site Property must meet the restricted residential use SCOs in 6NYCRR Part 375-6.

National Grid's Qualified Environmental Professional will ensure that procedures defined for materials reuse in this ISMP are followed and that unacceptable material does not remain on the Site/Off-Site Property. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on the Site/Off-Site Property will be placed below the clean soil cap under the demarcation layer on the Site or beneath the impervious surface (asphalt) on the Off-Site Property, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Concrete crushing or processing on-site will not be performed without prior NYSDEC approval on the Site or the approval of National Grid on the Off-Site Property. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site/Off-Site Property will not be reused on-site.

F-8 FLUIDS MANAGEMENT

All impacted liquids to be removed from the Site/Off-Site Property, including but not limited to, excavation dewatering waters, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the Site/Off-Site Property, and will be managed off-site, unless prior approval is obtained by National Grid from the NYSDEC for fluids generated by activities performed on the Site and approval is granted by National Grid for activities performed on the Off-Site

Property.

Discharge of water generated during large-scale construction activities to surface waters (i.e., a local pond, stream or river) will be performed under a State Pollution Discharge Elimination System (SPDES) permit obtained by National Grid.

F-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities on the Site or the Off-Site Property, the cover system will be restored by National Grid in a manner that complies with the ROD. The Site soil cover system to be installed as part of the remedy is comprised of a minimum of 24 inches of clean soil. The existing cover system on the Off-Site Property is comprised of the building's foundation system and the asphalt pavement. Demarcation layers will be installed as part of the Site cover system as part of implementation of the remedy. The demarcation layer will consist of orange geotextile or equivalent material and will be installed to provide a visual reference to the top of the remaining MGP-related impact zone, the zone that requires adherence to special conditions for disturbance of remaining MGP-related impacted soils defined in this ISMP. The cover system (asphalt) on the Off-Site Property, after disturbance during implementation of the remedy, will be restored using the orange geotextile or equivalent material. This material will be installed only in areas disturbed during remediation by the invasive activities. The property owner shall not change the type of cover system following excavation without prior written permission from National Grid. A figure, to be prepared by National Grid, showing the modified surface will be included in the subsequent Periodic Review Report and in an updated ISMP.

F-10 BACKFILL FROM OFF-SITE SOURCES

Materials proposed for import onto the Site/Off-Site Property will be approved by National Grid's Qualified Environmental Professional and will be in compliance with provisions in this ISMP prior to receipt at the Site/Off-Site Property.

Imported material shall be sampled in accordance with the frequency requirements presented in Table 5.4(e)10 of NYDEC DER-10. Imported material to be used on the Site/Off-Site Property shall meet the restricted residential use SCOs (6NYCRR Subpart 375-6).

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the Site/Off-Site Property. Imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for the Site/Off-Site Property, will not be imported onto the Site/Off-Site Property without prior approval by NYSDEC or materials being imported to the Site or by National Grid for materials being imported to the Off-Site Property. Solid waste will not be imported onto the Site/Off-Site Property.

Trucks entering the Site/Off-Site Property with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

F-11 STORMWATER POLLUTION PREVENTION

General stormwater pollution prevention activities will be conducted in support of Site excavation including the following:

- Barriers and hay bale checks will be installed around the entire perimeter of the construction area and will be inspected once a week and after every storm event by National Grid's QEP. Results of inspections will be recorded in a logbook and maintained at the Site by National Grid's QEP and available for inspection by the NYSDEC. Necessary repairs shall be made promptly.
- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.
- Undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.
- Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.
- Erosion and sediment control measures identified in the ISMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

- Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

All maintenance, monitoring and repairs to the soil erosion and sediment control measures will be performed under the supervision of National Grid's QEP.

F-12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during the implementation of the remedy or post-remedial subsurface excavations or development related construction on the Site or the Off-Site Property, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. by National Grid's QEP as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the history of the Site or the Off-Site Property and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed by National Grid to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive work conducted on the Site or the Off-Site Property will be promptly communicated by phone to NYSDEC's Project Manager by National Grid. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline by National Grid. These findings will be also included in the PRR to be prepared by National Grid.

F-13 COMMUNITY AIR MONITORING PLAN

Community air monitoring for VOCs and particulates will be conducted for any soil disturbance activities at the Site/Off-Site Property when conducting activities in areas with known or potentially impacted soils, in accordance with the CAMP provided in Appendix G to the ISMP. The CAMP will be implemented by National Grid. The quantity and locations of community air monitoring stations will be determined by National Grid's QEP

in conjunction with the NYSDOH, based on the size and location of the proposed excavation; however, at a minimum there will be one upwind and one downwind monitoring location. CAMP monitoring data will be recorded by National Grid and included in the project report to be prepared by National Grid. Any exceedances of action levels listed in the CAMP will be reported by National Grid to NYSDEC and NYSDOH Project Managers.

F-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include limiting the areal extent of open excavations, covering excavations with polyethylene sheeting or tarps, etc. If nuisance odors are identified at the Site/Off-Site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until nuisance odors have been abated. NYSDEC and NYSDOH will be notified by National Grid of odor events and of any other complaints about the project. Implementation of odor controls, including the halt of work, is the responsibility of the National Grid's Remediation Engineer, and any measures that are implemented will be discussed in the PRR to be prepared by National Grid.

Necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to conditions on the Site or the Off-Site Property or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

F-15 DUST CONTROL PLAN

Dust (i.e., particulate) monitoring will be performed in accordance with the CAMP provided in Appendix G to the ISMP during invasive activities to be conducted on the Site/Off-Site Property in areas of known or potential impacted soils. A dust suppression plan that addresses dust management during invasive activities, will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of hand-held water sprays of a dedicated on-site water truck for road wetting. The truck will be capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

National Grid maintains responsibility to prepare the Dust Control Plan, as necessary**F-16**

OTHER NUISANCES

A plan for rodent and noise control will be developed by National Grid's QEP, as necessary.

APPENDIX G

HEALTH AND SAFETY PLAN AND COMMUNITY AIR MONITORING PLAN

(To be updated prior to Site intrusive work)

Health and Safety Plan for Quarterly Groundwater Monitoring/Sampling and Off-Site Investigation Activities

at

Patchogue Former MGP Site

234 West Main Street

Village of Patchogue, Suffolk County, NY 11772

June 2015

Revision 7

BC Project Number: 142128

Prepared by:

2 Park Way, Suite 2A

Upper Saddle River, New Jersey 07458

Prepared for:

NATIONAL GRID

175 East Old Country Road

Hicksville, NY 11801

2 Park Way, Suite 2A

Upper Saddle River, New Jersey 07458

Approval Page

for

Health and Safety Plan for Quarterly Groundwater Monitoring/Sampling and Off-Site Investigation Activities

at

Patchogue Former MGP Site

(Revision 7)

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: 142128).

	Name	Signature	Title	Date
Prepared By:	Thakur Chaturgan		Field Operations Lead	6/9/15
Reviewed By:	Keith Bogatch		Project Manager	6/9/15
Reviewed By:	Thomas Parel		Site Safety Officer	6/9/15
Reviewed By:	Jim Bucha, CIH, CSP		Director of Health and Safety	6/9/15
Effective Dates:	June 2015	through	July 2016	

THE AMERICAN BOARD OF INDUSTRIAL HYGIENE INCORPORATED
CERTIFICATION NUMBER 6738 CP
EXPIRES 12-1-2016
PENNSYLVANIA-1960
JAMES A. BUCHA, CIH

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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 Compound(s) of Concern:

Compounds of Concern and Materials 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:

- Benzene
- Toluene
- Ethylbenzene
- Xylenes
- 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.

Standard PPE for Level D for this project consists of:

- Work shirt and long pants;
- ANSI- or ASTM-approved steel-toed boots or safety shoes,
- ANSI-approved safety glasses;
- ANSI-approved hard hat (where required on-site or when overhead hazards are present);
- 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);
- Full-body Tyvek suits (non-chemical resistant) to prevent exposure to ticks, chiggers and other insects; and
- High-visibility traffic safety vest.

SEE SECTION 10 FOR SITE EMERGENCY CONTINGENCY PROCEDURES

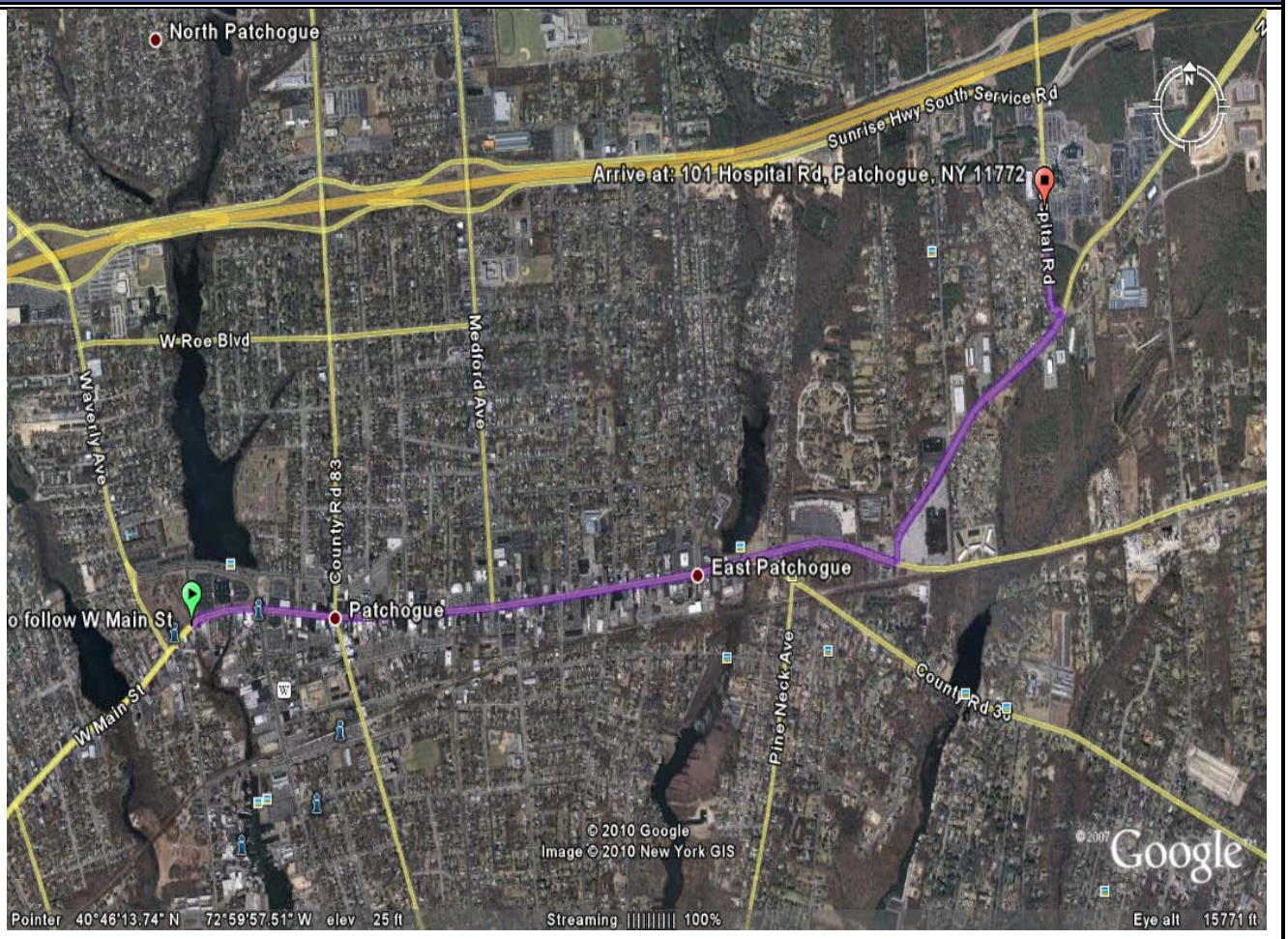
Do not endanger your own life. Survey the situation before taking any action.

BC Office	**2 Park Way, Suite 2A Upper Saddle River, New Jersey 07458** **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, NY**
Hospital Phone Number	**(631) 654-7100**
BC Project Manager (PM): Keith Bogatch	Office: 201-574-4765 Cell: 201-739-2320
BC Field Operations Lead: Thakur Chaturgan	Office: 201-574-4752 Cell: 718-506-2460
Site Safety Officer (SSO): Thomas Parel	Office: 201-574-4700 Cell: 516-301-0535
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
Subcontractor: Zebra Technical Services, LLC Contact: David Vines	Phone: 516-596-6300
Subcontractor: Bertin Engineering, Associates Contact: Mikki Rehak	Phone: 201-670-6688
OTHER CONTACT(s)	None identified as of 6/03/15.

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, NY

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. FOLLOW PROTOCOLS 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 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 First 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, 1 second per breath. 7. If breathing remains absent, initiate CPR; 30 compressions for each two breaths. Repeat for 5 cycles before re-analyzing patient or until help arrives. 8. 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	April 2012	Addition to SOW – Utility Corridor Work Plan Implementation	C. Trent/ J. Bucha
5	June 2013	Deletion of Investigation Activities and Utility Corridor Work Plan Implementation/Annual Update	K. Bogatch/ L. Crabtree/ J. Bucha
6	April 2014	Addition of Off-Site Investigation Activities	J. Marolda
7	June 2015	Revised schedule for groundwater monitoring and addition of Off-Site Investigation Activities	T. Chaturgan

Section 1

Introduction

Brown and Caldwell (BC) has prepared this Health and Safety Plan (HASP) for use during the Semi-annual Groundwater Monitoring/Sampling and Off-Site 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 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 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.

1.2 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.

1.3 Scope of Work

Brown and Caldwell personnel will be observing and documenting subcontractor activities. Brown and Caldwell personnel will also be conducting media sampling (i.e. water and soil).

1.3.1 Groundwater Monitoring and NAPL Gauging

Two semi-annual groundwater monitoring events will be conducted at the Site on an annual basis. Each groundwater monitoring event will consist of water level measurements, NAPL gauging, and collection of groundwater samples for laboratory analysis from all available monitoring wells at the time of the sampling. 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 during the two groundwater sampling events, 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").

1.3.2 Off-Site Investigation

Utility Clearance

Prior to conducting the intrusive activities described below, New York 811, the Village of Patchogue, and Suffolk County Water Authority will be contacted to clear underground utilities. In addition, a private utility locating service will be contracted to evaluate the proposed boring locations for the presence of subsurface utilities. Based on the results of the utility mark-outs, the proposed drilling locations may be adjusted to provide adequate clearance from underground and aboveground utilities, as necessary.

The final locations for the drilling locations will be determined in the field following the mark-out of underground utilities and completion of the utility survey by private contractor.

Soil Borings

Off-site investigation activities will be performed, via the implementation of a soil boring program, to further delineate and finalize the limits of the remediation on the off-site property to the east of the former MGP site. Soil borings will be completed at nine proposed locations. If impacts are observed in the borings, "step-out" borings will be completed to further evaluate the extent of the impacts.

The soil borings will be either be advanced using direct-push technology (e.g., GeoProbe®) or conventional drilling methods [e.g., hollow-stem augers (HSA)] and continuously sampled with either a four-foot long sampler (e.g., Dual Tube® or Macrocore®) or two-foot long split spoon sampler, respectively. With the exception of a boring proposed in the vicinity of PASB-41 in which the boring will be advanced to approximately 30 feet bgs, all other proposed soil borings will be advanced from ground surface to a minimum of 10 feet bgs. However, in the event that impacts are identified near the base of the boring, efforts will be made to further evaluate the vertical extent of impacts by extending the borings to deeper depths until a clean zone is established.

Up to two soil samples from each of the borings will be collected and submitted for analysis of benzene, toluene, ethylbenzene and isomers of xylene (BTEX), and polycyclic aromatic hydrocarbons (PAHs). In addition, at locations where no visible or olfactory indications of potential MGP-related impacts are observed, the collected samples will be analyzed for an expanded list of PAHs (including 34 commonly identified PAH compounds consisting of 18 parent [non-alkylated] PAH compounds and 16 alkylated PAH compounds) as part of a forensic evaluation to assess whether the distribution of PAHs (if detected) are indicative of MGP-related materials or other materials not associated with former MGP operations.

Survey

Surveying of the soil borings that are completed, including any "step-out" borings that are drilled will be performed following completion of the drilling program. The survey will include location coordinates, and ground surface elevation data. 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.

Section 2

Key BC Project Personnel and Responsibilities

Keith Bogatch is the Project Manager (PM). Jim Bucha, CIH, CSP is the BC Director of Health and Safety. Lydia Crabtree, CSP is the BC Regional Safety Unit Manager (RSUM). Thakur Chaturgan is the BC Field Operations Lead and Thomas Parel has been designated as the BC Site Safety Officer (SSO) for this project. 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 and requiring that each BC project team member, including subcontractors, reads or is briefed on the HASP.
- Checking 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" or minimum 2-person teams 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 Unit Safety 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.
- Set up, assemble, and check 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.
- Practice the "buddy system" as appropriate for site activities.
- Do not use faulty or suspect equipment.
- Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.
- Practice contamination avoidance whenever possible.
- Do not smoke, eat, drink, or apply cosmetics while in chemically-affected areas of the site or before proper decontamination.

- Wash hands, face and arms before taking rest and lunch breaks and before leaving the site at the end of the workday.
- Check in and out with the SSO upon arrival and departure from the site.
- Perform decontamination procedures as specified in this HASP.
- Notify 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.
- Do not approach or enter 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.
- Use respirators correctly and as required for the Site; check the fit of the respirator with a negative or positive pressure test; do not wear respirator with facial hair or other conditions that prevent a face-to-face piece seal.
- Confined spaces will not be entered 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.

Section 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.

Site Specific Chemical Concerns			
Known or Suspected Compounds	Source (soil/water/sludge, etc.)	Known Concentration Range Specify (ppm, mg/kg, mg/l)	
		Lowest	Highest
Benzene	Soil	Not detected (ND)	6.3 mg/kg
	Groundwater	ND	46 µg/l
Toluene	Soil	ND	22 mg/kg
	Groundwater	ND	120 µg/l
Ethylbenzene	Soil	ND	130 mg/kg
	Groundwater	ND	390 µg/l
Xylene, Total	Soil	ND	195 mg/kg
	Groundwater	ND	460 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	15 µg/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) and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs).

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 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 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 TLV is listed as 20 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 TLV is listed as 100 ppm.

3.1.5 Polynuclear Aromatic Hydrocarbons (PAHs)

Polynuclear Aromatic Hydrocarbons (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 the more common 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 TLV is listed as 0.2 mg/m3 (coal tar pitch volatiles, as benzene soluble aerosol).

3.1.6 Hydrogen cyanide

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 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 minimize 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 Hazards
- ☐ Confined Spaces
- ☒ **Sharp Objects/Cutting Utensils**
- ☐ Elevated Platforms/Working Surfaces
- ☒ **Traffic**
- ☐ Arc Flash Protection
- ☒ **Water Hazards** (non-boating)
- ☐ Removing Manhole Covers
- ☒ **Housekeeping**
- ☒ **Materials and Equipment Handling - Lifting**
- ☒ **Drilling**
- ☒ **Underground Utilities**
- ☐ Equipment Refueling
- ☐ Lockout/Tagout
- ☐ Fire/Explosion
- ☒ **Cutting Acetate Sleeves**
- ☐ Ladder Use
- ☒ **Driving**
- ☐ Boating Safety
- ☐ Building Collapse
- ☒ **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 bend 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 the 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 verify 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 (e.g., USA, Dig Alert, Blue Stake, etc.) 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 ed. 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 the 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 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. When applicable, BC shall request an owner's representative to initiate the LO/TO procedure and apply the first lock. When initiated by others, BC will remove their locks prior to leaving a facility. 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 has 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, an 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, the 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 half 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 Entry Permit form.

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 retracts into the handle of the safety blade holder.
- Replace blades when they become dull. If material becomes hard to cut then 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 / Working Surfaces

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 and implemented. Consider using amber/yellow warning lights to alert traffic to the work zone. Note that amber/yellow warning lights may be required by specific clients or ordinances.

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 collisions/incidents to BC's Risk Manager.

3.4.21Arc 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. 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, molten 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 must comply with BC's Electrical Safety and Lock-Out/Tag-Out Policy in the Health and Safety Manual 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 must be used:

1. BC employees will 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, with the exception of those BC employees who have completed NFPA 70 E and have appropriately planned, including appropriate PPE, for the task.
2. BC employees that closely supervise work within the flash protection boundary should document the possible electrical hazards, appropriate PPE, and mitigation techniques to be implemented during the project with a detailed project work plan attached to this plan's appendices. The Electrical Safety Officer (ESO) or similarly qualified person must approve all project work plans with identified shock or arc flash hazards.
3. Prior to performing this work, the Project Manager (PM) will verify that the above-mentioned project work plan is prepared and approved and reviewed by the PM, the project field team, the SSO, and cognizant Health and Safety Manager.
4. Only BC employees with NFPA 70E Qualified Person training 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.

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 may 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 Arc Flash policy in BC's Health and Safety Manual for detailed requirements.

Questions concerning this policy should be directed to the BC Electrical Safety Officer RSUM.

Definitions

Energized Electrical Work. Work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts 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 appropriate 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 must maintain a 4-foot minimum observation distance (10 feet is preferred) from the exposed (i.e. doors open, covers off) live electrical equipment rated 600V and below. In the event that the flash protection boundary must be crossed, qualified BC personnel will don PPE appropriate for Hazard/Risk Category 2. For equipment rated above 600V, BC personnel must maintain a 10-foot minimum observation distance and not enter the flash protection boundary unless qualified and approved to do so.

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 must 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 cushion, 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 mishap 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 Water Hazards (non-boating activities)

Wading in streams poses a few natural hazards such as uneven terrain, and potentially dangerous water levels. Field work should be halted when there has been significant rainfall within the past 24 hours or during the course of a work day. The potential for rapidly rising water levels is present in many of these streams/rivers within the project area. SSO shall evaluate field conditions after a rainfall and halt field work if there is the possibility of the development of a hazardous condition.

Open Water

Streams or stormwater ditches may be located near freeways and highways. High stream flows commonly associated with storm events present a threat to workers. Slippery conditions, streamside vegetation, and unstable stream banks could cause a worker to fall into a stream. The risks of a fall include bodily injury, hypothermia and drowning. Work in and around streams will require the use of the buddy system for safety purposes. During storm events that cause streams and rivers to rise to dangerously high conditions, employees should discontinue their work until safe working conditions resume. Prior to entering water, employees must evaluate the need to wear PFDs, rubber boots, or waders and use them as is deemed necessary based on conditions present. Some factors to consider when evaluating the need to wear a PFD are stream current speed, stream bed material (e.g. slippery stones vs. small gravel/sand), water depth, and how far out from the bank the employee will be required to go into the stream.

Changing Water Levels

When precipitation falls in the area, water levels within the stream may change quickly. Rising water levels may be dangerous. All personnel should exit the stream once wet weather has occurred in the area. If the forecast calls for rain, the group should meet and discuss alternative activities that may be planned for the day. After a rain, the SSO must evaluate field conditions and halt field work if there is the possibility of the development of a hazardous condition. When walking in the stream, efforts will be made to walk in the shallow and/or slower moving parts of the stream whenever possible.

3.4.24 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, notify the PM and RSUM and stay outside the building at an appropriate distance to avoid falling debris.

3.4.25 Removing/Replacing Manhole Covers

Manhole structures are the principal means of access into wastewater collection systems and into other underground utilities and facilities. In general, manhole entries are conducted to determine the physical conditions of manholes and pipelines, collect data, and for maintenance activities.

Removing and replacing manhole covers can present potential hazards (overexertion, struck by, caught between, contaminated air, traffic, etc.) to personnel. Therefore, personnel should always first seek to have client or contractor personnel remove and install the manhole cover whenever possible. If this is not possible, then BC personnel need to plan and carefully consider all the potential hazards and controls associated with the removal and installation. Hard hat, safety glasses, safety boots, and leather/cut-resistant gloves must be used when attempting to remove manhole covers.

When working in the vicinity of an open sewer manhole, air monitoring must be performed to verify that the atmosphere is safe for work activities. At no time are personnel to break the plane of the manhole with any part of their body. Where entry must be made, the requirements of the Confined Spaces section of this HASP must be complied with at all times (i.e. training, air monitoring, ventilation, permitting, rescue, etc.).

General Procedures for Removing/Replacing Manhole Covers

The following are general guidelines for the removal and replacement of manhole covers. Use procedures as they apply to the specific covers to be removed. Additional tools or different procedures may be necessary for a particular location.

Freeing the Manhole Cover

When the cover is stuck in its frame, remove any encrustation with a cold chisel. Next, place a block of wood on the cover near the rim and hit the block of wood with a heavy hammer. Do this at different points around the rim until the cover has loosened.

Unseating the Manhole Cover

Lift the cover with the Hook and Lifter tool. Next, attach the hook and lifter tool to the outer edge/rib before trying to move the cover. Unseat the cover, about four inches, by pulling and lifting with a fluid motion.

Removing the Manhole Cover

Evaluate the area surrounding the manhole cover to be removed and verify conditions that could present a hazard during removal have been properly mitigated. Use proper body mechanics – using the leg and arm muscles to lift and pull the cover – don't use your back.

With your feet properly positioned evenly apart and footing secure, pull the cover clear of the frame. Once clear of the frame keep pulling the cover with a steady motion and remove it from the work area. Potential pinch points exist to the hands, fingers, and feet. Never place your hands, fingers, or feet under the manhole cover. Whenever possible, have someone assist with the removal and replacement of the manhole cover.

Replacing the Manhole Cover

Stand parallel to the desired direction of travel for moving the manhole and check the cover frame of the manhole to make sure it is free of any obstructions or debris.

Place the point of the Hook and Lifter tool under the edge of the cover, lift slightly, and drag the cover toward its frame.

Move to the opposite side of the cover and repeat the lifting and dragging motion.

Continue alternating the lifting and dragging until the cover is partially over the manhole frame.

With the hook, lift the edge that is farthest from the opening until the cover slides into the frame of the manhole.

Check the cover for proper seating in the manhole cover frame.

3.4.26 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's 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.

3.5 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**
- ☒ **Cold Stress**
- ☒ **Hurricanes/Nor' Easters**
- ☐ Earthquakes
- ☒ **Heat Stress**
- ☒ **Lightning/Electrical Storms**
- ☐ Tornados and Strong/Straight Line Winds
- ☒ **Flooding**

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

Climate conditions, particularly 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. 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. The SSO and site workers will monitor each other for signs of heat stress. If an employee exhibits signs or symptoms of heat-related illness, the SSO, or designee, must be notified and the appropriate response procedures initiated.

Heat Related Illness			
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.

The effects of ambient temperature can cause physical discomfort, loss of efficiency, and personal injury, and can increase the probability of mishaps. 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 are encouraged to drink plenty of water/fluids to stay properly hydrated. in addition, a work schedule will be established that will provide sufficient rest periods for cooling down (at least five minutes when workers feel the need to do so) and have access to shade from the sun (which, in addition to natural shade or canopies, includes resting inside a vehicle with the air conditioner running). Personnel must 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.

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.

Cold Stress Symptoms and Response			
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.

Cold Stress Symptoms and Response			
Condition	Signs	Symptoms	Response
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 is 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/Nor' Easters

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.

Nor'easters have the potential to cause as much damage as hurricanes, with powerful winds, rain or snow and large waves. They can pound and erode beaches with heavy surf, affect inland areas with flooding, or coat the land with thick layers of ice and snow.

Nor'easters result from the counterclockwise rotation of a low pressure system and the clockwise rotation of a high pressure system, combining to bring wind and moisture to the northeast. The nor'easter's ferocity will depend on the strength of the two systems.

One reason nor'easters are so dangerous is that they tend to move much more slowly than hurricanes. That slow movement allows the storm's effects to accumulate in a given area.

A nor'easter's wind circulation can cause tidal waters in back bays to be held in place, and not allow the water to drain through inlets and into the ocean. The accumulation of more and more water in tidal areas can cause widespread flooding.

Nor'easters can occur all year long, but are primarily a risk between September and April.

In the event of a hurricane or nor' easter, be prepared by:

- Checking NOAA Weather Radio All Hazards, your local radio and TV stations (i.e, The Weather Channel) for updates, watches, warnings or emergency instructions.
- Know the Coastal Evacuation Route for coastal areas or an inland area with chronic flooding.

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.

3.5.8 Flooding

Flooding may occur at or en-route to and from the Site and may be the result of weather conditions or due to thawing of ice and snow (especially in the Spring).

In the event flooding starts to occur:

- Stay tuned to NOAA Weather Radio All Hazards, your local radio and TV stations (i.e., The Weather Channel) for updates, watches, warnings or emergency instructions.

- Know the Coastal Evacuation Route for coastal area or an inland area with chronic flooding
- If the waters start to rise inside before you have evacuated, retreat to higher ground, including the roof. Use cell phone or land line to call for help. Take a flashlight and a portable radio. Then, wait for help. Don't try to swim to safety; wait for rescuers to come to you.
- Avoid flooded areas. Do not attempt to cross any flooded areas in a vehicle or on foot. Flood waters may be deeper than they look.
- Avoid low-lying areas like ditches, creeks, and rivers.
- Before entering or re-entering a building, check for any signs of structural damage.
- When entering a building, do not use matches, lighters, or open flame. Use a flashlight only.
- After a flood, steps and floors are often slippery with mud and covered with debris, including nails and broken glass. Be careful walking around.

3.6 Biological Hazards

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

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

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 cross bands. 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 cross bands. 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 cross bands 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 inflicting 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 lumber, 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

Section 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 or 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,
- ANSI-approved hard hat (where required on-site or when overhead hazards are present);
- 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);
- Full-body Tyvek suits (non-chemical resistant) to prevent exposure to ticks, chiggers and other insects, and
- High-visibility traffic safety vest.

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

- Chemical goggles when in contact with chemical liquids can be reasonably expected or when handling corrosive chemicals. In addition, a face shield may be required to protect the face from splash hazards.

- Chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected soils or groundwater is anticipated.
- 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.

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

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.

Respirator Cartridge Replacement	
Type of Cartridge	Cartridge Change-out Schedule
Particulate (i.e., HEPA)	At least weekly or sooner the 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.

Section 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 sufficient 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

On-site worker exposure to airborne contaminants will be monitored during intrusive site activities.

5.1.1 Photoionization Detector and Flame ionization Detector

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

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 if purifier wastes are encountered. 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 are indicated, the monitoring frequency will be increased, as appropriate. If during this time, sustained measurements are observed, 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 Volatile Organic Compounds

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

VOC – Action Levels		
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 cartridges: Increase engineering control efforts and re-monitor effectiveness. Note: For PID/FID values above 1 ppm, benzene is to be analyzed for with a colorimetric tube. Contact Director or RSUM prior to respirator upgrade.

VOC – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
	> 25 ppm above background (no benzene indicated) or Benzene indicated > 1.0 ppm (colorimetric tube)	Cease operations and evacuate work area. Contact Director or RSUM and PM immediately.

5.2.2 Action Levels for Airborne Dust

Dust – Action Levels		
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	Level C: Half- or full-face air-purifying respirator fitted with HEPA (P-100) cartridges: Increase engineering control efforts and re-monitor effectiveness. Contact Director and RSUM prior to respirator upgrade.
	> 2.5 mg/m^3	Cease operations and evacuate work area. Contact Director or RSUM and PM immediately.

5.2.3 Action Levels for Cyanide

Cyanide – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
Soil-intrusive activities if purifier wastes are encountered	< 2.5 ppm	Level D: No respiratory protection required.
	≥ 2.5 ppm	Cease operations and evacuate work area. Contact Director or RSUM and PM immediately.

5.2.4 Action Levels for Hydrogen Sulfide and LEL

Hydrogen Sulfide and LEL – Action Levels		
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 or RSUM 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

The following action levels for VOCs are in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan:

Action Level	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.

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

5.3.2 CAMP Particulate Action Levels

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	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	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.

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

Section 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 notes or 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.

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 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.

Section 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.

Exception: When there is only one employee performing field activities for the project, a formal and documented daily tailgate safety meeting (or completion of the form) is not required. However, personnel are still expected to plan their work activities and attend any site specific safety meetings or training so that tasks are performed safely.

Section 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.

Section 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 confirm 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 Incident Investigation Report will be completed within 24 hours by the SSO, or other designated person. A copy of the 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, 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.

Section 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.
File in project folder when complete.

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

Instrument(s)

Manufacturer/Model:	Manufacturer/Model:
Manufacturer/Model:	Manufacturer/Model:

Does the instrument(s) have a current calibration per the manufacturer's instructions? ☐ Yes ☐ No

Was the instrument(s) field checked (i.e bump tested or field calibrated) per the manufacturer's instructions? ☐ Yes ☐ No

Remarks:

Monitoring Data

TIME	LOCATION AND ACTIVITY	P/FID (PPM)	COLORIMETRIC TUBES (PPM)	RAM (mg/m^3)	MULTI-GAS DETECTION %LEL	H2S	O2	OTHER

Appendix B:

Site Safety Checklist

Brown AND Caldwell

Site Safety Checklist

Instructions: Complete this form immediately prior to project start.

File in project folder when complete.

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.
File in project folder when complete.

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

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 Fieldwork 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 Fieldwork 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)

☐ Physical ☐ Natural Phenomena ☐ Chemical ☐ Electrical ☐ Biological ☐ Radiological

☐ Other (specify):

Place a copy in the project file.

Appendix E:

Incident Investigation Report

Preliminary Incident Investigation Report Form

Privileged and Confidential
Do Not Distribute

Instructions:

If an 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, witness statements, or other information that may be helpful in understanding how the accident/incident occurred. For assistance in completing this form, contact your office H&S Coordinator/Specialist or your Regional Safety Unit Manager (RSUM).

HSC – Review and enter report into the BC Online 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.

Brown AND Caldwell

Preliminary Incident Investigation Report Form

Privileged and Confidential
Do Not Distribute

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)

- ☐ Failure to recognize hazard(s)
- ☐ Failure to use equipment or use it properly
- ☐ Failure to use PPE or use it properly
- ☐ Failure to warn, secure, or barricade
- ☐ Horseplay
- ☐ Improper lifting
- ☐ Improper loading, placement, or position for task
- ☐ Performing excessive repetitive activities
- ☐ Operating equipment without authority
- ☐ Removing or making safety devices inoperable
- ☐ Servicing equipment in operation
- ☐ Using defective equipment
- ☐ Unclassified (not determined)
- ☐ 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)

- ☐ Congested or restricted area
- ☐ Defective tools, equipment, or materials
- ☐ Fire or explosion hazards
- ☐ Hazardous environmental conditions (vapors, dusts, etc.)
- ☐ High or low temperature exposures
- ☐ Inadequate guards or barriers
- ☐ Inadequate or excessive illumination
- ☐ Inadequate ventilation
- ☐ Inadequate walking/working surfaces
- ☐ Noise Exposures
- ☐ Poor housekeeping
- ☐ Radiation exposures
- ☐ Unclassified (not determined)
- ☐ 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 Factor Codes

- ☐ Alcohol or drug influence (possible)
- ☐ Fatigue
- ☐ Inadequate skill, capability, knowledge, or training
- ☐ Inattention
- ☐ Rushing to complete work
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Job Factor Codes

- ☐ Inadequate engineering
- ☐ Inadequate leadership/supervision
- ☐ Inadequate maintenance, wear, abuse, or misuse
- ☐ Inadequate planning or accelerated schedule
- ☐ Inadequate tools/equipment
- ☐ Inadequate work standards/procedures
- ☐ Unclassified (not determined)
- ☐ 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)

- ☐ Equipment repair or replacement
- ☐ Improve design or construction
- ☐ Improve housekeeping
- ☐ Improve PPE
- ☐ Install safety guard or device
- ☐ Reinstruction or reprimand of personnel involved
- ☐ Temporary/permanent reassignment of personnel
- ☐ Work method change
- ☐ Use safer materials or equipment
- ☐ Develop and publish lessons learned
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Appendix F:

Miscellaneous Health and Safety Information

APPENDIX H

GENERIC QUALITY ASSURANCE PROJECT PLAN

GENERIC
QUALITY ASSURANCE PROJECT PLAN

FOR

SITE INVESTIGATIONS

AT NON-OWNED FORMER MGP SITES

Prepared for:
Niagara Mohawk
300 Erie Boulevard West
Syracuse, New York

Prepared By:
Foster Wheeler Environmental Corporation
One Park Place
300 South State Street, Suite 620
Syracuse, New York

NOVEMBER 2002

Reviewed and Approved by: _____ _____
(Project Quality Assurance Manager) (Signature) (Date)

Site Specific
Revisions Attached: Supplement No. _____ Date _____

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Attachment 1 Field PAH and PCB Soil Test Technical Guides and Test Kit Instructions

1.0 GENERAL

This Generic Quality Assurance Project Plan (QAPP) has been prepared to specify procedures that will provide data of known, documented quality, and which will be legally defensible, should the need exist. This document specifically supplements the Generic Field Sampling Plan (FSP), also attached as an appendix to the Site-Specific Work Plan. To the extent discrepancies exist between this Generic QAPP and the Site-Specific Work Plan, the Site-Specific Work Plan shall control.

2.0 PROJECT DESCRIPTION

The project sites are Former Non-owned Manufactured Gas Plant (MGP) sites. The purpose of the investigations is to gather sufficient data to enable the New York State Department of Environmental Conservation (NYSDEC) and Niagara Mohawk, a National Grid Company (NM) to characterize chemical substances which are or may be present at the Sites and to enable the NYSDEC and NM to determine whether such substances pose a significant threat to public health or the environment.

The data collected as a result of these investigations will be used to support the Site Characterizations and Remedial Investigation/Feasibility Studies (RI/FS) as described in the Site-Specific Work Plans. The types, numbers, and locations of environmental samples to be collected are also described in the Site-Specific Work Plans. Field procedures for all environmental sampling activities are detailed in the FSP.

3.0 PROJECT ORGANIZATION

The project organization is described in detail in the Site-Specific Work Plan. The project organization describes the relationship between the NM Project Manager, NYSDEC Project Manager, NM's Engineering Consultant, and subcontractors (e.g. laboratories, data validators, drillers, etc.).

For the purpose of quality control, the Engineering Consultant's Project Quality Assurance Manager (PQAM) will be responsible for review of data upon receipt from the analytical laboratory. The PQAM will assure that data validation screening is performed by trained and experienced data validators using the applicable criteria specified in the NYSDEC 2001 Analytical Services Protocol (ASP). For the purposes of this document, all references to ASP indicate the 2001 NYSDEC Analytical Services Protocol. The specific requirements for data validation screening are given in Section 9.3. The PQAM will be responsible for ensuring that all analytical data are in conformance with requirements of this QAPP.

4.0 QA/QC OBJECTIVES FOR MEASUREMENT OF DATA

The overall quality assurance (QA) objective for the project is to develop and implement procedures which will provide data of known, documented quality. Field and laboratory quality assurance/quality control (QA/QC) requirements defined in the NYSDEC ASP and other applicable guidelines ensure acceptable levels of data quality will be maintained throughout the sampling and analysis program.

The QA/QC objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. The data reduction, validation, and reporting scheme is presented in Figure 1. The quality assurance samples to be collected (type and frequency of collection) are specified in the Site-SpecificWork Plans.

4.1 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), and relative range are common. For this project, precision will be evaluated by recording duplicate measurements of the same parameter on similar sample aliquots under the same conditions and calculating the relative percent difference (RPD) between the values. The formula for calculating RPD is presented in Section 13.2.

RPDs can only be calculated when the duplicate samples both contain detectable concentrations of the analyte. If an analyte is considered not detected at the detection limit, then RPD cannot be calculated. Instead, the results of the analysis of the two-spiked laboratory samples will be used to determine precision.

Measurement data for this project will include field data as well as laboratory analytical data. Laboratory precision will be performed according to the requirements described in the associated analytical methods. The field measurement data may include immunoassay polycyclic aromatic hydrocarbon (PAH) and/or polychlorinated biphenyl (PCB) screening, pH, conductivity, temperature, turbidity, organic vapor readings, and water level measurements. The objective for precision of field data collection methods is to take replicate (minimum of two for every 20 samples) measurements for field parameters to determine the reproducibility of the measurements.

Precision of the immunoassay screening will be evaluated by the field analysis of replicate samples as equivalent levels of PAHs/PCBs. As the screening is not quantitative (i.e., the screening determines if the constituents are present above or below standard values and does not provide a numeric result), RPDs cannot be calculated on the field-analyzed samples. Therefore, measurement of equivalent levels of constituent (i.e., detected below the same standard or within the same range of two standards) will be considered as denoted precision of the screening test.

For the pH meter, precision will be tested by multiple readings in the medium of concern. Consecutive

readings should agree within 0.1 pH units after the instrument has been field calibrated with standard buffers before each use. The thermometer will be visually inspected prior to each use to ensure its condition is satisfactory. Consecutive measurements of a given sample should agree to within 1°Celsius. After calibration, the conductivity meter will be tested for precision at ± 1% of full-scale, depending on the meter/scale. The organic vapors will be measured using a Photovac Microtip (or equivalent) photoionization detector (PID). Daily background and upwind readings of drilling and sampling activities will be measured prior to commencing work and at periodic intervals throughout each day's activities. The natural variation/fluctuation in measurements at background or upwind locations will be used for baseline background values, and the variability will be noted. Water level indicator readings will be precise within 0.01 feet for duplicate measurements or additional water level measurements will be collected to determine whether the difference is due to operator or instrument error. Turbidity measurements will be calibrated to a precision of ± 2% nephelometric turbidity units (NTUs).

4.2 Accuracy

Accuracy is a measure of the difference between a measured value and the "true" or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity, which is recovered, or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes that are close to the detection limits are less accurate because they are affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument or other variables and thus will be more accurate.

The accuracy of laboratory-measured data will be evaluated by determining the percent recovery of both matrix and blank spike samples as described in Section 13.1. For the measurement of organics by gas chromatography (GC) or GC/mass spectroscopy (MS), the recovery of a surrogate spiked into each sample, blank, and standard will also be used to assess accuracy.

Accuracy between the immunoassay screening and the laboratory analytical results will be evaluated by the confirmatory testing of 10 percent (i.e., one in ten) of the environmental samples at the off-site laboratory. The rate of potential false positives and negatives should be less than 15 percent. Screening samples will not be spiked in the field by the addition of known parameter concentrations. However, the confirmatory samples sent to the off-site laboratory will undergo surrogate spiking and recovery evaluation and, to the extent possible, may be chosen as the site-specific matrix spike sample(s) for additional accuracy determination.

The objective for accuracy of the other field measurements is to achieve and maintain factory equipment specifications for the field equipment. Field measurements cannot be assessed for accuracy by spiking the medium with the analytical parameter and measuring the increase in response;

therefore, these instruments can only be assessed for accuracy by the response to a known sample (such as a calibration standard) used to standardize them. The pH meter, conductivity meter, and turbidity meter are calibrated with solutions traceable to the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards).

All volatile organic detectors (such as the PID) will be calibrated to an appropriate standard daily prior to use.

4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, or analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the FSP. Laboratory sample containers will be thoroughly cleaned in accordance with procedures outlined in Section 5.2. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated through the analysis of field duplicate samples, coded to ensure the samples are treated and analyzed as separate samples. The analytical laboratory will make every reasonable effort to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received. Many means of homogenization expose the sample to significant risk of contamination or loss through volatilization, and these should be avoided if possible.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank/duplicate and chain-of-custody procedures are presented in Sections 5.3 and 6.1.

4.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. The QC objective for completeness is generation of valid data for 100 percent of the analysis requested. Any data deficiencies and their impact on project goals will be evaluated during data validation and discussed in the Data Usability Summary Report (DUSR) (see Section 9.3.2).

4.5 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Ensuring traceability of all analytical standards and/or source materials to USEPA or NIST;
- Verifying all calibrations with an independently prepared standard from a source other than that used for calibration;
- Using standard reporting units and reporting formats including the reporting of QC data;
- The validation of all analytical results, including the use of data qualifiers in all cases where appropriate; and
- The requirement that all validated flags be used any time an analytical result is used for any purpose whatsoever.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

5.0 SAMPLING PROCEDURES

5.1 Sampling Program

The objective of the sampling program is to provide current data concerning the presence and nature and extent of contamination of groundwater, surface water, soils (surface and subsurface), and/or sediment. Sampling and analysis may include as identified in the Site-SpecificWork Plan:

- groundwater samples
- surface water samples
- sediment samples
- surface and/or subsurface soil samples
- air samples

5.2 Sampling Procedures and Handling

Sample Container Preparation

Sample containers will be properly washed and decontaminated by the factory or laboratory prior to use. All preservatives will be added to containers prior to shipment by the laboratory. The types of containers and preservation techniques are shown in Table 1. Records of the sources of bottles and preservatives will be kept by the analytical laboratory.

Methods of Sampling

As a minimum, sampling procedures will be in accordance with the most recent NYSDEC or USEPA guidelines and/or regulations, as appropriate. Alternate techniques will be utilized when such guidelines and/or regulations are inappropriate or non-existent. Alternate techniques will be implemented only after consultation with NYSDEC, whenever possible.

Referenced sampling procedures are listed below. All procedures will be the latest in effect as of the date of this Generic QAPP.

- USEPA - 600-4-79-020, "Methods for Chemical Analysis of Water and Wastes"
- National Water Well Association - "Manual of Ground-water Sampling Procedures"
- USEPA - 600-4-83-040, "Characterization of Hazardous Waste Sites - a Methods Manual: Volume II. Available Sampling Methods"
- USEPA - OSWER - 9950.1 "RCRA Ground-water Monitoring Technical Enforcement Guidance Document"
- USEPA - 540/S-95/504, "Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures"

- NYSDEC – "Technical and Administrative Guidance Memoranda" (TAGMs)

All sampling methods are explained in detail in the FSP.

5.3 Quality Assurance Samples

Field Quality Control Samples

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. The blanks will include:

Trip Blank - A trip blank will be prepared by the laboratory, and will consist of 40-ml volatile organic analysis (VOA) vials containing distilled, deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for which analysis for Target Compound List (TCL) volatiles or benzene, toluene, ethylbenzene and total xylenes (BTEX) is planned. The trip blank will be analyzed for TCL volatile organic compounds or BTEX to assess any contamination introduced as a result of sampling and transport, , handling and storage.

Equipment Blank - Equipment blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix as specified in the Site-SpecificWork Plan. Equipment blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory, which has passed through or over the sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to collecting a sample. The equipment blanks will be analyzed for the same parameters as the matrix being sampled.

In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike (MS)/matrix spike duplicates (MSD)/matrix duplicates (MD).

The duplicates will consist of:

Field Duplicate - To determine the reproducibility and homogeneity of samples, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise. The frequency of collection of these samples is one per 20 field samples as specified in the Site-SpecificWork Plans. The criteria for assessing coded field duplicates are given in Section 6.0.

Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate (MS/MSD/MD) - MS/MSD/MD samples (MSD for organics; MD for inorganics) will be collected at a frequency of one pair per 20 field samples per seven day sample delivery group (SDG). The reproducibility and homogeneity of the samples can be assessed by determining the

RPD for both spike and non-spike compounds as described in Section 13.0. The MS, MSD, and MD samples should be Site-Specific, unless otherwise authorized by the Engineering Consultant's Project Manager and/or PQAM after consultation with NM and NYSDEC personnel whenever possible.

6.0 SAMPLE TRACKING AND CUSTODY

Sample chain-of-custody (COC) will be initiated by the laboratory with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling the samples will be minimized.

In-situ or on-site monitoring data will be controlled and entered in permanent logbooks. Personnel involved in the COC and transfer of samples will be trained on the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity will be provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 2. A sample will be considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with custody seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

6.1 Field Sample Custody

A COC record will accompany the sample from time of collection to receipt by the analytical laboratory. If samples are split and sent to different laboratories, COC records will be sent with each sample. Figure 3 is a typical example of a chain-of-custody record. The "remarks" column will be used to record specific considerations associated with sample acquisition such as: sample type, container type, sample preservation methods, and analyses to be performed. Two copies of this record will accompany the samples to the laboratory. The laboratory will maintain one file copy, and the completed original will be returned to the Engineering Consultant's Project Manager.

Individual sample containers, provided by the laboratory, will be used for shipping/couriering samples. The shipping containers are insulated, and ice will be used to maintain samples at approximately four degrees Celsius until samples are returned and in the custody of the laboratory. All sample bottles within each shipping container will be individually labeled and controlled.

Each sample shipping container will be assigned a unique identification number by the laboratory, and will be marked with indelible ink on the outside of the shipping container. This number will be recorded on the COC record. The field sampler will indicate each individual sample designation/location number in the space provided on the appropriate COC form for each sample collected. The shipping container will then be closed, and a seal provided by the laboratory affixed to the latch. This seal must be broken to open the container. Tampering may be indicated if the seal

is broken before receipt at the laboratory. The laboratory will contact the FOL or Engineering Consultant's Project Manager, and the associated samples will not be analyzed if tampering is apparent.

6.2 Laboratory Sample Custody

The FOL will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The laboratory sample program will meet the following criteria:

- The laboratory will designate a sample custodian who is responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of any discrepancy in documentation, the laboratory will immediately contact the Engineering Consultant's Project Manager and/or PQAM as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. That assessment will be recorded as part of the incoming COC procedure.
- The samples will be stored in a secured area at a temperature of approximately four degrees Celsius until analyses are to commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking form will accompany the laboratory report and will become a permanent part of the project records.

6.3 Sample Tracking System

A sample tracking system will be implemented to monitor the status of sampling events and laboratory analysis of samples. Sample numbers, types, analytical parameters, sampling dates, and sample delivery group (SDG) designations for samples, and required due dates for receipt of analytical results will be entered into the system. The Engineering Consultant's Project Manager will use the tracking system to monitor the project sampling schedules and the status of analytical reports, and to implement any penalty clauses for late delivery per standard laboratory subcontracts when necessary.

A description of the sample tracking system follows:

1. For each day that samples are collected, the Field Operations Lead (FOL) or designee will complete a COC form (Figure 3) and a Daily Status and Monitoring Report (Figure 4) listing all appropriate samples.
2. The FOL or designee will retain the client copy of the COC, and forward the laboratory copy of the COC with the sample shipment.
3. The FOL or designee will fax copies of the completed COC form and Daily Status and Monitoring Report to the Engineering Consultant's PM. The Engineering Consultant's PM or a designated employee will confirm sample shipment with the laboratory and resolve any sample transfer issues.
4. The status of analytical results will be tracked by the Engineering Consultant's PM or designee using the information provided on the completed COC form and Daily Status and Monitoring Report. The information shall be summarized in a computerized database, as warranted.

Upon receipt of the analytical results from the laboratory, the Engineering Consultant's PM or designee will review the data package for completeness and contract compliance. The Engineering Consultant's PM will then forward the result package to the data validator for validation. The data validator shall be required to submit a complete set of validated data to the Engineering Consultant's PM within 60 days of receipt of the data package report.

The Engineering Consultant's Project Manager or a designated representative will maintain day-to-day contact with the laboratory concerning specific samples and analyses directly or by assignment.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 Field Instrumentation Calibration

The FOL will be responsible for ensuring that instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to their specific calibration protocols/procedures.

All field measurement instruments must be calibrated according to the manufacturer's instructions prior to the commencement of the day's activities. Exceptions to this requirement shall be permitted only for instruments that have fixed calibrations pre-set by the equipment manufacturer. Calibration information shall be documented on instrument calibration and maintenance log sheets or in a designated field logbook. The calibration information (log sheet or logbook) shall be maintained at the site during the on-site investigation and, once the field work is completed, shall be placed in the Engineering Consultant's project files. Information to be recorded includes the date, the operator, and the calibration standards (concentration, manufacturer, lot number, expiration date, etc.). All project personnel using measuring equipment or instruments in the field shall be trained in the calibration and usage of the equipment, and are personally responsible for ensuring that the equipment has been properly calibrated prior to its use.

In addition, all field instruments must undergo response verification checks at the end of the day's activities and at any other time that the user suspects or detects anomalies in the data being generated. Verification checks may also be performed at the request of NM or NYSDEC representatives. The checks consist of exposing the instrument to a known source of analyte (e.g., the calibration solution), and verifying a response. If an unacceptable instrument response is obtained during the check (i.e., not within specifications), the data shall be labeled suspect, the problem documented in the site logbook, and appropriate corrective action taken.

Any equipment found to be out of calibration shall be re-calibrated. When instrumentation is found to be out of calibration or damaged, an evaluation shall be made to ascertain the validity of previous test results since the last calibration check. If it is necessary to ensure the acceptability of suspect items, the originally required tests shall be repeated (if possible), using properly calibrated equipment, to acquire replacement data for the measurement in question.

Any instrument consistently found to be out of calibration shall be repaired or replaced within 24 hours or field work will be terminated until the malfunctioning equipment is repaired/replaced.

7.2 Laboratory Instrumentation Calibration

Personnel at the laboratory will be responsible for ensuring that analytical instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to specific protocols/procedures.

Off-site laboratory equipment shall be calibrated using certified/nationally recognized standards and according to the applicable methodologies and the laboratory Standard Operating Procedures (SOPs).

In addition, these methods/procedures specify the appropriate operations to follow during calibration or when any instrument is found to be out of calibration.

8.0 ANALYTICAL PROCEDURES

All off-site laboratory samples will be analyzed according to the methods provided in Exhibit D of the NYSDEC ASP. QA/QC procedures given in Exhibit E and I of the ASP will be followed. Regardless of the method used, all analytical and extraction holding times must meet the NYSDEC ASP requirements for that analytical group (i.e., volatile analyses, including BTEX, have a holding time of seven days, if unpreserved). Holding times will be calculated from verified time of sample receipt at the laboratory. For NYSDEC ASP, samples must be received at the laboratory within 48 hours of sample collection. The analytical laboratory chosen for the project will be certified, and must maintain certification, under the New York State Department of Health's Environmental Laboratory Approval Program for analyses of solid and hazardous waste. The breakdown of investigative samples is detailed in the Site-Specific Work Plan. Laboratory analytical methods and quantitation limits are presented in Tables 2 and 3 of this Generic QAPP. The method detection limits (MDLs) for the analytes will be specified by the laboratory selected for the project based on its most recent MDL studies, and subject to approval by the NYSDEC.

Field screening samples will be analyzed according to the NYSDEC ASP and the manufacturer's instructions. Unless site-specific requirements dictate a change in concentration limits (which would be explained within the Site-Specific Work Plan), the standard levels for the PAH and PCB screening will be 1 ppm and 10 ppm. The test system user shall be technically qualified individual who has received training in the immunoassay analysis requirements, procedures and potential risks prior to field screening of samples. Use of the field screening test kits will only occur in a controlled environment, following the storage and handling procedures outlined in the NYSDEC ASP and the manufacturer's instructions. Additional technical information on the field screening testing are presented in Attachments 1 and 2.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the ASP.

The data package provided by the laboratory will contain all items specified in the ASP, as appropriate to the analyses performed. Category B reporting will be used.

9.1 Chain-of-Custody Records

Completed copies of the COC records accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the report of analytical testing.

9.2 Data Handling

One complete copy and one additional copy of the analytical data summary report will be provided by the laboratory. One set of the analytical data will be forwarded directly to the data validator by the laboratory. The Engineering Consultant's Project Manager will immediately arrange for filing of the complete package, after the QA/QC reviewer checks the package to ensure all deliverables have been

provided. The second data summary report will be used to generate summary tables. These tables will form the foundation of a working database for assessment of the site contamination condition.

The Engineering Consultant's Project Manager will maintain close contact with the QA/QC reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA/QC review has been completed, the Engineering Consultant's Project Manager may direct the team leaders or others to initiate and finalize the analytical data assessment.

9.3 Data Validation

9.3.1 Full Data Validation

Data validation is a basic step in the control and processing of the project data generated by the laboratory. The data validation process will consist of a systematic review of the analytical results and QC documentation, and will be performed in accordance with the guidelines identified in Section 9.3.1. All off-site laboratory data will undergo full validation, unless otherwise stated in the Site-Specific Work Plan. On the basis of this review, the data validator will make judgments and express concerns and comments on the quality and limitations of specific data, as well as on the validity of the overall data package. The data validator will prepare documentation of his or her review and conclusions in a Data Usability Summary Report (DUSR; see Section 9.3.2).

The data validator will inform the Engineering Consultant's Project Manager of data quality and limitations, and assist the Project Manager in interacting with the laboratory to correct data omissions and deficiencies. The laboratory may be required to rerun or resubmit data depending on the extent of the deficiencies, and their importance in meeting the data quality objectives within the overall context of the project. The validated laboratory data will be reduced into a computerized tabulation which will be suitable for inclusion in the Site Characterization and RI Reports and will be designed to facilitate comparison and evaluation of the data. The data tabulations will be sorted by classes of constituents and by sample matrix. Each individual table will present the following information:

- Sample matrix, designations, and locations;
- Sample dates;
- Constituents for which positive results were obtained;
- Reported constituent concentrations in the field and/or trip blanks associated with the samples;
- Constituent concentration units;
- Name and location of laboratory which performed the analyses;
- Data qualifiers provided by the laboratory; and
- Data qualifiers and comments provided by the data validator, if any.

9.3.1 Data Usability Summary Report (DUSR)

A Data Usability Summary Report (DUSR) will be prepared after reviewing and evaluating the analytical data. The parameters to be evaluated in reference to compliance with the analytical method protocols includes all sample chain-of-custody forms, holding times, raw data (instrument print out data and chromatograms), calibrations, blanks, spikes, controls, surrogate recoveries, duplicates and sample data. If available, the field sampling notes should also be reviewed and any quality control problems should be evaluated as to their effect on the usability of the sample data.

The DUSR will describe the samples and analysis parameters reviewed. Data deficiencies, analytical method protocol deviations and quality control problems will be described and their effect on the data will be discussed in the DUSR.

Resampling/reanalysis recommendations, if applicable, will be made. Data qualifications are documented for each sample analyte following the NYSDEC ASP guidelines.

This work will be performed by trained and experienced data validators who meet the NYSDEC

approval criteria. The Environmental Scientist preparing the DUSR must submit a resume to the NYSDEC Quality Assurance Unit documenting relevant experience in environmental sampling and analysis methods and data review and documentation of a Bachelors Degree in Natural Science or Engineering. The results of the data validation screening (i.e. missed holding times or data rejected due to blank contamination) will be incorporated into the data summary tables used in the final investigative report. The DUSR identifies data gaps caused by non-compliant or rejected data, and will indicate what steps have been or will be taken to fill these gaps.

10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

10.1 Quality Assurance Batching

Each set of samples will be analyzed concurrently with calibration standards, method blanks, MS, MSD or MD, and QC check samples (if required by the protocol). The MS/MSD/MD samples will be designated by the field personnel. If no MS/MSD/MD samples have been designated, then the laboratory must contact the Project Quality Assurance Officer (PQAO) or Engineering Consultant's Project Manager for corrective action.

10.2 Organic Standards and Surrogates

All standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or earlier based upon data indicating deterioration.

10.3 Laboratory Quality Control Samples

The quality control samples included are detailed below.

Method Blanks/Preparation Blanks: Analyses for organic compounds (method blank) and inorganics (preparation blank) include a blank analysis of the laboratory reagent water. The blank is analyzed with each set of samples or more often as required to verify that contamination has not occurred during the analytical process. The concentration of target compounds in the blanks must be less than or equal to the method detection limits specified in the ASP for the selected method of analysis.

Matrix Spike/Matrix Spike Duplicate Analysis - This analysis is used to determine the effects of matrix interference on analytical results. Spikes of analytes are added to aliquots of sample matrix in the manner specified in the ASP. Selected samples are spiked to determine accuracy as a percentage recovery of the analyte from the sample matrix and precision as RPD between the MS and MSD samples. A matrix duplicate is prepared in the same manner as the matrix spike sample.

Analytical Duplicate Samples - Replicate samples are aliquots of a single sample that are split on arrival at the laboratory, or upon analysis. Significant differences between two replicates, split in a controlled laboratory environment, will result in flagging the affected analytical results.

Surrogate Spike Analyses - Surrogate spike analyses are used to determine the efficiency of recovery of organic analytes in the sample preparations and analyses. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method.

Laboratory Control Sample/ (Spike Blank) - For each method which requires a laboratory control sample (LCS) or spike blank, a LCS spike blank will be prepared with each quality control batch and analyzed according to criteria specified in the ASP. These samples support an assessment of the ability of the analytical procedure to generate a correct result without matrix effects or interference affecting the analysis.

11.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

Quality assurance audits may be performed by the Project Quality Assurance Manager (PQAM) or personnel designated by the PQAM. The PQAM and his or her designees function as an independent body and report directly to Engineering Consultant's quality assurance management. The PQAM may plan, schedule, and approve system and performance audits based upon the Engineering Consultant's procedure customized to the project requirements. These audits may be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). At times, the PQAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits.

Formal audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by lead auditors after gathering and evaluating all resultant data. Items, activities, and documents determined by lead auditors to be in noncompliance will be identified at exit interviews conducted with the involved management. Noncompliances will be logged, documented, and controlled through audit findings which are attached to and are a part of the integral audit report. These audit finding forms will then be directed to management to satisfactorily resolve the noncompliance in a specified and timely manner. All audit checklists, audit reports, audit findings, and acceptable resolutions must be approved by the PQAM prior to issue. QA verification of acceptable resolutions will be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the PQAM will close out the audit report and findings.

It is the Engineering Consultant's Project Manager's overall responsibility to verify that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Engineering Consultant's Project Manager within 15 days of completion of the audit. Serious deficiencies must be reported to the Engineering Consultant's Project Manager within 24 hours.

Serious deficiencies identified during an audit will be reported to NM and NYSDEC as part of the DUSR or Site investigation and/or RI Reports.

11.1 System Audits

System audits, performed by the PQAM or designated auditors, may encompass evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Engineering Consultant's Project Manager requests the PQAM to perform unscheduled audits, these activities will be instituted.

11.2 Performance Audits

In accordance with the requirements for NYSDOH ELAP CLP certification, the laboratory will participate in all performance evaluation testing.

Also, one field audit may be performed by the PQAM or designated auditor during collection of the field samples to verify that field samplers are following established sampling procedures. Performance of a field audit will be based on the type of investigation activities being performed, the length of the field project, and any available information concerning prior inspections of the project or sampling team. The Site-Specific Work Plan will provide details on the performance of a field audit.

12.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

12.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators. Analytical instruments will be serviced at intervals recommended by the manufacturer. An instrument repair/maintenance log book will be kept for each instrument, and this log will be available on-site during field activities and, at the completion of the investigation, be placed in the project files. Entries include the date of service, type of problem encountered, corrective action taken, and initials and affiliation of the person providing the service.

The instrument use log book will be monitored by the analysts to detect any degradation of instrument performance. Changes in response factors or sensitivity are used as indications of potential problems. These are brought to the attention of the laboratory supervisor and preventive maintenance or service is scheduled to minimize down time. Back-up instrumentation and an inventory of critical spare parts are maintained to minimize delays in completion of analyses.

Use of equipment in need of repair will not be allowed, and field work will be terminated until the malfunction is repaired or the instrument replaced.

12.2 Schedules

Written procedures, where applicable, will identify the schedule for servicing critical items in order to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange any necessary and prompt service as required. Service to the equipment, instruments, tools, gauges, etc. shall be performed by qualified personnel.

12.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools, and gauges are used at the sites. The Engineering Consultant's Project Manager or the PQAM may audit these records to verify complete adherence to these procedures.

12.4 Spare Parts

Where appropriate, a list of critical spare parts will be identified by the operator in consultation with the equipment manufacturer. These spare parts will be stored for availability and use in order to reduce the downtime. In lieu of maintaining an inventory of spare parts, a service contract for rapid instrument repair or backup instruments will be available.

13.0 ASSESSMENT PROCEDURES FOR DATA ACCEPTABILITY

Procedures used to assess data precision and accuracy will be in accordance with the appropriate laboratory method, and as periodically updated.

13.1 Accuracy

The percent recovery is calculated as below:

$$\% = \frac{Ss - So}{S} \times 100$$

So = The background value, i.e.; the value obtained by analyzing the sample

S = Concentration of the spike added to the sample

Ss = Value obtained by analyzing the sample with the spike added

% = Percent Recovery

13.2 Precision

The relative percent difference (RPD) is calculated as below:

$$RPD = \frac{|V1 - V2|}{0.5\ (V1 + V2)} \times 100$$

V1, V2 = The two values obtained by analyzing the duplicate samples

13.3 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the total amount expected to be obtained under ideal conditions. A target of 100 percent completeness, calculated for each analysis method, has been established as the overall project objective.

$$PC = \frac{NA}{NI} \times 100$$

where:

PC = Percent completeness
NA = Actual number of valid analytical results obtained
NI = Theoretical number of results obtainable under ideal conditions

14.0 CORRECTIVE ACTION

The following procedures have been established to assure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted on-site, at the laboratory, or at a subcontractor location, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the FOL, Engineering Consultant's Project Manager, and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action. All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality.

At a minimum, corrective actions may be initiated:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined deficient
- When equipment or instrumentation is found faulty
- When samples and test results are questionably traceable
- When quality assurance requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/inter-field comparison studies
- As required by NM
- As required by NYSDEC ASP, 2001

Procedure Description

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities.

Work may be audited at Engineering Consultant's office, Site, laboratory, and subcontractor locations by the PQAM and/or designated auditor. Items, activities, or documents ascertained to be in noncompliance with quality assurance requirements will be documented and corrective actions mandated through audit finding sheets attached to the audit report. Audit findings are logged,

maintained, and controlled by the PQAM (Section 11.0).

Technicians assigned quality assurance functions will also control noncompliance corrective actions by having the responsibility of issuing and controlling the appropriate Corrective Action Request Form (Figure 5). All project personnel may identify a noncompliance; however, the technician is responsible for documenting, numbering, logging, and verifying the closeout action. It is the Engineering Consultant's Project Manager's responsibility to verify that all recommended corrective actions are produced, accepted, and received in a timely manner.

The Corrective Action Request (CAR) identifies the adverse condition, reference document(s), and recommended corrective action(s) to be administered. The issued CAR is directed to the responsible manager in charge of the item or activity for action. The individual to whom the CAR is addressed returns the requested response promptly to the technician in charge, affixing his signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The technician maintains the log for status control of CARs and responses, confirms the adequacy of the intended corrective action, and verifies its implementation. The technician will issue and distribute CARs to specified personnel, including the originator, responsible project management involved with the condition, the Engineering Consultant's Project Manager, involved subcontractor, and the FOL, at a minimum. CARs are transmitted to the project file for the records.

15.0 QUALITY ASSURANCE REPORTS

Quality assurance reports to management may consist of the reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and the data validation report.

At the end of the project, the PQAM may submit a lessons leaned report to the Engineering Consultant's Project Manager which will discuss the QA activities. That report may include discussions of any conditions adverse or potentially adverse to quality, such as responses to the findings of any field or laboratory audits; any field, laboratory, or sample conditions which necessitated a departure from the methods or procedures specified in this QAPP; field sampling errors; and any missed holding times or problems with laboratory QC acceptance criteria; and the associated corrective actions undertaken. This report shall not preclude immediate notification to project management of such problems when timely notice can reduce the loss or potential loss of quality, time, effort, or expense.

These reports, if prepared, shall be reviewed by the Engineering Consultant's Project Manager for completeness and the appropriateness of any corrective actions, and they shall be retained in the project files.

In the final investigative report, laboratory and field QC data will be presented, including a summary of QA activities and any problems and/or comments associated with the analytical and sampling effort. Any corrective actions taken in the field, results of any audits, and any modifications to laboratory protocols will be discussed.

Attachment 1

NYSDEC ASP Methods 4035 (PAHs) and 4020 (PCBs)

Attachment 2

Field PAH and PCB Soil Test Technical Guides and Test Kit Instructions

TABLE 3
TARGET ANALYTES AND CONTRACT REQUIRED QUANTITATION (CRQ) LIMITS[1]

	Contract Required Quantitation Limit Water Samples (ug/L)	Contract Required Quantitation Limit Soil Samples (ug/kg)
NYSDEC ASP TCL Volatile Organic Compounds (by 2001-1)		
Acetone	10	10
Benzene	10	10
Bromodichloromethane	10	10
Bromoform	10	10
Bromomethane	10	10
2-Butanone	10	10
Carbon disulfide	10	10
Carbon tetrachloride	10	10
Chlorobenzene	10	10
Chloroethane	10	10
Chloroform	10	10
Chloromethane	10	10
Dibromochloromethane	10	10
1,1-Dichloroethane	10	10
1,2-Dichloroethane	10	10
1,1-Dichloroethene	10	10
1,2-Dichloroethene (cis and trans)	10	10
1,2-Dichloropropane	10	10
cis-1,3-Dichloropropene	10	10
trans-1,3-Dichloropropene	10	10
Ethylbenzene	10	10
2-Hexanone	10	10
4-Methyl-2-pentanone	10	10
Methylene chloride	10	10
Styrene	10	10
1,1,2,2-Tetrachloroethane	10	10
Tetrachloroethene	10	10
Toluene	10	10
1,1,1-Trichloroethane	10	10
1,1,2-Trichloroethane	10	10
Trichloroethene	10	10
Vinyl chloride	10	10
Total Xylenes	10	10

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2)		
Base/Neutral Extractables		
Acenaphthene	10	330
Acenaphthylene	10	330
Anthracene	10	330
Benzo(a)anthracene	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(g,h,i)perylene	10	330
Benzo(a)pyrene	10	330
bis(2-Chloroethoxy)methane	10	330
bis(2-Chloroethyl)ether	10	330
bis(2-ethylhexyl)phthalate	10	330
4-Bromophenyl phenyl ether	10	330
Butyl benzyl phthalate	10	330
Carbazole	10	330
4-Chloroaniline	10	330
2-Chloronaphthalene	10	330
4-Chlorophenyl phenyl ether	10	330
Chrysene	10	330
Dibenz(a,h)anthracene	10	330
Dibenzofuran	10	330
Di-n-butylphthalate	10	330
1,2-Dichlorobenzene	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
3,3'-Dichlorobenzidine	10	330
Diethyl phthalate	10	330
Dimethyl phthalate	10	330
2,4-Dinitrotoluene	10	330

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.)		
2,6-Dinitrotoluene	10	330
Di-n-octylphthalate	10	330
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadiene	10	330
Hexachloroethane	10	330
Indeno(1,2,3-cd)pyrene	10	330
Isophorone	10	330
2-methyl Naphthalene	10	330
Naphthalene	10	330
2-Nitroaniline	25	800
3-Nitroaniline	25	800
4-Nitroaniline	25	800
Nitrobenzene	10	330
N-Nitroso-diphenylamine	10	330
N-Nitroso-dipropylamine	10	330
2,2' Oxybis(1-chloropropane)	10	330
Phenanthrene	10	330
Pyrene	10	330
1,2,4-Trichlorobenzene	10	330

NOTES

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2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Semivolatile Organic Compounds (by 2001-2, Cont.) **Acid Extractables (cont.)**		
4-Chloro-3-methylphenol	10	330
2-Chlorophenol	10	330
2,4-Dichlorophenol	10	330
2,4-Dimethylphenol	10	330
4,6-Dinitro-2-methylphenol	25	800
2,4-Dinitrophenol	25	800
2-Methylphenol	10	330
4-Methylphenol	10	330
2-Nitrophenol	10	330
4-Nitrophenol	25	800
Pentachlorophenol	25	800
Phenol	10	330
2,4,5-Trichlorophenol	25	800
2,4,6-Trichlorophenol	10	330
NYSDEC ASP TCL Pesticides and PCBs (by 2001-3)		
Aldrin	0.05	1.7
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Chlordane (alpha &/or gamma)	0.05	1.7
4,4'-DDD	0.10	3.3
4,4'-DDE	0.10	3.3
4,4'-DDT	0.10	3.3
Dieldrin	0.10	3.3
Endosulfan I	0.05	1.7
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TCL - Pesticides and PCBs (by 2001-3, Cont.)		
Endrin	0.10	3.3
Endrin Aldehyde	0.10	3.3
Endrin Ketone	0.10	3.3
Heptachlor	0.05	1.7
Heptachlor Epoxide	0.05	1.7
Methoxychlor	0.50	17.0
Toxaphene	5.0	170.0
Aroclor-1016	1.0	33.0
Aroclor-1221	2.0	67.0
Aroclor-1232	1.0	33.0
Aroclor-1242	1.0	33.0
Aroclor-1248	1.0	33.0
Aroclor-1254	1.0	33.0
Aroclor-1260	1.0	33.0
NYSDEC ASP TAL Metals and Cyanide (by CLP-M)		
Aluminum	200	
Antimony	60	
Arsenic	10	
Barium	200	
Beryllium	5	
Cadmium	5	
Calcium	5000	
Chromium	10	
Cobalt	50	
Copper	25	
Iron	100	
Lead	3	
Magnesium	5000	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

TABLE 3 (Cont'd.)
TARGET ANALYTES AND CRQ LIMITS[1]

	Contract Required Quantitation Limit Water Samples(ug/L)	Contract Required Quantitation Limit Soil Samples(ug/kg)
NYSDEC ASP TAL Metals and Cyanide (by CLP-M) (Cont.)		
Manganese	15	
Mercury	0.2	
Nickel	40	
Potassium	5000	
Selenium	5	
Silver	10	
Sodium	5000	
Thallium	10	
Vanadium	50	
Zinc	20	
Cyanide	10	

NOTES

1. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Quantitation limits listed for soil are based on wet weight.
2. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in quantitation limits, the Site-Specific Work Plan (which will include this information) will take precedence.

These CRQLs are the instrument detection limits obtained in pure water that must be met using the procedure in Exhibit E. The quantitation limits for samples may be considerably higher depending on the sample matrix.

TABLE 1
SAMPLE CONTAINERIZATION

Analysis	Bottle Type	Preservation[1]	Holding Time[2]
Aqueous Samples			
Volatile Organics (BTEX)	40 ml glass vial with Teflon-lined septa	Cool to 4°C	7 days
PCBs/Pesticides	1000 ml amber glass	Cool to 4°C	5 days*
Semivolatile Organics (PAHs)	1000 ml amber glass	Cool to 4°C	5 days*
Metals	1000 ml polyethene	HNO_3 to pH <2	6 months (Mercury 26 days)
Cyanide	1000 ml polyethene	NaOH to pH >12	12 days
Soil & Sediment Samples			
Volatile Organics (BTEX)	Wide-mouth glass w/ teflon-lined septa [3]	Cool to 4°C	7 days
Semivolatile Organics (PAHs)	Wide-mouth glass w/ teflon cap [3]	Cool to 4°C	5 days*
Pesticide/PCBs	Wide-mouth glass w/ teflon cap [3]	Cool to 4°C	5 days*
Metals, Cyanide	Wide mouth glass w/ teflon cap [3]	Cool to 4°C	Metals - 6 months Mercury - 26 days Cyanide - 12 days

NOTES

1. All samples to be preserved in ice at 4°C during collection and transport.
2. Days from verified time of sample receipt (VTSR) by the laboratory.
3. Sized appropriately for the analytical method.
4. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in containerization requirements, the Site-Specific Work Plan (which will include this information) will take precedence.

* Extraction of water samples for pesticides/PCB analysis by separating funnel must be completed within five days of VTSR. Continuous liquid-liquid extraction is the required extraction for water samples for semivolatiles. Continuous liquid-liquid extraction of water samples, or sonication or soxhlet procedures for semivolatile and pesticides/PCB analyses, shall be started within five days. If a re-extraction and reanalysis must be performed, the extraction must start within 10 days and completed within 12 days of VTSR. Extracts of either water or soil/sediment samples must be analyzed within 40 days of VTSR.

TABLE 2
LABORATORY ANALYSIS PROGRAM

Matrix	Parameter [1]	Analytical Method [2]
Water	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	PCBs and Pesticides	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
Soil & Sediments	BTEX	Method 8260B*
	VOC	2001-1
	SVOC	2001-2
	PAHs	Method 8270C*
	Pesticides and PCBs	2001-3
	Metals	CLP-M (various for individual metals)
	Cyanide	CLP-M
	TCLP	Method 1311; Method Series 7000, 8000
Waste Characteristics		Methods 1010/1020A; 9040B/9041A; Section 7.3

NOTES

1. Abbreviations: BTEX = Benzene, Toluene, Ethylbenzene, Xylene; VOCs = Volatile organic compounds; SVOCs = Semivolatile organic compounds; PAHs = Polycyclic aromatic Hydrocarbons; TCLP = Toxicity Characteristic Leaching Procedure; PCBs = Polychlorinated Biphenyls; CLP = Contract Laboratory Program.
2. NYSDEC Analytical Services Protocol, 2001, Category B deliverables.
   Analyses must meet NYSDEC ASP holding time specified for Methods in Exhibit I Part II.
3. If the information provided in this table differs from the most recent version of the ASP (2001), the ASP requirements will take precedence. In addition, if site-specific requirements dictate a change in analytical requirements, the Site-Specific Work Plan (which will include this information) will take precedence

* BTEX and PAH analyses must meet NYSDEC ASP holding time specified for Methods 2001-1 and 2001-2, respectively.

FIGURE 1

DATA REDUCTION, VALIDATION AND REPORTING

Figure 1

DATA REDUCTION, VALIDATION & REPORTING SCHEME

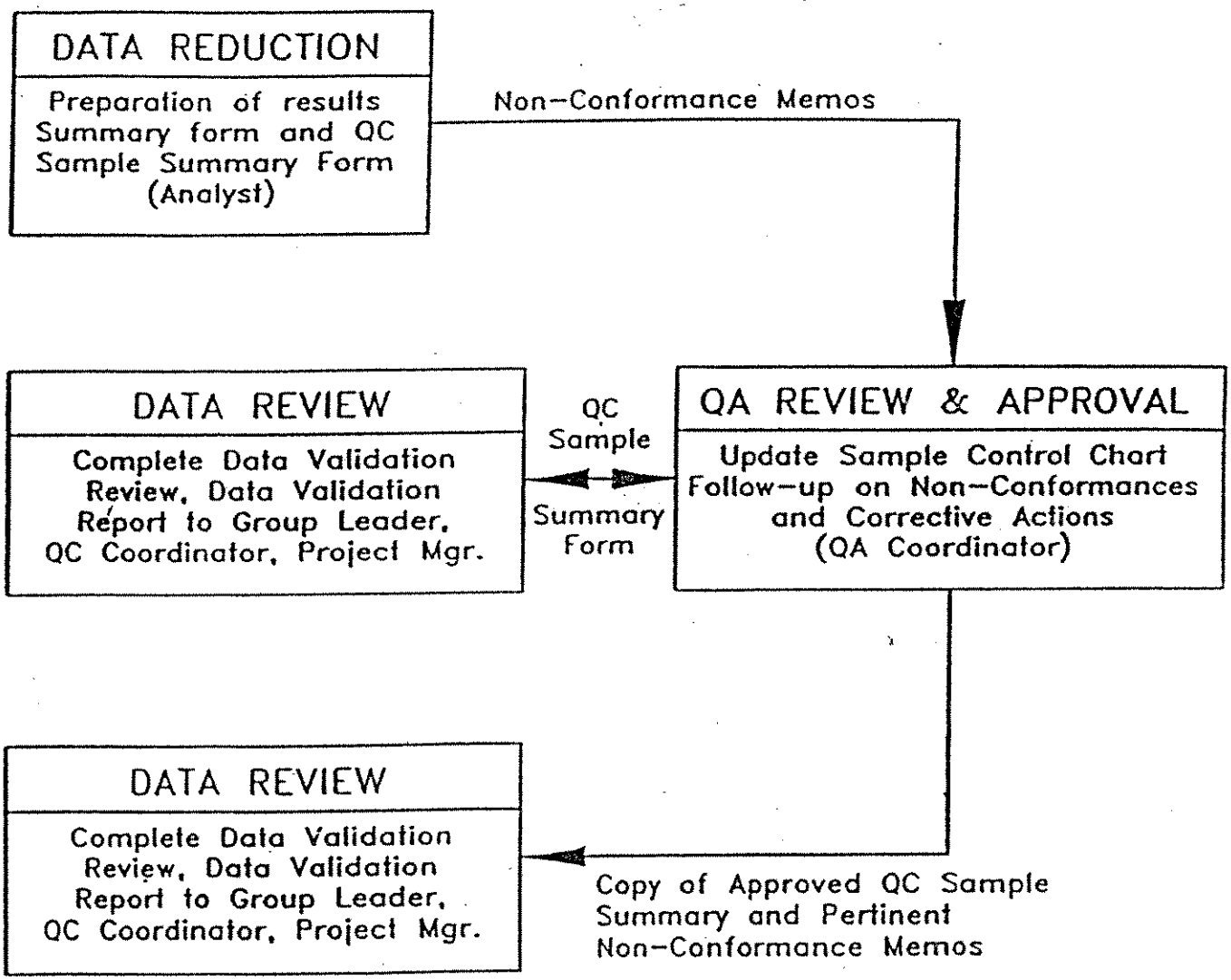
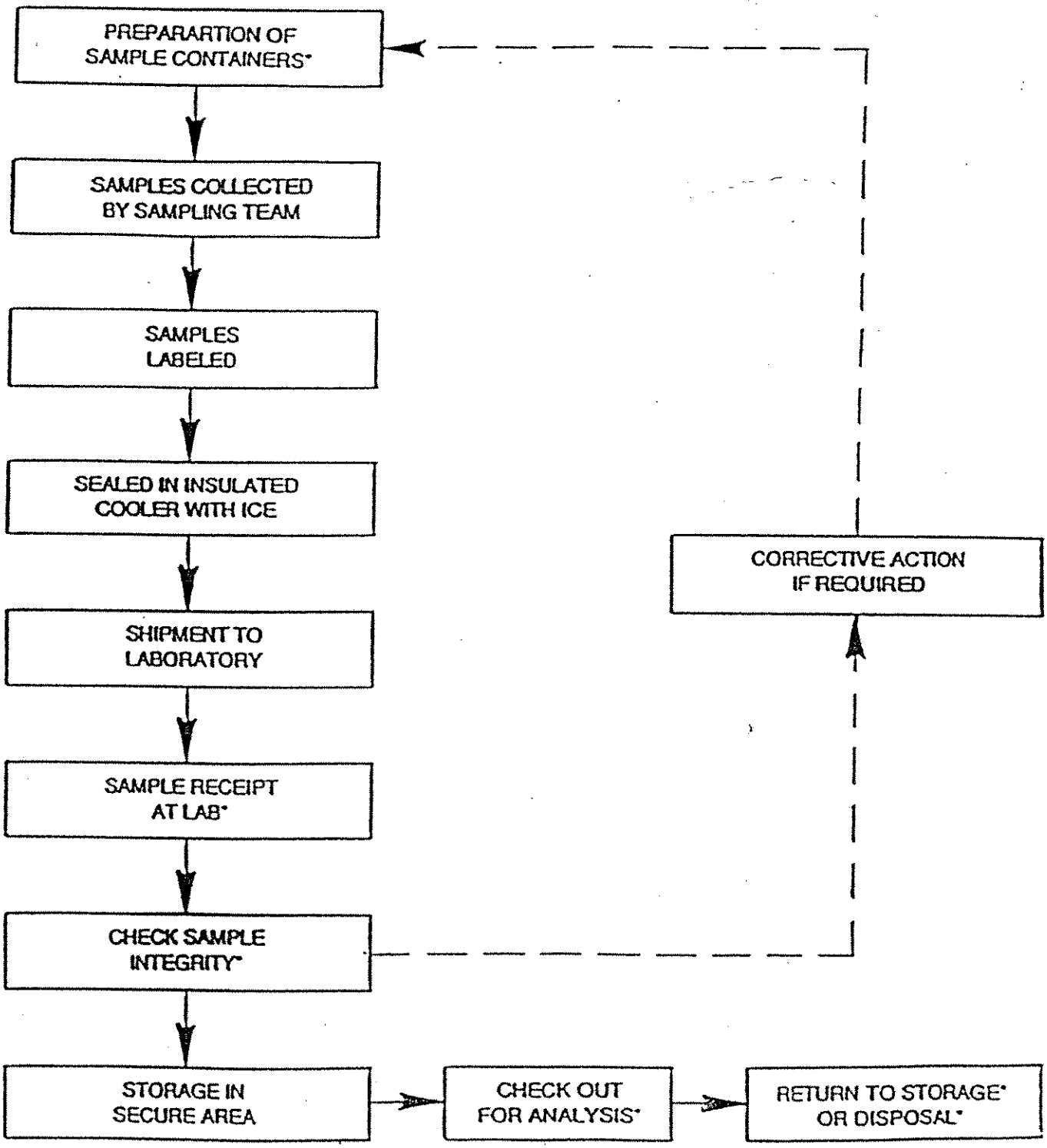


FIGURE 2

SAMPLE CUSTODY

Figure 2

SAMPLE CUSTODY



* Requires sign-off on Chain of Custody Form.

FIGURE 3

CHAIN-OF-CUSTODY RECORD

Severn Trent Laboratories
200 Monroe Turnpike
Monroe CT 06468
Tel: (203) 261-4458
Fax: (203) 268-5346

Committed To *Your* Success

CHAIN OF CUSTODY RECORD

PAGE OF NO.

STL JOB #:

CLIENT:

PROJECT ID:

STL PROJECT MGR:

RUSH ☐ YES ☐ NO DUE DATE

TESTS

BOTTLE TYPE AND PRESERVATION

BOTTLE SET #	CLIENT SAMPLE ID.	DATE / TIME SAMPLED	MATRIX	LAB (STL)	QC (Y / N)	FIELD FILTERED / CIRCLE Y or N								SAMPLE REMARKS
						Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

MATRIX CODES

A - AIR
AQ - AQUEOUS
C - COMPLEX
D - DRUM WASTE
OI - OIL
S - SOIL
SL - SLUDGE
W - WIPE
O - OTHER
FB - FIELD BLANK
TB - TRIP BLANK

BOTTLES PREPARED BY	DATE / TIME	BOTTLES REC'D BY	DATE / TIME
SIGNATURE		SIGNATURE	
SAMPLES COLLECTED BY	DATE / TIME	RECEIVED IN LAB BY	DATE / TIME
SIGNATURE		SIGNATURE	

REMARKS ON SAMPLE RECEIPT

☐ BOTTLES INTACT ☐ CUSTODY SEALS
☐ PRESERVED ☐ SEALS INTACT
☐ CHILLED ☐ SEE REMARKS

LABORATORY COPY

FIGURE 4

DAILY STATUS AND MONITORING REPORT

DAILY STATUS & MONITORING REPORT
Niagara Mohawk SIR & MSA Programs

Date:_____ Site Name:_____

Project Manager:_____ Project Field Operations Lead:_____

Description of Field Work Performed:

_____

_____

_____

_____

Media	Sample Number	Types of Analyses	Sample Sent to Lab? (Y/N)	Comments

Means of Sample Shipment to Laboratory? Name and Location of Laboratory:

_____

_____

_____

_____

Issues/Concerns Raised:

_____

_____

_____

_____

Work to be Performed Tommorrow:

_____

_____

_____

_____

Name of Preparer:_____

FIGURE 5

CORRECTIVE ACTION REQUEST FORM

Figure 5

CORRECTIVE ACTION REQUEST	CAR NO. _____ DATE _____
PROJECT NO./TITLE _____ _____ _____ TASK NO./TITLE _____ _____	REFERENCE(S) _____ _____ REPLY DUE DATE _____
SUBJECT _____ _____	PREPARED BY _____
DESCRIPTION OF CONDITION	APPROVED BY _____ PROJECT MANAGER
_____ _____ _____ _____ _____	
CAUSE AND CORRECTIVE ACTION (Include Effective Date) _____ _____ _____ _____ _____ _____ _____ _____	
_____ TASK MANAGER DATE	_____ PROJECT QA OFFICER DATE	_____ PROJECT MANAGER DATE
CLOSEOUT ACTION _____ _____ _____ _____ _____ _____ _____ _____	
_____ PROJECT QA OFFICER DATE	_____ PROJECT MANAGER DATE	SEE REVERSE SIDE FOR INSTRUCTIONS

ATTACHMENT 1

ENSYS FIELD PAH AND PCB SOIL TEST TECHNICAL GUIDES AND TEST KIT INSTRUCTIONS

STRATEGIC DIAGNOSTICS INC.

PAHEnSys® 12T SOIL TEST SYSTEM 70613

RAPID IMMUNOASSAY SCREEN

User's Guide

This method correctly identifies 95% of samples that are PAH-free and those containing 1ppm or greater of PAHs. A sample that develops less color than the standard is interpreted as positive. It contains PAHs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PAHs.

IMPORTANT NOTICE

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of PAHs. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLE SHOOTING GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

Wash Step - Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. *Solution*: Make sure that the operator washes four times vigorously.

Pipette Calibration - An out-of-calibration pipette may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution*: Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipette is out of calibration is if the gold barrel is loose and will turn. (When set on 30 µl there should be about 1/4 of an inch between the white plunger and the end of the clear pipette tip.)

Air bubbles in the pipette - the presence of air bubbles in the pipette tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution*: quickly examine the pipette tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if necessary.

Mixing - Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution*: observe the mixing times in the instructions and to mix with sufficient force to ensure that the liquid is homogeneous.

Timing - it is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the test. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

Addition of Drops - it is important to carefully count the drops added to color development steps. The addition of ±1 drop to the instructed 5 drops can cause variability in the results RIGHT AROUND THE DETECTION LEVELS OF INTEREST. One drop less could result in a darker color (a less dilute solution) and result in a false negative. One drop more could result in a lighter color (a more dilute solution) and result in a false positive

Wiping the Tubes - wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

Mixing Lot #'s - never mix lots! Each kit's components are QC'd together for optimal performance and may give inaccurate results with components from other kits, that are not of the same lot #. Also, the user must NEVER mix components from different types of kits (ex: Petro kit buffer tubes can't be used with a PAH kit).

Storage and Operating Temperatures - temperature requirements are very important and should be strictly adhered to. This information can be found in the kit User's Guide.

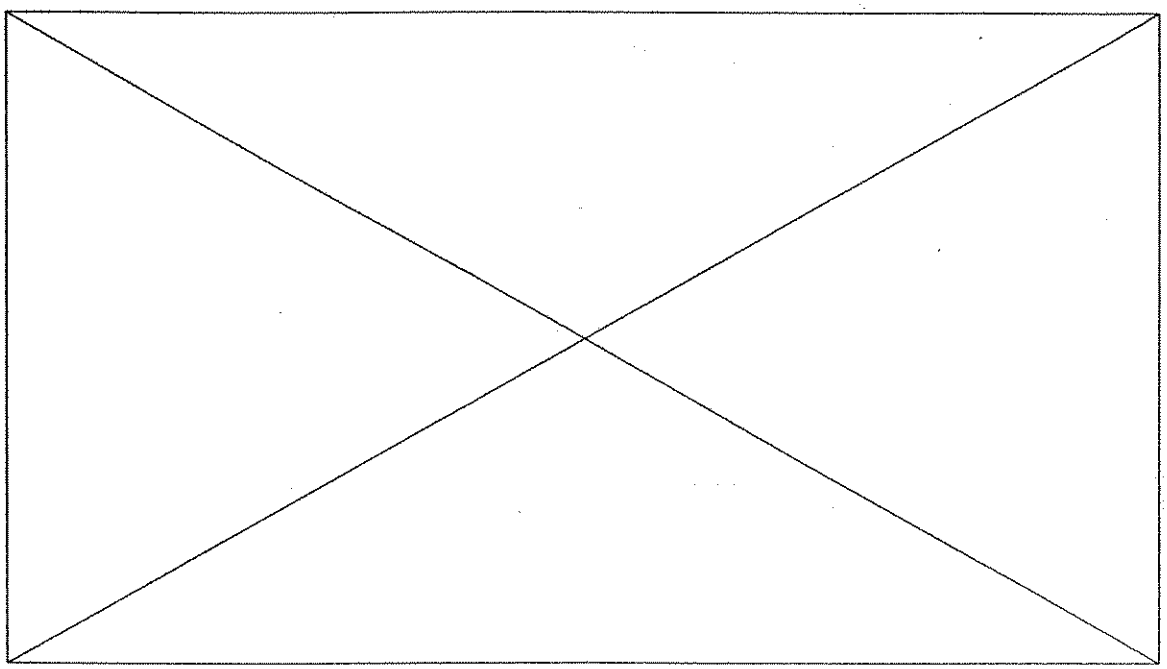
Shelf-life - each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- **Mechanical pipette tips**
- **Stop solution**
- **Standard vial**
- **4 antibody coated tubes**
- **Substrate A**
- **Filtration barrel & plunger**
- **1 and 10 ppm**
- **dilution ampules**
- **Substrate B**
- **Bulb pipette**
- **4 blue buffer tubes**
- **4 conjugate tubes**



READ BEFORE PROCEEDING

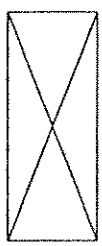
- Follow diagram above to setup workstation.
- Items that you will need that are not provided in the test kit include:
  a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PAHs at 1 and 10 ppm.

PAH Standard

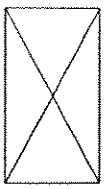
Ampule Cracker

TEST PREPARATION

- Label amber vial "PAH standard" and the current date; Standard is usable for up to 2 weeks from this date. Open PAH Standard ampule by slipping ampule cracker over top, and then breaking top at scored neck. Transfer to empty amber vial with bulb pipette. Always cap tightly when finished using Standard.



Bulb Pipette

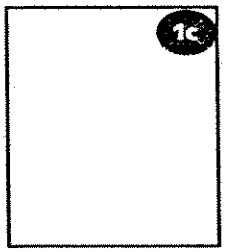


Amber Vial

PHASE 1 SAMPLE EXTRACTION & PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

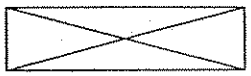


1a Place unused weigh boat on pan balance.

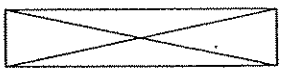
1b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c Weigh out 10 + / - 0.1 grams of soil.

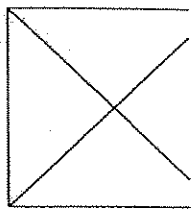
1d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Pan balance

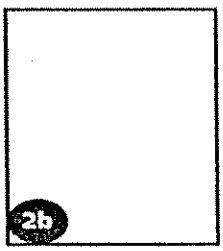


Wooden spatula



Weigh Boat

EXTRACT PAHS

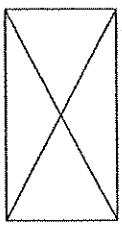


2a Uncap extraction jar and place on flat surface. Without contacting solvent, puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

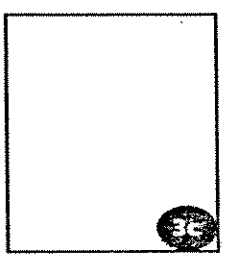
2c Recap extraction jar tightly and shake **vigorously** for one minute.

2d Allow to settle for one minute. Repeat steps **1a -2c** for each sample to be tested.



Sample extraction jar

FILTER SAMPLE

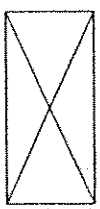


3a Remove lid from extraction jar.

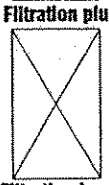
3b Disassemble filtration plunger from filtration barrel.

3c Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer **at least** 1/2 bulb capacity into filtration barrel. **Do not use more than one full bulb.**

3d Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).



Filtration plunger



Filtration barrel

Bulb pipette

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM FOR DETECTION LEVELS OTHER THAN 1 & 10PPM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.

2. At your request, your kit may include extra dilution ampules to reach high detection levels.

3. **EVERY AMPULE PROVIDED MUST BE USED!**

If there are any questions concerning the dilution procedure please call Technical Services before running the samples to help avoid costly mistakes.
1-800-544-8881.

EXAMPLE:

Lowest ppm	Intermediate ppm	Highest ppm	Dilution Ampules

NOTE: Your order may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Label the glass conjugate and plastic antibody coated tubes with a permanent marking pen.
- When using the mechanical pipette always withdraw and dispense below the liquid level. Instructions for operating the Mechanical Pipette are found on page 13.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE AND BUFFER SAMPLE FOR 1 PPM AND 10 PPM DETECTION LEVELS

4a Uncap enough blue buffer, conjugate, and antibody coated tubes for Samples and Standards.

4b Empty a blue buffer tube into each conjugate tube.

4c Assemble new tip onto mechanical pipette.

4d Open 1 and 10 ppm dilution ampules by slipping ampule cracker over tip, and then breaking top at scored neck.

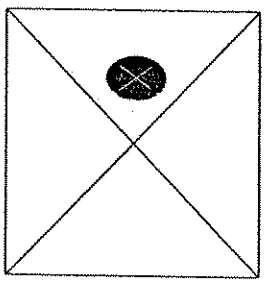
PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

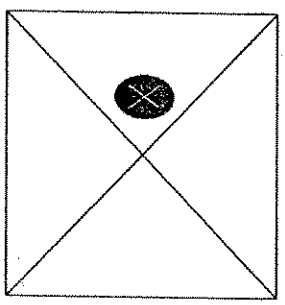
DILUTE AND BUFFER SAMPLE

4e Withdraw 75 µL of filtered sample using mechanical pipette and dispense below the liquid level in 1 ppm dilution ampule. Gently shake ampule for 5 seconds.

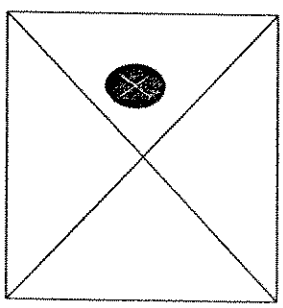
4f Withdraw 75 µL of diluted sample from the 1 ppm dilution ampule and dispense below the liquid level in the 10 ppm dilution ampule. Gently shake ampule for 5 seconds.



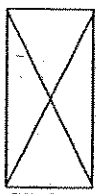
4g Withdraw 75 µL of diluted sample from 10 ppm dilution ampule and dispense below the liquid level in corresponding conjugate tube. Always wipe tip after dispensing into conjugate tube. Withdraw 75µL of 1ppm sample and dispense into corresponding conjugate tube.



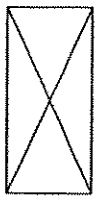
4h Assemble new tip onto mechanical pipette and withdraw 75µl of PAH Standard and dispense below the liquid level in two conjugate tubes. Immediately replace cap on PAH Standard vial.



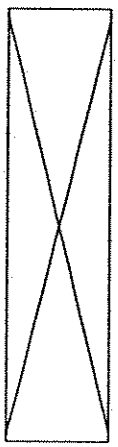
4i Gently shake conjugate tubes for 5 seconds.



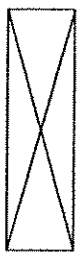
Dilution ampules (1 & 10 ppm)



Plastic Safety Sleeve



Mechanical pipette



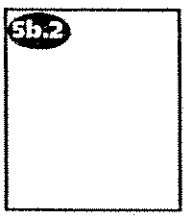
Mechanical pipette tip

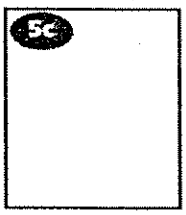
READ BEFORE PROCEEDING

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM CONJUGATE TUBE TO ANTIBODY COATED TUBE





5a. Set timer for 10 minutes.

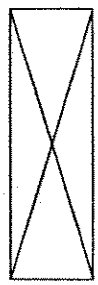
5b. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding conjugate tubes.

2. **Start timer and immediately** invert **all** connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

5d. Disconnect and discard the smaller glass conjugate tubes. [It is not important to worry about drops of liquid adhering to lips of tubes].



Antibody coated tubes (contained in resealable "zip-seal" aluminized pouch)

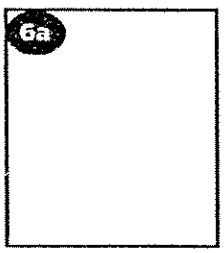
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

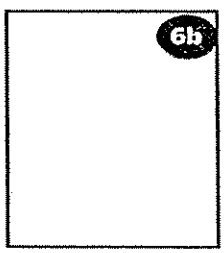
DILUTE AND BUFFER SAMPLE

4e Withdraw 75 µL of filtered sample using mechanical pipette and dispense below the liquid level in 1 ppm dilution ampule. Gently shake ampule for 5 seconds.

4f Withdraw 75 µL of diluted sample from the 1 ppm dilution ampule and dispense below the liquid level in the 10 ppm dilution ampule. Gently shake ampule for 5 seconds.



4g Withdraw 75 µL of diluted sample from 10 ppm dilution ampule and dispense below the liquid level in corresponding conjugate tube. Always wipe tip after dispensing into conjugate tube. Withdraw 75µL of 1ppm sample and dispense into corresponding conjugate tube.



Wash bottle

4h Assemble new tip onto mechanical pipette and withdraw 75µl of PAH Standard and dispense below the liquid level in two conjugate tubes. Immediately replace cap on PAH Standard vial.

4i Gently shake conjugate tubes for 5 seconds.

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

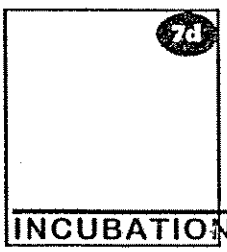
READ BEFORE PROCEEDING

- This phase of the procedure requires critical timing and care in handling the antibody coated tubes.

ADD ENZYME

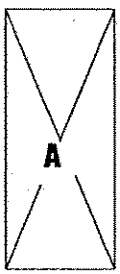
6a Dispense first drop from enzyme dropper into liquid waste container.

Note: before dispensing drops, tap capped tip on hard surface to avoid dispensing air bubbles.

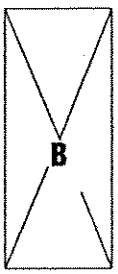


6b Dispense 3 drops of enzyme into each blue buffer tube by squeezing the dropper.

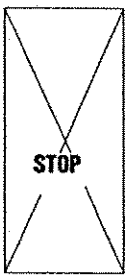
6c Shake buffer tubes for 5 seconds.



Substrate A



Substrate B



Stop

INCUBATION

7a Set timer for 10 minutes.

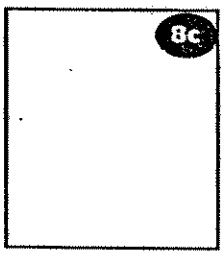
7b Start timing and immediately pour solution from each blue buffer tube into appropriate antibody coated tube.

7c When pouring is complete, gently shake all 4 tubes for 5 seconds.

PHASE 4 INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



8a Wipe outside of all antibody coated tubes.

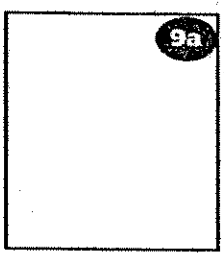
8b Place both Standard tubes in photometer.

8c Switch tubes until the photometer reading is negative or zero. Record reading.

If reading is greater than - 0.3 in magnitude , results are outside QC limits. Retest the sample(s).

8d Remove and discard tube in right well. The tube in the left well is the more conservative standard and should be used.

MEASURE SAMPLE



9a Place 1 ppm tube in right well of photometer and record reading shown on display.

If photometer reading is negative or zero, PAHs are present.

If photometer reading is positive, concentration of PAHs are less than 1 ppm.

9b Place 10 ppm tube in right well of photometer and record reading shown on display.

If photometer reading is negative or zero, PAHs are present.

If photometer reading is positive, concentration of PAHs are less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

How It Works

Standards, Samples, and color-change reagents are added to test tubes coated with a chemical specific to PAHs. The concentration of PAHs in an unknown **Sample** is determined by comparing its color intensity with that of a **Standard.**

Note: PAHs concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PAHs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after its expiration date.
- Each analysis must include 2 **Standards,** with no more than a total of 12 antibody coated tubes.
- Do not exceed incubation periods prescribed by the specific steps.
- Results may not be valid if photometer reading for **Standards** exceed 0.3 in magnitude.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If liquid from the extraction jar, or PAH Standard comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 40° F/4 °C and less than 90° F/32° C.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

System Description

Each PAH RISc Soil Test System contains enough material to perform four complete tests, each at 1 and 10 ppm.

The PAH RISc Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free:

1-800-544-8881.

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PAH-free soil and soil containing 1 ppm and 10 ppm of PAHs were tested with the EnSys® PAH analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PAHs. Either a 1 ppm or a 10 ppm sample that has developed more color than the standard is interpreted as negative. It contains less than the indicated level of PAHs (1 ppm or 10 ppm).

The company does not guarantee that the results with the EnSys® PAH Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

Strategic Diagnostics Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

SDI neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall SDI be liable for incidental or consequential damages resulting from the use or handling of this product.

MECHANICAL PIPETTE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE MECHANICAL PIPETTE

To Set Or Adjust Volume

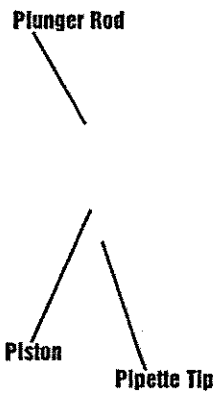
Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "075". Tighten volume lock screw and replace push-button cap.

To Assemble Pipette Tip

Slide larger mounting end of pipette tip onto end of pipette. Holding tip in place, press push-button until plunger rod enters pipette tip. Ensure no gap exists between piston and plunger rod (see illustration).

To Withdraw Sample

With tip mounted in position on pipette, press push-button to first stop and hold it. Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.



To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipette, please refer to your pipette manual.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS SDI EnSys® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of EnSys RISC® immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. **Method blank** - analyze methanol from the extraction jar.

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. 1-800-544-8881.

Data for PAH EnSys® Soil Test

Operator: _____ Date: _____ Location: _____

Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	N O T E S
	Standards	_____ ppm		_____ ppm		

STRATEGIC DIAGNOSTICS INC.

PCB EnSys® 12T SOIL TEST SYSTEM

70203

RAPID IMMUNOASSAY SCREEN

User's Guide

IMPORTANT NOTICE

This method correctly identifies 95% of samples that are PCB-free and those containing 1 ppm or greater of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of polychlorinated biphenyls. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLESHOOTING GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. Solution: Make sure to wash four times vigorously, washing the whole set of 12 tubes at once.

PIPET CALIBRATION

An out-of-calibration pipet may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution*Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipet is out of calibration is if the gold barrel is loose and will turn. (When set on 30 µl there should be about a 1/4 of an inch between the white plunger and the end of the clear pipet tip.)

AIR BUBBLES IN THE PIPET

The presence of air bubbles in the pipet tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution*Quickly examine the pipet tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if necessary.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution*Observe the times in the instructions and mix with sufficient force to ensure that the liquid is homogenous.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

WIPING THE TUBES

Wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PAH kit).

STORAGE AND OPERATING TEMPERATURES

Temperature requirements are very important and should be strictly adhered to. This test kit should be stored at less than 80°F/27°C and operated between 40°F/4°C and 90°F/32°C.

SHELF-LIFE

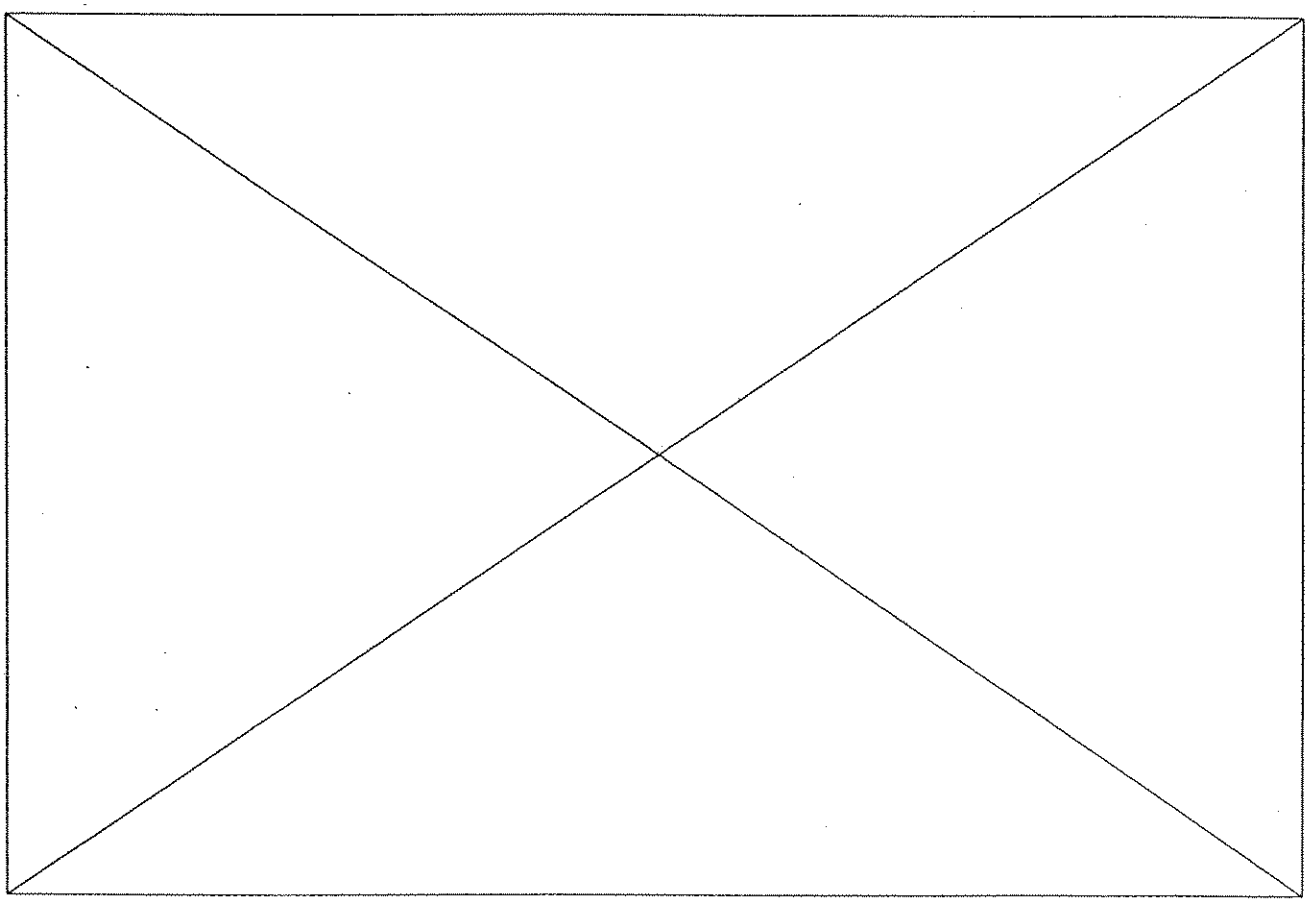
Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- Mechanical pipet tips
- Filter barrels & plungers
- Ampule cracker
- Glass PCB buffer tubes
- Substrate A
- Eppendorf pipet tips
- Bulb pipets
- PCB standard
- Antibody coated tubes
- Substrate B
- Extraction jars
- 1 & 10 ppm dilution ampules
- Stop Solution



Workstation shows components for 3 samples tested at 2 levels

TEST PREPARATION

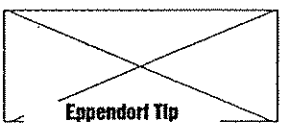
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Do not attempt to run more than 12 tubes, two of which must be standards.
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PCBs at 1 and 10 ppm. See table on page 10 for sensitivity to various Aroclors.

TEST PREPARATION

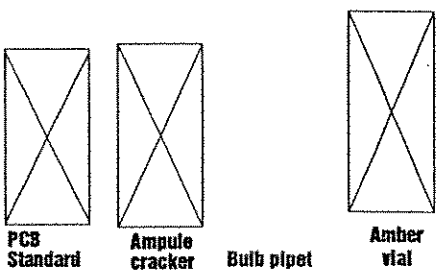
- Label all Eppendorf repeater tips. Tips can be reused for future analyses. Label the first 5mL tip "A", the second 5mL tip "B" and the third 5mL tip "Stop".



- Label the 12.5 mL tip "Buffer".

STANDARD PREPARATION

- Open PCB Standard ampule by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer solution to empty vial with Bulb Pipets.



- Label vial with current date. Standard is usable for 2 weeks. Always cap tightly when finished using standard.

PHASE 1 EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

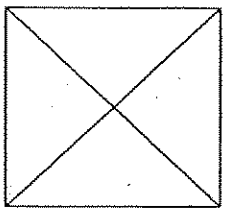
WEIGH SAMPLE

1a. Place unused weigh boat on pan balance.

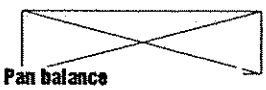
1b. Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c. Weigh out 10 ⁄ 0.1 grams of soil.

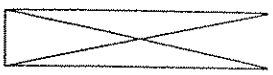
1d. If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Weigh Boat



Pan balance



Wooden spatula

EXTRACT PCBS

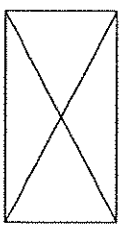
2a. Uncap extraction jar and place on a flat surface. Without contacting solvent puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b. Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

2c. Recap extraction jar tightly and shake **vigorously** for one minute.

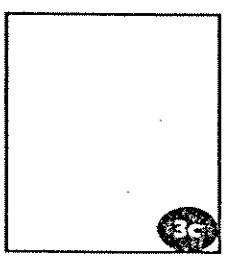
2d. Allow to settle for one minute.

Repeat steps 1a - 2c for each sample to be tested.



Extraction Jar

FILTER SAMPLE

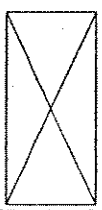


3a. Disassemble filtration plunger from filtration barrel.

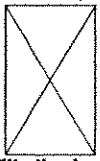
3b. Insert bulb pipet into top (liquid) layer in extraction jar and draw up sample. Transfer **at least ½** bulb capacity into filtration barrel. **Do not use more than one full bulb.**

3c. Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps **3a - 3c** for each sample to be tested.



Filtration plunger



Filtration barrel

Bulb pipet

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SAMPLE DILUTION PROGRAM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.

2. Your kit may include extra dilution ampules to reach high detection levels.

3. **EVERY AMPULE PROVIDED MUST BE USED!**

   If there are any questions concerning the dilution procedure please call SDI Technical Services before running the samples to help avoid costly mistakes. (1-800-544-8881)

EXAMPLE:

NOTE: Your Kit may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

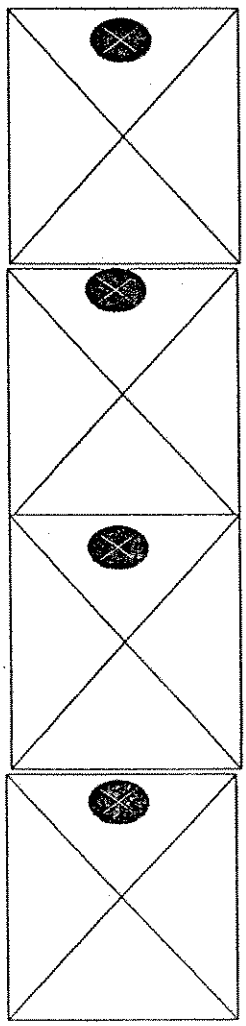
PHASE 2 SAMPLE & STANDARD PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Label the plastic antibody coated tubes with a permament marking pen.
- When using the mechanical pipet always withdraw and dispense below the liquid level.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE SAMPLES AND STANDARDS



4a. Set the Eppendorf Repeater on 4, assemble the "Buffer" tip and fill with Buffer.

4b. Dispense 1 mL of Buffer into each glass buffer tube.

4c. Open 1 and 10 ppm dilution ampules by slipping ampule cracker over top, and then breaking top at scored neck.

4d. Withdraw 60 µL of filtered sample using mechanical pipet and dispense below the liquid level in "1 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

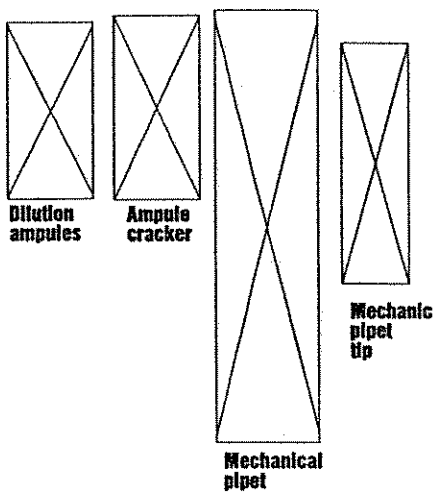
4e. Withdraw 60 µL from the "1 ppm" dilution ampule using mechanical pipet and dispense below the liquid level in "10 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

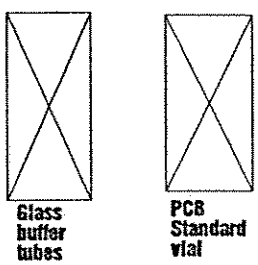
4f. Transfer 60 µL from each dilution ampule into glass buffer tubes. Always wipe tip after dispensing into buffer tube.

4g. Change pipet tip and repeat 4d - 4f for each sample.

4h. Assemble new pipet tip on mechanical pipet and transfer 60 µL from Standard vial into two glass buffer tubes. Immediately replace cap on PCB Standard vial.

4i. Shake all glass buffer tubes for 5 seconds.

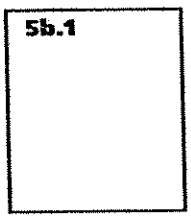


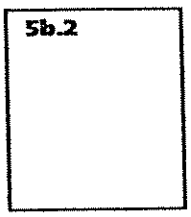


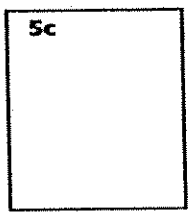
PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM DILUTION TUBE TO ANTIBODY COATED TUBE







5a. Set timer for 10 minutes

5b. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding glass buffer tubes.

2. Start timer and immediately invert all connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

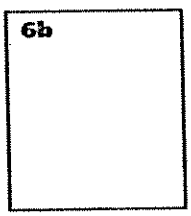
5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

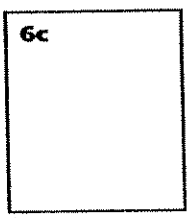
5d. Disconnect and discard the smaller (dilution) tubes. It is not important to worry about drops of liquid adhering to lips of tubes.

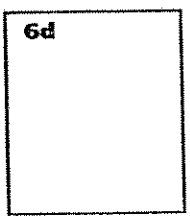
5e. Place conjugate tubes behind antibody tubes in workstation. Remove grey caps and discard.

TRANSFER OF CONJUGATE TO ANTIBODY COATED TUBES

AFTER 10 MINUTES, IMMEDIATELY:







6a. Set timer for 5 minutes.

6b. Working left to right in the workstation:

Start timer and immediately:

Dissolve the conjugate pellets by horizontally connecting the antibody coated tubes and conjugate tubes and **tilt the liquid up to pour it onto the conjugate.**

6c. Return the connected tubes to the appropriate workstation row making sure **the larger (antibody coated) tube is on the bottom. It is important that this step is completed within one minute for all tubes.**

6d. In order to adequately mix solution, **invert** all connected tube pairs **several more times** making sure that the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

6e. Disconnect and discard the conjugate tubes. It is not important to worry about the loss of liquid adhering to lip of tubes.

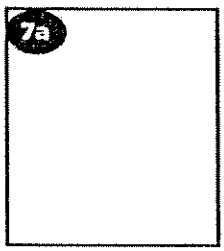
PHASE 3 THE IMMUNOASSAY

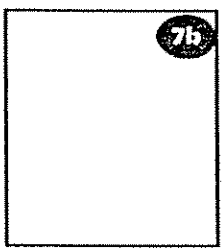
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING
WASH PROCEDURE

- An accurate test requires a vigorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a harmless, dilute solution of detergent.

WASH



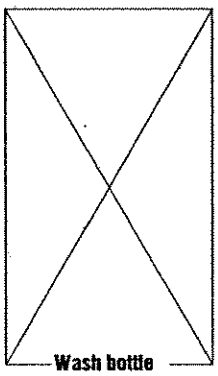


7a After the 5 minute incubation, empty antibody coated tubes into liquid waste container.

7b Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

7c Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.



PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

COLOR DEVELOPMENT

8a. Set the Eppendorf Repeater on 2, assemble the "A" tip and fill with Substrate A (TMB, yellow label).

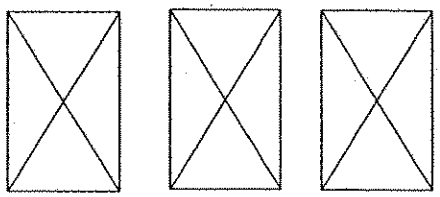
8b. Dispense once (200 µL) into each antibody coated tube.

8c. Set timer for exactly 2 1/2 minutes.

8d. Assemble "B" tip, fill with Substrate B, start timer, and dispense once (200 µL H_2O_2, green label) into each antibody coated tube.

8e. Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.

8f. Assemble "Stop" tip, fill with Stop Solution (red label), and stop reaction at end of 2 1/2 minutes by dispensing once (200 µL) into each antibody coated tube.



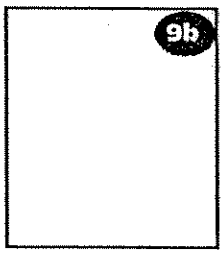
AROCLOR SENSITIVITY

Aroclor	Lowest Detection Level
1248	1.0 ppm
1254	0.5 ppm
1260	0.5 ppm
1242	2.0 ppm
1232	4.0 ppm
1016	4.0 ppm

PHASE 4 ANALYSIS OF RESULTS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



9a. Wipe outside of all antibody coated tubes.

9b. Place both Standard tubes in photometer.

9c. Switch tubes until the photometer reading is negative or zero. Record reading.

If reading is greater than - 0.3 in magnitude (reading is less than or lower than - 0.3), results are outside QC limits. Retest the sample(s). (See QC Example)

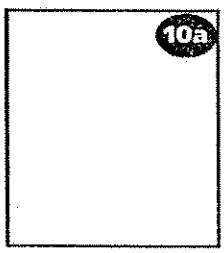
9d. Remove and discard tube in right well. The tube in the left well is the conservative standard.

QC Check Example:

If the photometer reading (with both Standard tubes) is **-0.34 or 0.34**, results are outside the QC limits, and the samples should be retested.

If the photometer reading (with both Standard tubes) is **-0.27 or 0.27**, results are within the QClimits, and testing may proceed.

MEASURE SAMPLE



10a. Place 1 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 1 ppm.

10b. Place 10 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each SDI PCB Ensys® Soil 12 Test Case contains enough material to perform 12 test samples, each at two detection levels.

The SDI PCB EnSys Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-544-8881.

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 1 ppm or greater of PCBs were tested with the SDI EnSys PCB analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

SDI does not guarantee that the results with the PCB EnSys Soil 12 Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown **Sample** is determined by comparing its color intensity with that of a **Standard**.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are Standards) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always follow the procedure in this user's guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.

REPEATER PIPET & MECHANICAL PIPET

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE REPEATER PIPET

To Set Or Adjust Volume

To determine the pipetting volume, the dial setting (1-5) is multiplied by the minimum pipetting volume of the tip.

To Assemble Pipet Tip

Slide filling lever down until it stops. Then raise the locking clamp and insert the tip until it clicks into position. Be sure the tip plunger is fully inserted into the barrel before lowering the locking clamp to affix the tip in place.

To Fill Tip

With tip mounted in position on pipet, immerse end of tip into solution. Slide filling lever upward slowly.

To Dispense Sample

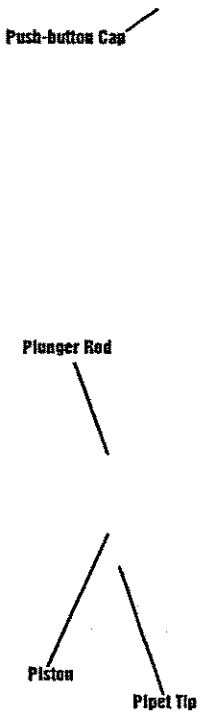
Check the volume selection dial to ensure pipetting volume. Place tip inside test tube so that tip touches the inner wall of tube. Completely depress the pipetting lever.

To Eject Tip

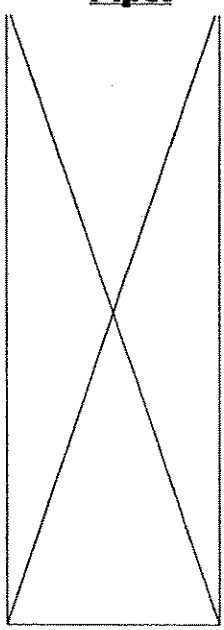
Empty tip of any remaining solution into appropriate container. Raise locking clamp upward, and remove the tip.

For additional information regarding operation and use of repeater, please refer to your Repeater pipet manual.

Mechanical Pipet



Repeater Pipet



HOW TO OPERATE THE MECHANICAL PIPET

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "060". Tighten volume lock screw and replace push-button cap.

To Assemble Pipet Tip

Slide larger mounting end of pipet tip onto end of pipet. Holding tip in place, press push-button until plunger rod enters pipet tip. **Ensure no gap exists between piston and plunger rod.**

To Withdraw Sample

With tip mounted in position on pipet, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipet, please refer to your pipet manual.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS SDI EnSys® 12 TEST SYSTEM

Please read the following before proceeding with field testing.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of fieldanalysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of SDI's EnSys immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. **Method blank** - analyze methanol from the extraction jar.

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. (1-800-544-8881)

Data for SDI PCB EnSys® 12T Soil Test

Operator: _____ Date: _____ Location: _____

Sample ID	ΔOD	OD sample	Interpretation	OD sample	Interpretation	Comments
	Standards	_____ ppm		_____ ppm		

APPENDIX I

SITE MANAGEMENT FORMS

ENVIRONMENTAL EASEMENT AND ENGINEERING CONTROL INSPECTION FORM
Patchogue Former Manufactured Gas Plant

A. General Information:

Inspector:_____ Inspection Date:_____ Last Inspection Date:_____

Title:_____ Affiliation (employer):_____

Street Address: _____ City:_____

State: _____ Zip Code: _____ Telephone: _____Email: _____

B. Site Location:

Site Street Address: _____ Municipality: _____

County: _____ State:_____ Block(s): _____ Lot(s):_____

D. Institutional Controls:

1. Is the current land use consistent with Environmental Easement? Yes _____ No _____ If no, explain below.

_____

_____

2. Do the institutional and engineering controls continue as designed and intended to protect the public health and safety and the environment? Yes _____ No _____ If no, explain below.

_____

_____

3. Was each alteration or disturbance (e.g., penetration) of the engineering control, if any, performed expediently and appropriately to maintain the integrity of the engineering control? Yes ____ No _____ If no, explain below.

_____

_____

4. Do any new standards, regulations, or laws apply to the site that might necessitate the implementation of additional procedures, apart from those specified in the Environmental Easement, to evaluate the protectiveness of the engineering control? Yes _____ No _____ If yes, explain below.

_____

_____

ENVIRONMENTAL EASEMENT AND ENGINEERING CONTROL INSPECTION FORM
Patchogue Former Manufactured Gas Plant

C. Engineering Control Conditions (Use extra sheet provided, if needed):

1(a) Engineering Control Type: _____

(b) Condition of the Engineering Control surface (describe any cracks, disturbances, etc.):

_____

_____

_____

_____

_____

_____

(c) Describe maintenance activities performed, if any, during reporting period:

_____

_____

(d) Are repairs needed? Yes _____ No _____ If yes, describe type, location, and size of repair area. (Mark locations on attached site map. Attach pre-and post- repair photographs on the "Photograph Log". Use additional sheets if necessary.)

_____

_____

_____

_____

2 (a) Engineering Control Type: _____

(b) Condition of the Engineering Control surface (describe any cracks, disturbances, etc.):

_____

_____

_____

(c) Describe maintenance activities, if any, performed during reporting period:

_____

_____

_____

(d) Are repairs needed? Yes _____ No _____ If yes, describe type, location, and size of repair area. (Mark locations on attached site map. Attach pre-and post- repair photographs on the "Photographic Log". (Use additional sheets if necessary.)

_____

_____

ENVIRONMENTAL EASEMENT AND ENGINEERING CONTROL INSPECTION FORM
Patchogue Former Manufactured Gas Plant

I, hereby, certify that the engineering controls were inspected and maintained and its integrity remains so that the remedial action continues to be protective of the public health and safety and of the environment.

Inspector's Name (print or Type):_____ Title: _____
Inspector's Signature: _____ Date: _____

FIGURE 1

SITE NAME:

SITE ID.: _____
INSPECTOR: _____
DATE/TIME: _____
WEll ID.: _____

MONITORING WELL FIELD INSPECTION LOG
NYSDEC WELL DECOMMISSIONING PROGRAM

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back).....		

WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL: .....

	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED..... _____
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable) _____
PROTECTIVE CASING MATERIAL TYPE: ..... _____
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches): ..... _____

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet): ..... _____
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet): ..... _____
MEASURE WELL DIAMETER (Inches): ..... _____
WELL CASING MATERIAL: ..... _____
PHYSICAL CONDITION OF VISIBLE WELL CASING: ..... _____
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE ..... _____
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES..... _____

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):

REMARKS:

Brown AND Caldwell

Upper Saddle River, NJ Office

LOW-FLOW GROUNDWATER SAMPLING FIELD DATA

Well Number:
Sample I.D.: (if different from well no.)

Project:
Personnel:

Date: _____ Time: _____
Weather: _____ Air Temp.: _____

WELL DATA:

Casing Diameter: _____ ❑ Stainless Steel ❑ Steel ❑ PVC ❑ Teflon® ❑ Other: _____
Intake Diameter: _____ ❑ Stainless Steel ❑ Galv. Steel ❑ PVC ❑ Teflon® ❑ Open rock
DEPTH TO : Static Water Level: _____ ft Bottom of Well:_____ft
DATUM: ❑ Top of Protective Casing ❑ Top of Well Casing ❑ Other:
CONDITION: Is Well clearly labeled? ❑ Yes ❑ No Is well clean to bottom? ❑ Yes ❑ No
Is Prot. Casing/Surface Mount in Good Cond.? (not bent or corroded) ❑ Yes ❑ No
Does Weep Hole adequately drain well head? ❑ Yes ❑ No
Is Concrete Pad Intact? (not cracked or frost heaved) ❑ Yes ❑ No
Is Padlock Functional? ❑ Yes ❑ No ❑ NA Is Inner Casing Intact? ❑ Yes ❑ No
Is Inner Casing Properly Capped and Vented? ❑ Yes ❑ No
VOLUME OF WATER: Standing in well: _____ To be purged: _____

PURGE DATA:

METHOD: □ Bailer, Size: ____ ❑ Bladder Pump ❑ 2" Submersible Pump ❑ 4" Submersible Pump
❑ Centrifugal Pump ❑ Peristaltic Pump ❑ Inertial Lift Pump ❑ Other: _____

MATERIALS: Pump/Bailer: ❑ Teflon® ❑ Stainless Steel ❑ PVC ❑ Other: _____
Tubing/Rope: ❑ Teflon® ❑ Polyethylene ❑ Polypropylene ❑ Other: _____

Pumping Rate: _____ Elapsed Time: _____ Volume Pumped: _____
Was well Evacuated? ❑ Yes ❑ No Number of Well Volumes Removed: _____
PURGING EQUIPMENT: ❑ Dedicated ❑ Prepared Off-Site ❑ Field Cleaned

SAMPLING DATA:

METHOD: ❑ Bailer, Size: ____ ❑ Bladder Pump ❑ 2" Submersible Pump ❑ 4" Submersible Pump
❑ Syringe Sampler ❑ Peristaltic Pump ❑ Inertial Lift Pump ❑ Other: _____

MATERIALS: Pump/Bailer: ❑ Teflon® ❑ Stainless Steel
Tubing/Rope: ❑ Teflon® ❑ Polyethylene

SAMPLING EQUIPMENT: ❑ Dedicated ❑ Prepared Off-Site ❑ Field Cleaned
Metals samples field filtered? ❑ Yes ❑ No Method: _____
APPEARANCE: ❑ Clear ❑ Turbid ❑ Color: _____ ❑ Contains Immiscible Liquid
FIELD DETERMINATIONS: See attached form for field parameter data.

DUP : ❑ No ❑ Yes Name: _____
MS/MSD : ❑ No ❑ Yes Name: _____

I certify that this sample was collected and handled in accordance with applicable regulatory and project protocols.

Signature: _____ Date: _____

Brown AND Caldwell

2 Park Way, Upper Saddle River, NJ 07458
Phone: (201) 574-4700 Fax: (201) 236-1607

NJ FIELD LAB ID# 02023
LOW-FLOW GROUNDWATER FIELD DATA SHEET

Project Name:		Project Number:	
Client:		Date:	
Personnel:		Well ID:	
Purge/Sample Depth:		Sample ID:	

Actual Time	Certified Parameters					ORP (mV)	DTW (ft)	Pumping Rate (mL/min)	Comments
	pH	Temp (ºC)	Cond ( )	DO (mg/L)	Turbidity (NTU)				

Certified Sample Information:

Time of Sample: _____ Analyst Signature: _____

Instrument Data:

Manufacturer/Model: _____

Serial No. Unit: _____ Serial No. Handheld: _____

Calibration Date/Time: _____

Are low-flow parameters subject to field lab certification? ☐ Yes ☐ No (not required for CERCLA sites or sites outside of NJ)

If yes, low-flow data must be accompanied by a completed "Field Calibration Record, Horiba U-52" form or equivalent.

APPENDIX J

GENERIC FIELD SAMPLING PLAN

GENERIC
FIELD SAMPLING PLAN

FOR

SITE INVESTIGATIONS

AT

NON-OWNED FORMER MGP SITES

Prepared for:

Niagara Mohawk, A National Grid Company
300 Erie Boulevard West
Syracuse, New York

Prepared by:

Foster Wheeler Environmental Corporation
One Park Place
300 South State Street, Suite 620
Syracuse, New York

NOVEMBER 2002

Site Specific
Revisions Attached: Supplement No. ___ Date ___

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1.0 INTRODUCTION

This generic Field Sampling Plan (GFSP) has been prepared for Niagara Mohawk, a National Grid Company (NM) in response to the Voluntary Cleanup Order (VCO) (Index No. DO 0001 0011) between NM and the New York State Department of Environmental Conservation (NYSDEC). This document is intended to provide guidance for implementation of various types of environmental sampling activities that may be utilized during Site Investigation and/or Remedial Investigations, Interim Remedial Measures, Feasibility Studies, Remedial Designs, and/or Remedial Actions at Non-owned Former MGP sites. The numbers and types of environmental samples to be collected are identified in the detailed respective Site-Specific Work Plans, to which this document is appended. If any discrepancy occurs between the Site-Specific Work Plan and the Generic Work Plan/Field Sampling Plan then the Site-Specific Work Plan will govern.

During the performance of any investigation, references in all work products to dense nonaqueous phase liquids (DNAPL) and/or other MGP impacted media (i.e. soil, water, sediments, etc.) will be made using the terminology and descriptions presented in the U.S.EPA documents entitled ***Ground Water Issue - Dense Nonaqueous Phase Liquids*** (Huling and Weaver; March 1991) and included as Attachment B.

2.0 GENERAL FIELD GUIDELINES

2.1 Underground Utilities

All underground utilities, including electric, telephone, cable TV, sewers, water, natural gas, etc., will be identified prior to any drilling and subsurface sampling. Underground Facilities Protective Organization (UFPO) will be contacted by phone at least 72 hours prior to field activities so their underground utilities can be marked at the Site. Other potential on-site hazards such as sharp objects, known subsurface structures, overhead power lines, and building hazards will be identified during the Site reconnaissance visit.

2.2 Sample Identification

Each sample will be given a unique identification as shown in Table 1. With this type of identification, no two samples will have the same label. Labels or tags identified as shown in Table 1 will be attached to each sample container. Labels or tags will be rendered waterproof by either covering the label with clear plastic wrapping tape or utilizing waterproof material for the tag or label.

2.3 Sampling Equipment

The following is a general list of equipment, which may be necessary for sample collection:

- Stainless steel spoons and bowls for mixing soil and sediment samples;
- Appropriate sample containers (and coolers) provided by the laboratory;
- Sample bottles (kept closed and in the laboratory-shipped coolers until the samples are collected);
- Reagent-grade preservatives and pH paper or meter (or pre-preserved sample containers) for aqueous samples;
- Chain-of-Custody labels, tags, seals, and record forms;
- Logbook, field sampling records, and indelible ink markers;
- Laboratory grade decontamination detergents (such as Alconox, Liquinox, etc.), reagent-grade solvents, and deionized, organic-free water to be used for decontaminating equipment between sampling stations;
- Squirt Bottles;
- Ruler and measuring tape;
- Garbage bags;
- Paper towels and/or baby wipes;
- Buckets, wash basins, and scrub brushes to be used for decontaminating equipment;

- Digital camera or camera and film to document sampling procedures and sample locations;
- Stakes and flagging tape and/or spray paint to identify sampling locations;
- Shipping labels and forms;
- Knife;
- Vermiculite or other packing/shipping material for sample bottles;
- Strapping tape;
- Clear plastic tape;
- Duct tape;
- Aluminum Foil;
- Reclosable plastic bags;
- Ice;
- Portable field instruments, which may include but not be limited to a pH meter, conductivity meter, turbidity meter, dissolved oxygen (DO) meter or multi-parameter flow through cell, photoionization detector (PID), and water level indicator;
- Combustible gas indicator (CGI);
- Poly-sheeting;
- Driller's jars (for archiving samples);
- Polypropylene or stainless steel bailers;
- Poly propylene rope and/or Teflon line; and
- Submersible, peristaltic and/or centrifugal pump and associated tubing.

Other sampling materials and equipment may be utilized as warranted by field conditions encountered at time of sampling and media to be sampled. Appropriate health and safety equipment and PPE, as per the Generic Environmental Health and Safety (EHS) Plan (Volume II) will be used.

2.4 Field Records

The Project Manager will control all field logbooks. Each field logbook will receive a serialized number and be issued to the field operations leader (FOL). Field logbooks will be maintained by the FOL and other team members while in the field to provide a daily record of significant events, observations, and measurements during the field investigation. All entries will be signed and dated at the bottom of each page.

Information pertinent to the field investigation and/or sampling activities will be recorded in the logbooks. The logbooks will be bound with consecutively numbered pages. Entries in the logbook will include, at a minimum, the following information:

- Name and title of author, date and time of entry, and physical/environmental/weather conditions during field activity;
- Purpose of sampling activity;
- Location of sampling activity;
- Name and address of field contact;
- Name and title of field crew members;
- Name and title of any Site visitors;
- Sample media (soil, sediment, groundwater, etc.);
- Sample collection method;
- Number and volume of sample(s) collected;
- Description of sampling point(s);
- Volume of groundwater removed before sampling;
- Preservatives used;
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- Field observations;
- Any field measurements made, such as pH, temperature, turbidity, conductivity, water level, etc.;
- References for all maps and photographs of the sampling site(s);
- Information pertaining to sample documentation such as:
    - Bottle lot numbers
    - Dates and method of sample shipments
    - Chain-of-Custody Record numbers
    - Overnight Shipping Air Bill Number

All original data recorded in Field Logbooks, Sample Tags, and Chain-of-Custody records will be written with waterproof ink. None of these accountable, serialized documents will be destroyed.

If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a single line through the error, placing the initials of the individual making the correction and date next to the crossed out information and entering the correct information. The erroneous information will not be erased. All field personnel will be instructed as to the proper field logging techniques for maintaining the integrity of the documentation.

3.0 EQUIPMENT DECONTAMINATION

3.1 Drill Rig and Backhoe Decontamination

A decontamination pad will be constructed of high-density polyethylene sheeting, no less than 10-millimeters thick, on a prepared surface sloped to a sump. The sump must also be lined and of sufficient volume to contain at least 20 gallons of decontamination water. The size of the pad shall be of sufficient size to contain the fluids generated during the decontamination of on-site equipment. The decontamination pad will be no larger than the back of the drill rig, since the back of the drill rig will be the largest piece of equipment anticipated on-site. Sides of the pad will be bermed so that all decontamination water is contained. Upon completion of all field activities, the decontamination pad will be properly decommissioned. To accomplish decommissioning, all free liquids will be removed from the surface of the High Density Polyethylene (HDPE) sheeting, including the sump area, and allowed to air dry. The HDPE sheeting will then be cut to manageable size, folded or rolled, and placed in the waste container (usually a roll-off container or 55-gallon drum). The earthen material or wood timbers used to construct the containment berm will be inspected to ascertain if the material has come in contact with decontamination liquids during use. If they have, the materials will be disposed in the waste container for subsequent disposal at an appropriate facility. If the materials have not been in contact with decontamination liquids, they may be reused.

All equipment used in intrusive work including backhoe, drilling rig, augers, bits, tools, split-spoon samplers and tremie pipe will be cleaned with a high-pressure hot water or steam cleaning unit and scrubbed with a wire brush to remove dirt, grease, and oil before beginning field work and before leaving the project Site upon completion of the last sampling activity. All tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be avoided. The back of the drill rig and all augers, rods, and tools will be decontaminated between each drilling location according to the above procedures. The backhoe bucket, arm, and any other part of the equipment, which may have contacted excavated soil, will be decontaminated between each test pit location. Tools, augers, and rods will be decontaminated between drilling monitoring wells.

Decontamination water collected in the sump of the decontamination pad will be at a minimum removed from the sump at intervals less than 90% of its capacity and prior to rain events. The liquids will be pumped to a 55-gallon drum and stored in an appropriate satellite storage area. All waste handling will be performed in accordance with waste handling regulations.

Unless sealed in manufacturers packaging, monitoring well casing and screens will be steam cleaned immediately before installation. The screen and casing shall then be wrapped in polyethylene plastic and transported from the designated decontamination area to the well location.

3.2 Sampling Equipment Decontamination

Prior to sampling, all non-dedicated/non-disposable equipment (i.e., bowls, spoons, and bailers) will be washed with potable water and a laboratory grade detergent (such as Alconox). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, 55-gallon drums, etc. The sampling equipment will then be rinsed with potable water followed by a reagent-grade isopropanol rinse and finally a deionized water rinse. Additionally, all equipment used to collect samples for metals analysis will receive a nitric acid rinse followed by a deionized water rinse. Between rinses, equipment will be placed on polyethylene sheeting. At no time will decontaminated equipment be placed directly on the ground. Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

4.0 SITE RECONNAISSANCE AND SCREENING

The following practices, procedures and methods will be utilized in carrying out all field activities if specified in the Site-Specific Work Plan.

4.1 Site Reconnaissance

Following the contact with UFPO and markout of subsurface utilities at the Site, Site reconnaissance will be performed. The Site reconnaissance will be attended by the NM Project Manager, the Consultant Project Manager and/or the FOL, and representatives of the NYSDEC and/or the NYSDOH. During this task, the NYSDEC-approved sampling locations, as outlined in the Site-Specific Work Plan, will be marked in the field with a wooden stake and/or spray paint. Conflicts with the NYSDEC-approved sampling locations, based on the utility markout, will be modified during this visit.

Prior to this Site visit, the property owner and/or company representative will be contacted by the NM Project Manager to meet at the Site. The property owner and/or company representative will be asked if subsurface structures exist on the property and will be asked to identify their locations. Subsurface structures will consist, but are not limited to the following: septic tanks, cesspools, underground irrigation lines, water supply wells, vaults, leaching fields, propane, oil, and/or fuel tanks, underground utilities installed by the owner, drainage lines, etc.

4.2 Metal Detector Survey

A metal detector survey may be conducted using the magnetic cable locator model MAC-51B (or equivalent); to locate unidentified underground utilities and possible buried drums or tanks. The area around each proposed subsurface investigation point may be checked with the MAC-51B (or equivalent) prior to any subsurface investigation. Initially, the locator will be tested on known locations of underground utilities to verify that it is functioning properly.

If there is no indication of buried utilities, drums, or tanks, then subsurface sampling will proceed. However, if the locator indicates the presence of a buried object, activities will not proceed in that location until the type of buried object is determined. If the object cannot be identified from surface or shallow digging, a test pit may be required to determine the identity of the buried object. If a test pit is required, the procedure and scope will be reviewed with the NM Project Manager prior to conducting the work.

The NM Project Manager will keep the property owner or company representative informed of planned Site activities.

4.3 PAH Field Screening

PAH screening of soil samples may be used to determine the extent of PAHs in soil and to optimize the location of samples for confirmatory laboratory analysis.

If PAH field screening is conducted at any Site, then adequate facilities will be provided for proper use of the PAH-specific immunoassay test. The individual responsible for conducting the immunoassay test in the field shall receive instruction in the proper use and storage of the test kit. The instructions for the PAH Field Screening Kit are provided as Attachment A of the Generic Quality Assurance Project Plan (QAPP) (Volume II). The test is a simple procedure designed to test any type of soil sample for PAHs. The test uses a semi-quantitative, colorimetric method that incorporates immunoassay technology. The test is performed using tubes, which are coated with a chemical that specifically reacts with PAHs. To perform the test, the standards, samples and reagents are added in a step-wise manner to the coated tubes. The procedure results in a color change within each tube inversely proportional to the concentration of PAHs. The color in the tubes is read by inserting the tubes in a standardized color photometer. The test consists of the following three steps:

1. Sample Preparation: First, PAHs are extracted from the soil using a solvent. The extract is clarified using a disposable 0.45-micron filter tip.

2. Testing: After sample preparation, the PAH standards and the sample and the enzyme are added to the coated tubes. After 10 minutes incubation, the tubes are rinsed and color-developing reagents are added. Within a few minutes, color development occurs in the tubes.

3. Results Interpretation: The color of the sample tube is compared against the color of the standard tube using a photometer to determine if PAHs are present in the sample. The result will indicate concentrations in three ranges; less than 1 ppm, between 1 and 100 ppm, and over 100 ppm.

4.4 PCB Field Screening

Polychlorinated biphenyls (PCBs) screening of soil samples may be used to determine the extent of possible PCBs in soil and to optimize the location of samples for confirmatory laboratory analysis. The field screening may be conducted using a PCB-specific immunoassay test. The individual responsible for conducting the immunoassay test in the field shall receive instruction in the proper use and storage of the test kit. The instructions for the PCB Field Screening Kit are provided as Attachment A of the Generic Quality Assurance Project Plan (QAPP) (Volume II). The test is a simple procedure designed to test any type of soil sample for PCBs. The test uses a semi-quantitative, colorimetric method that incorporates immunoassay technology. The test is performed using tubes, which are coated with a chemical that specifically reacts with PCBs. To perform the test, the standards, samples and reagents are added in a step-wise manner to the coated tubes. The procedure results in a color change within each tube proportional to the concentration of PCB. The color in the tubes is read by inserting the tubes in a comparative photometer. The test consists of the following three steps:

1. Sample Preparation: First, PCBs are extracted from the soil using a solvent. The

extract is clarified using a disposable 0.45-micron filter tip.

2. Testing: After sample preparation, the PCB standards and the sample are added to the coated tubes using dropper bottles. After 10 minutes incubation, the tubes are rinsed and color-developing reagents are added. Within a few minutes, color development occurs in the tubes.

3. Results Interpretation: The color of the sample tube is compared against the color of the standard tube using a photometer to determine the concentration of the sample. The result will indicate concentrations in 3 ranges; less than 5 ppm, between 5 and 50 ppm, and over 50 ppm. Also, with a dilution samples can be tested for over 500 ppm.

PCB specific screening with the eminase test kits will be utilized on-sites, which have historically been associated with either electrical equipment from a certain time period that employed the use of PCB oils or when records may reflect the use of PCBs at that facility. The test kits will be used as part of an overall analytical program, which will include laboratory analysis of on-site soils.

4.5 Private Water Supply Inventory

If off-site groundwater impacts are detected through the sampling program, or if specifically requested by the NYSDEC, than an inventory of private water supply sources within a one-half mile radius around the project Site will be researched. The research will be conducted by contacting the municipal Water Department (if one exists), the municipal engineer, the NYS Department of Health and consulting the *Atlas of Community Water System Sources*, and/or the United States Geologic Society (USGS).

5.0 SUBSURFACE BORING PROTOCOL

5.1 Drilling Methods and Sample Collection

Overburden

Soil borings, in general, will be drilled with hollow-stem augers or flush-joint casing. When advancing a soil boring, re-entry of the split-spoon sampler into the previously sampled interval shall not be permitted. Hollow-stem augers with center plug will be advanced at two-foot intervals, consistent with the split-spoon sampling pace. Alternative methods may be used at the geologist's discretion with the authorization of NM and NYSDEC. Split-spoon sampling will be conducted in accordance with ASTM Specification D-1586-84 for standard penetration test and split barrel sampling, unless otherwise authorized by the field geologist. Split-spoons will be decontaminated after each sample is collected.

A plywood sheet or other suitable basin (during mud or water rotary drilling) will be placed around the augers during drilling to contain soil cuttings/mud drilling and prevent them from contacting the ground surface. Soil cuttings will be placed in a 55-gallon steel drum or a roll-off container for subsequent sampling and disposal. Decontamination water and drilling mud/water will be placed in tanks and/or 55-gallon steel drums for proper disposal.

Boring Completion Methods

All soil borings will be completed by adding cement/bentonite grout, via tremie pipe, from the bottom of the borehole up to the ground surface as the augers are withdrawn. The grout will be mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite.

Geoprobe® Coring

If prescribed in the Site-Specific Work Plan, Geoprobe® coring will be performed in accordance with the manufacturer's specifications. An assembled Geoprobe Macro-Core® open-tube soil sampler, with a one use dedicated liner, will be driven one sampling interval (approximately 4 feet) into the subsurface then retrieved using a Geoprobe® soil probing machine. The collected soil core will be removed from the sampler along with the liner. The field geologist will classify and sample the soil located within the liner. Upon completion, the excess soil will be placed into a 55-gallon drum for disposal and the inner liner properly disposed. After decontamination, the Macro-Core sampler will be reassembled using a new liner. The clean sampler will then be advanced back down the same borehole to collect the next soil core interval.

Upon completion of sampling, the borehole will be grouted from the base of the borehole to ground surface. As the Geoprobe ® piping is removed from the borehole, grout will be place in the Geoprobe ® piping and allowed to flow out, via gravity, into the void left by the piping.

Procedures for geologic logging and field classification will be as presented in Section 5.2.

Shelby Tube Sampling

Shelby tube samples will be collected in accordance with the latest revision of ASTM D/587. When the desired sampling depth is reached, the hollow-stem auger or casing will be cleaned out using whatever method is preferred so as not to disturb the material to be sampled. The Shelby tube will be lowered to the bottom of the borehole, then advanced (pushed) via pressure without rotation by a continuous relatively rapid motion until 24 inches of penetration is achieved. At the discretion of the field geologist, a period of approximately 10 minutes, measured from the time of insertion, will be allowed to provide for sample adhesion to the tube walls. Prior to removal, the tube may be rotated two complete revolutions to shear the bottom of the sample from the native material.

Upon removal, the field geologist will log the tops and bottoms of the sample for soil classification. Samples recovered via Shelby tube will be preserved in conformance with the latest revision of ASTM D 4220. To preserve the natural moisture content of the samples, the tube ends will be sealed with a minimum of 0.50 inch of paraffin wax. Plastic slip caps will be applied at the ends of the sample tube, taped, then dipped and sealed in wax.

Rock Coring

Conventional or wire-line HX or NX coring will be used if rock drilling is specified in the Site-Specific Work Plan. Prior to drilling at such locations, a minimum 4-inch diameter, temporary steel casing or equivalent will be placed or locked into the top of bedrock. Rock coring will be conducted in accordance with the latest version of ASTM D2113. Upon retrieval, the core will be placed in a core box labeled as follows:

Outer Core Box and/or End Panels

1) Project/Site name
2) Site location
3) Boring/well number
4) Box number
5) Core run number and footage interval
6) Date

Inside Core Box Cover (in columns)

1) Boring/well number
2) Run number
3) Depth interval
4) Actual recovery
5) Rock quality degree (RQD) in percent
6) PID screening results where applicable

7) Comments

In addition, a geologist will be on-site during the drilling operations to fully describe each core, including:

1) Color
2) Thickness of bedding
3) Rock type
4) Additional petrographic information
5) Texture
6) Weathering state
7) Structure
8) Detailed description of discontinuities and fillings
9) Formation name
10) Detailed description of visible impacts
11) Miscellaneous observations

Sample descriptions, PID readings, and drilling locations will be recorded in the field logbook.

5.2 Geologic Logging, Soil Classification and Documentation

The field geologist will log borehole geology in the field logbook and on field forms. All samples collected from the borehole will be classified in accordance with ASTM standards D2487 Standard Method for Classification of Soils for Engineering Purposes and D2488 Standard Practice for Description and Identification of Soils or using the Burmeister Method and classifying the soils using the Unified Soil Classification System. The field geologist will be on-site during the drilling operations to classify/log each sample in the field logbook and/or field forms including:

- Site;
- Boring number;
- Interval sampled;
- Date;
- Initials of sampling personnel;
- Drilling Company's Name;
- Soil type;
- Color;
- Feet of recovery;
- Moisture content;
- Texture;

- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

If no recovery, or limited recovery, is observed in the sample, then a description regarding the lack of sample recovery should be provided on the log of boring, if evidence of an obstruction or equivalent can be identified. If no observable evidence is identified then no opinion or guess should be entered on the log of boring.

Figure 1 presents an example of a log of boring form to be completed. If this form is not utilized, the form used should be approved by the Consultant's Project Manager as well as NM's project manger.

Photo documentation

Photo documentation of the Site activities will be conducted consistently throughout the implementation of the field program. A photographic log will be created and maintained as part of the overall field program. Visually impact materials and/or distinct stratigraphic changes in the soil column will be included in the photographic documentation for the individual Sites.

6.0 MONITORING WELL INSTALLATION AND DEVELOPMENT

Monitoring wells will be installed at the locations identified in the Site-Specific Work Plan. After the completion of drilling and monitoring well installation, all wells will be developed prior to the collection of groundwater samples. The following procedures will be used to install and develop all monitoring wells.

6.1 Monitoring Well Specifications

Monitoring wells installed in unconsolidated deposits that do not penetrate a presumed confining layer will be constructed according to the following specifications:

- PVC or stainless steel 2-inch diameter threaded, flush-joint casing and screens with O-rings will be installed.
- Wells will be screened in the unconsolidated deposits. Screens will be approximately 10 feet in length, and slot openings will be 0.020 inch. Alternatives may be used at the discretion of the field geologist, based on Site-specific geologic conditions.
- A sump, up to 2 feet in length, may be attached to the bottom of the screen to collect dense nonaqueous phase liquids (DNAPLs), if appropriate. A sump will not be installed if DNAPL is not observed in the boring.
- The top of the casing will extend to approximately 2 to 3 feet above ground surface where possible, given Site-specific considerations. Otherwise, flush-mount casings will be used.
- Where appropriate, the annulus around the screens will be backfilled with silica sand (#1 Morie or equivalent), based on Site-specific geologic conditions and screen slot size, to a minimum height of 2 feet above the top of the screen.
- A bentonite pellet/chip seal or slurry (30 gallons water to 25 to 30 lbs. bentonite, or relative proportions) will be placed above the sand pack. The bentonite pellet/chip seal will be installed via gravity and allowed to hydrate for at least 1 hour before placement of grout above the seal. If the bentonite slurry method is used for installation of the seal, then a side discharging tremie pipe will be utilized for the installation of the bentonite seal. Where possible, the bentonite seal will be a minimum of 24-inches in depth, except in those instances where the top of the well screen is in close proximity to the ground surface. In these instances, the well will be completed in accordance with specifications provided by the field geologist, which will incorporate an adequate surface seal into the well design.
- A fine sand pack (Morie 00 or equivalent) approximately 1 foot thick will be placed above and below the bentonite seal to isolate it and to prevent mixing of components.
- The remainder of the annular space will be filled with a cement-bentonite grout up to the ground surface. The grout will be pumped from the bottom up. The grout will be

mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite. The grout will be allowed to set for a minimum of 48 hours before wells are developed.

- Each monitoring well will have an expansion plug or plumbers plug and a 4-inch diameter, steel casing with a hinged, locking cap placed over the monitoring well. The protective casing will extend approximately 2 feet below ground surface and be cemented in place. In some areas, it may be necessary to provide flush mounted casings. All wells will have keyed-alike locks and the keys will be maintained by the NM project manager.
- A concrete surface pad (2 ft x 2 ft x 6-inch) will be sloped to channel water away from the well casing.
- A weep hole will be drilled at the base of the protective standpipe casing to allow any water between the inner and outer casing to drain. If a flush mounted protective casing is installed then a small diameter drainage tube will be installed in the side of the casing discharging to the surrounding subsurface soils.
- The flush mounted monitoring well protective casing will be a minimum 8-inch diameter box or equivalent. All flush mounted well risers will be capped with an expansion plug or plumbers plug.
- The top of the PVC well casing will be permanently marked/notched and surveyed to 0.01 foot, and elevations will be determined relative to a fixed benchmark or datum. The measuring point on all wells, the permanent mark/notch will be on the innermost PVC casing.
- Each outer casing will be permanently labeled using a steel hand stamp or equivalent (i.e. MW-4).

Modification of the above installation procedure will be subject to changes in the field. All field-executed changes will be communicated to the NYSDEC for their discussion and approval, if appropriate.

Based on field conditions and evaluation of the best methodology to ensure the integrity of the seal, the field geologist will select the best method (i.e. bentonite pellet via gravity or bentonite slurry via tremie) to install the bentonite seal above the sand pack.

Figure 3 shows details of an overburden monitoring well construction diagram for wells installed in unconsolidated material. Figure 2 shows details of a monitoring well installed with a flush mounted protective casing.

Figure 4 shows details of a typical double-cased monitoring well construction diagram for wells installed in unconsolidated soils that do penetrate a presumed confining layer. The decision to install double-cased wells will be made on a boring-specific basis by the field geologist. Double-cased wells will be installed when the boring for the monitoring well penetrates a presumed confining layer. The

confining layer shall be defined as a minimum five (5) foot thick, predominantly clay unit which has been shown to be laterally continuous across the Site. In the event the field geologist and NM and NYSDEC Project Managers decide a reasonable possibility exists for contamination to be deposited in deeper, clean zones during the drilling and installation of a monitoring well, the well will be double-cased. The purpose of the steel protective casing will be to minimize the possibility that residual contamination is deposited at the depth of the screened interval during the drilling process.

Monitoring wells that penetrate confining layers will be installed according to the following specifications:

- 6-inch inside diameter (ID) steel outer casings will be installed to a depth of at least 2 feet below the lower limit of observed or measured contamination and/or the confining layer. This casing will be grouted in place with cement to inhibit downward migration of contamination.
- The 6-inch casing will be installed through 6.25-inch ID hollow-stem augers. The augers will be filled with grout prior to their removal to ensure the integrity of the borehole and the grout seal. Then, the 6-inch casing will be installed into the grout and hydraulically pushed approximately 1-foot beyond the bottom of the boring. A 3-foot thick grout plug will be installed at the base of the 6-inch diameter pipe through which the borehole will be advanced. Potable water will be tremied to the bottom of the inside of the casing to dilute the grout, thereby allowing the grout to be more easily pumped out of the casing. The grout, pumped out of the casing, will be drummed and staged with other investigation-derived waste (IDW).
- The cement-bentonite grout remaining in the annulus between the casing and the formation will be allowed to set for at least 24 hours before drilling is continued. The drilling will then continue using 4-inch diameter flush-joint spin casing and potable water. All lubricant water will be containerized.
- The well will be constructed of 2-inch diameter PVC or stainless steel riser pipe and screen, sand pack, bentonite seal, grout, and surface casing as specified for single cased monitoring wells discussed above and in accordance with NYSDEC requirements. The bentonite seal may consist of pellets or a bentonite slurry mixture in proportions relative to 30 gallons of water to 25-30 pounds of bentonite. The grout mix will consist of 30 gallons water to three 94-pound bags of cement and 25 pounds of granular bentonite.

Monitoring wells to be installed as open holes in bedrock will be installed according to the following specifications:

- Advance each boring to the top of the bedrock surface. Borehole advancement will be conducted using 6¼-inch inner diameter (ID) continuous flight hollow-stem augers in 2-foot intervals, to permit the continuous collection of subsurface soil samples with carbon steel split-spoon samplers in accordance with Section 5.1. Confirmation of the

bedrock surface depth will be based upon split-spoon and hollow stem auger refusal.

- Overbore the borehole to a 12-inch diameter borehole, in which to install a temporary 10-inch carbon steel overburden casing to bedrock, utilizing an appropriately sized tri-cone roller bit or thin wall bit. A 3–foot thick grout plug will be installed at the base of the 10-inch diameter pipe through which the borehole will be advanced, if appropriate.
- Subsequent to temporary casing installation, continue borehole advancement into the bedrock to a depth of 5 feet below the bedrock surface, first using the rock coring method for logging (see Section 5.1) and then overboring with a 9-inch outer diameter (OD) tri-cone roller bit via the water rotary method.
- Set a permanent 6-inch carbon steel casing 5-feet into the competent bedrock by the spin casing method.
- Backfill the annular space around the well casing with bentonite/cement slurry to the surface. The ratio of cement to bentonite for grouting will be approximately 30 gallons of water to three 94-pound bags of cement to every 25 pounds of granular bentonite.
- Remove the 10-inch temporary casing during pressure grouting. Allow grout to cure for at least 24 hours.
- Continue coring and then drilling in the borehole to the maximum anticipated total depth (i.e. 10 feet below the point where groundwater was encountered) and/or the depth where fracture zones indicate sufficient yield, first using the rock coring method and then overboring utilizing the water rotary method and a 5-inch OD tri-cone roller bit or equivalent.
- Complete the open hole monitoring well with a protective locking stick-up or flushmount box installed in a concrete pad as per Section 6.1.
- If the borehole extends to a depth greater than 25 feet below the bottom of the surface casing (due to depth and/or yield of groundwater), construct the monitoring well using 10 feet of 2-inch diameter Schedule 40 PVC or Schedule 5 stainless steel wire wound screen (0.010-inch slot or a slot size appropriate to the formation) and 2-inch diameter Schedule 40 PVC or Schedule 5 stainless steel riser pipe. For non-flushmounted wells, at least 2 to 3 feet of riser pipe must extend above the ground surface. Flushmounted wells will only be installed in high traffic areas, such as roadways, sidewalks, etc.
- Backfill the annular space to a minimum height of 2 feet above the top of screen with a sand pack. The sand pack shall be Morie #1 silica sand or equivalent (based on Site-specific geologic conditions and screen slot size). The remaining annular space will be filled with bentonite/cement grout up to the ground surface. The ratio of cement to bentonite for grouting will be approximately 30 gallons of water to three 94-pound bags of cement to every 25 pounds of granular bentonite.

- Complete the constructed monitoring well as described with a protective locking stickup or flushmount box installed in a concrete pad as per Section 6.1.

Modification of the above installation procedure will be subject to changes in the field. All field-executed changes will be communicated to the NYSDEC for their discussion and approval, if appropriate.

Characteristics of each newly installed well will be recorded on the appropriate well construction diagram. Each well will be identified with a well number placed on the inside of the well cap and on the outside of the protective casing or outside flush-mount cover. Each separate source of potable water used for the drilling process will be sampled once for TCL/TAL compounds.

6.2 Monitoring Well Development

After a minimum of 24 hours after completion, the monitoring wells will be developed by one or a combination of the following techniques:

- Surging;
- Bailing;
- Using a centrifugal pump and dedicated polyethylene tubing;
- Positive displacement pumps and dedicated polyethylene tubing, and/or
- Other methods recommended by the field geologist and approved by the NM and NYSDEC Project Managers.

Development water will initially be monitored for organic vapors with a PID. In addition, the development water will be observed for the presence of non-aqueous phase liquids (NAPLs) or sheens. The development water will be contained in a tank and/or 55-gallon steel drums on-site. The purge water will be disposed of in accordance with NYSDEC requirements. The wells will be developed until the water in the well is reasonably free of visible sediment (<50 NTU if possible) or until pH, temperature and specific conductivity stabilize, assuming a minimum of 10 well volumes of water has been removed from the monitoring well during development. In no case will well development exceed 8 hours per well. Following development, wells will be allowed to recover for at least one week before groundwater is purged and sampled. All monitoring well development will be overseen by a field geologist and recorded in the field logbook.

6.3 In-Situ Hydraulic Conductivity Testing

In-situ hydraulic conductivity testing may be performed on selected monitoring wells as indicated in the Site-Specific Work Plan to obtain estimates of groundwater velocities and potential groundwater recovery rates for the aquifer. The objective of the hydrogeologic testing is to determine the hydraulic properties of the aquifer in the vicinity of the Site.

Slug tests may be conducted in selected monitoring wells utilizing the rising or falling head slug test technique. Rising head tests can be performed in unconfined and confined aquifers. Falling head tests

should only be performed in confined aquifers. The slug tests will be performed by subjecting water-bearing units in the screened interval to a stress caused by the sudden displacement of the water level within the well. The rising head tests will be conducted as follows:

- Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 3.2.
- Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electric sounder (water level indicator) and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
- A weighted slug of known volume will be inserted gently into the well below the water table. The water level will be measured until the water level returns to static conditions.
- The slug will be suddenly withdrawn from the well and the water level recovery will be monitored at appropriate intervals until recovery is complete and stabilized.
- Wells, which were bailed dry during development, may not be able to provide meaningful data through slug tests. Tests will be terminated in wells which do not recover significantly (>80% of static level) within a certain amount of time, at the discretion of the field geologist. These wells will be bailed dry and their recovery measured with an electronic water level indicator.

The falling head tests will be conducted as follows:

- Slugs and other downhole equipment will be decontaminated before and after each test by methods described in Section 3.2.
- Prior to conducting each slug test, the static water level in the well will be measured to the nearest 0.01 foot. Water levels will be measured during the test with an electronic sounder (water level indicator) and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
- A weighted slug of known volume will be quickly inserted into the well below the water table. The water level will be measured until the water level returns to static conditions.
- The test will be terminated in wells which do not recover significantly (>80% of static level) within an unspecified time, at the discretion of the field geologist.

The slug test data will be analyzed using the Cooper, Bredehoeft, and Papadopulos (1967) type curve method or the Bouwer and Rice (1976, 1989) method. The Cooper et al. analysis assumes that the well penetrates a confined aquifer, and the Bouwer and Rice method applies where unconfined conditions are prevalent.

6.4 Well Abandonment

Monitoring wells installed in unconsolidated material will be abandoned in the following manner:

- Remove the protective casing and concrete pad.
- Over drill the well casing using hollow-stem augers or casing to at least one foot below the depth of the boring/well as indicated in the soil boring log.
- Remove the well casing from the hole. If the casing cannot be removed while the augers are in place, cutoff the casing at least two feet, and if possible five feet, below the ground surface.
- Add cement/bentonite grout via tremie pipe from the bottom of the augers as the augers are withdrawn.
- If the well casing cannot be overdrilled and removed, the well casing will be filled with cement/bentonite grout from the bottom up using a tremie pipe. The grout mixture will be as specified for the well installation (see Section 6.1).
- Add grout to the point where the casing was cut off. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

Monitoring wells installed in Consolidated (bedrock) or open holes will be abandoned in the following manner:

- Remove the protective casing and concrete pad.
- Add cement/bentonite grout via tremie pipe from the bottom of the well up to the ground surface. The grout mixture will be as specified for the well installation (see Section 6.1).□
- Add grout to the point where the casing was cut off. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

6.5 Packer Testing

Attachment A presents the packer test procedures to be used in the event the hydraulic conductivity of a discrete bedrock zone is required for the purpose of determining the well screen interval of bedrock wells. Down-hole packer equipment will be decontaminated following the procedures in the FSP (see Section 3.1) prior to use at each location and prior to demobilization.

7.0 TEST PIT EXCAVATIONS

When specified in the Site-Specific Work Plan, test pits will be excavated using a rubber-tired or track backhoe. In the event deep excavations are anticipated, a track hoe will be utilized. Locations of test pits, if proposed in the Site-Specific Work Plan, will be finalized in the field, based on the location of potential source areas and existing underground utilities. If the prospective test pit location is covered by asphalt or concrete, the area will be saw cut prior to excavation. During excavation activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring will be conducted in accordance with the Generic EHS Plan (Volume II). Test pit materials will be logged, as well as photographed for future reference. Material removed from the test pit will be placed on polyethylene sheeting. Should sampling of excavated material be performed, samples will be collected with a decontaminated or a new disposable sampling tool, or equivalent, from the center of the backhoe bucket. Upon completion, the material from the test pit will be placed back in the excavation in the reverse order in which it was excavated. The location and size of the test pit will be measured and described in the field logbook.

Visually clean soils, such as surface soils, will be segregated from soils that may be impacted. The visually clean soils will be used to cover the impacted soils/source materials when placed back in the excavation. At a minimum, the top two feet of back filled soil will be visually clean. If the original (top) two feet of soil is impacted or some portion of it is impacted then the soil will be replaced and/or supplemented with certified clean fill. Test pits will be backfilled as soon as possible after completion and in general prior to the cessation of activities at the end of the day. The closure of individual test pits, prior to work cessation at the end of the day, will be performed on a case by case basis utilizing criteria for the maintenance of safe working and overall Site conditions. For gravel roadways and parking areas, the backfill will be tamped down in 18-inch lifts. A 6-inch layer of clean run-of-crush gravel will be tamped in-placed as the final lift. For test pits located in asphalt-covered areas, the surface will be replaced with cold or hot asphalt mix, compacted by rolling, and trimmed flush with the adjoining surface. Test pits located in grass covered areas will be returned to original grade and reseeded. Following restoration of the excavation, the test pit will be staked/marked to facilitate subsequent location by surveying crews.

7.1 Underground Utilities

Potential for encountering underground utilities is part of any subsurface investigation, where test pitting will be utilized as part of the investigation. When performing test pitting in areas of suspected live underground utilities, the test pits will be advanced by hand digging to a depth of five (5) feet below ground surface to confirm the location of the live utility. If investigation of abandoned underground utilities is required, then the parameters of the investigation will be specified in the Site-Specific Work Plan.

If an abandoned under ground pipe/structure, associated historically with the former MGP operations, is encountered during the test pitting operation, then excavation activity will cease until the pipe or underground structure can be adequately investigated. The investigation of the piping will include the

description of the pipe/structure construction, material, condition, orientation, dimension, and contents of the pipe/structure, if possible. If the piping/structure interior can not be readily accessed then penetration of the underground utility may be necessary. Penetration of any underground utility should be conducted with the utmost care and consideration given for the utilization of proper tools (spark proof, beryllium coated, etc) for the task at hand. Once the interior of the pipe is accessible then a sample will be taken of the pipe contents, and sent to a laboratory for analysis.

If prior to initiation of test pitting activities, a live underground utility is identified in the area of anticipated test pitting, then the live underground line, if feasible, will be shut down. Consideration must be given to impacts to the facility operations prior to shutting down any active utility. (See the lockout tag out procedure section of the Generic HSP).

If during test pitting activities an unexpected live underground utility is encountered, excavation will cease, the orientation and dimensions of the underground utility will be recorded, and if possible, the live utility will be shielded from damage and test pitting will continue. If shielding is not possible then the test pit will be back filled and a new test pit attempted in the general vicinity of the initial location. When performing excavation activities next to a live underground utility, care will be taken not to undermine or impact the operation of the live underground utility. If a pipe or underground utility is accidentally severed, the owner of the utility, then NM, will immediately be notified. Liquid flows or electricity will be shut off immediately and appropriate repairs initiated as soon as possible. If a release of liquid occurs, the Consultant PM will notify NM who will then notify NYSDEC. All appropriate response actions will be implemented.

8.0 GROUNDWATER SAMPLING

The following is a step-by-step sampling procedure to be used to collect groundwater samples from the monitoring wells. Well sampling procedures will be recorded on the form shown in Figure 5. Sample management is detailed in the Generic QAPP (Volume II).

- Groundwater samples will not be collected until, at minimum, one week following well development.
- Prior to sampling, measure the static water level from the surveyed well elevation mark on the top of the PVC or stainless steel casing with a decontaminated water level probe. The elevation of nearby surface water bodies will also be recorded using bulkheads, culverts, or other convenient structures as reference points in which the elevation is known. These relative measurements will be used to aid with interpreting the relationship between observed surface water and groundwater fluctuations. Record time, date, and measurement to nearest 0.01 foot and record in the field logbook.
- Decontaminate all field test equipment and meter probes prior to use on-site.
- Prior to collecting a round of groundwater elevations an oil/water interface probe will be used to determine the presence of LNAPL and DNAPL in the well.
- A round of groundwater elevations will be collected prior to the start of sample collection. The measurement at each well location will be made from the top of the PVC or stainless steel casing with a water level probe. The measurements will be made in as short a time frame as practical to minimize temporal fluctuations in hydraulic conditions.
- Place a plastic sheet on the ground to prevent contamination of the bailer rope and/or the tubing associated with the purging (pump) equipment.
- Purge the well by removing a minimum of 3 well volumes or at least one volume of saturated sand pack, whichever is greater or use the low flow sampling procedures below. Purging will be conducted with a teflon, stainless steel or disposable polyethylene bailer, or a centrifugal, submersible, peristaltic, or whale pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist, and with the prior approval of NM and NYSDEC. Purging of the well to stabilized parameters may be performed at between 100 to 500ml/min. If the well goes dry before the required volumes are removed, the well may be sampled when it recovers sufficiently.
- Collect volatile organic analyte (VOA) or BTEX samples with Teflon, stainless steel or dedicated polyethylene bailers lowered by a dedicated polypropylene and/or Teflon line or other methods as indicated. TCL SVOCs, PAHs, pesticide/PCBs, TAL metals, natural attenuation parameters, and other non-conventional parameters may be collected with Teflon, stainless steel, or dedicated polyethylene bailer or a

submersible, or peristaltic pump using the low-flow sampling technique. Low flow well sampling will be at a rate less than or equal to 100ml/min.

Low-flow sampling procedures may be utilized to collect samples for metals analysis if sample turbidity is excessive. Low flow sampling will be performed according to USEPA (1998) guidance. The pump should be capable of throttling to a low flow rate suitable for sampling.

- Measure temperature, pH, turbidity, DO, and conductivity, at 5 to 10 minute intervals. When the parameters stabilize over 3 consecutive readings, sampling may commence. Record results in the field logbook prior to sample collection.
- Fill sample containers for VOCs or BTEX first. Sample containers for SVOCs and other analytes are then filled.
- After all samples are collected, dispose of polypropylene line and bailer, or other dedicated disposable sampling equipment.

9.0 SURFACE WATER SAMPLING

Surface water samples will be collected at the locations indicated in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). A decontaminated stainless steel or glass cup may be used to collect the water for these samples or the sample bottles may be directly dipped into the water. At no time will a sample jar, which contains preservative, be submerged in the sampling media. The sample should be collected from mid-depth by submersing the sampling device or sample container to a mid-depth position and opening the container and allowing it to fill. If this methodology does not work effectively then an alternative sampling device (i.e. bacon bomb etc) can be utilized. The stainless steel or glass cup will be decontaminated following the procedures outlined in Section 3.2. Surface water samples will be collected downstream first, and then progressing in an upstream direction. If sediment sampling is to be performed in conjunction with surface water sampling at corresponding locations, the surface water sample will be collected prior to the sediment sample.

Surface water flow measuring techniques will vary greatly based upon the existing field conditions. A discussion regarding the investigative techniques for collection of surface water flow measurements will be discussed in detail in the Site-Specific Work Plan.

All Field data will be recorded in the logbook and on the sample log sheet (Figure 6).

10.0 SURFACE SOIL SAMPLING

Surface soil samples will be collected at the locations indicated in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). Samples will be collected using decontaminated stainless steel equipment or disposable sampling equipment. If the selected sampling location is in a vegetated area, the vegetation will be removed over a one square foot area prior to sample collection. The sample will be collected from within the top 2-inches of the exposed ground surface. Samples will be collected by hand digging into the soil with a pre-cleaned stainless steel trowel or a disposable sampling tool. All samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory. Sample containers for volatile organic analysis will be filled first. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated steel trowel or disposable scoop. This composite sample will be analyzed for all remaining parameters identified in the Site-Specific Work Plan.

All samples collected for analysis will be placed immediately into laboratory sample jars and properly stored in a cooler with ice to 4°C before transport to the laboratory.

Duplicate samples will be collected at the frequency detailed in the Generic QAPP by alternately filling two sets of sample containers. Composite samples may be required to obtain a sufficient soil volume.

In addition, surface soil samples will be described by including:

- Site;
- Location number;
- Interval sampled;
- Date;
- Initials of sampling personnel;
- Soil type;
- Color;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

11.0 SUBSURFACE SOIL SAMPLING

11.1 Samples for Laboratory Analysis

Subsurface soil samples selected for laboratory analysis will be obtained from a standard 2-foot split-spoon or Geoprobe ® samplers and placed in the appropriate containers provided by the laboratory. The soil samples will be collected from the 2-foot sampling interval (assuming full recovery) of the split-spoon. Additionally, the Geoprobe ® methodology will utilize the standard 2-foot sampling interval. Sample containers for volatile organic analysis will be filled first. Samples for volatile analysis will be collected or biased toward the collection of that portion of the sample that exhibits the highest PID reading or as otherwise detailed in the Site-Specific Work Plan. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel bowl with a decontaminated stainless steel trowel or disposable scoop.

All samples collected for analysis will be placed immediately into sampling containers provided by the laboratory and properly stored on ice to 4°C before transport to the laboratory. Sample management is detailed in the Generic QAPP (Volume II). In addition, a geologist will be on-site during the drilling operations to fully describe each sample including:

- Soil type and sorting;
- Color;
- Feet of recovery;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations.

Duplicate samples will be collected at the frequency detailed in the Generic QAPP by alternately filling two sets of sample containers.

11.2 Geotechnical Testing

When identified in the Site-Specific Work Plan, laboratory geotechnical testing will be performed on selected soil samples in accordance with appropriate ASTM standards. Geotechnical analysis will be performed on soil samples collected in Shelby tubes or in glass sampling containers including, but not limited to, the following tests: grain size and sieve analysis, total organic carbon, permeability, specific gravity, Atterberg Limits, porosity, moisture content, and bulk density.

12.0 SEDIMENT SAMPLING

Proposed sediment sampling locations are identified in the Site-Specific Work Plan. Sample management is detailed in the Generic QAPP (Volume II). Sample locations in surface waterways will be marked along the bank prior to sampling. For all sample locations, the distance from the waterline to the sample location will be measured and recorded in the field logbook. Sediment samples will be collected from the furthest downstream point, progressing toward the furthest upstream sampling location. Following the completion of sampling the sediment locations will be marked along the shoreline for subsequent location by a survey crew.

12.1 Shallow Sediment Samples

Shallow sediment samples collected in shallow water will be collected with a Wildco core sampler, clam shell, lexane tubes, hand auger, vibracore or split-spoon sampler. Where possible, rocks and vegetative material will be discarded, and care will be taken to retain fine materials, which tend to disperse when disturbed. Sampling personnel will stand downstream of the sampling point to minimize disturbance of the bottom sediments during collection. Equipment will be decontaminated between samples following procedures outlined in Section 3.2. Field data will be recorded on the field sampling records. Surface sediment samples will be collected from a depth interval of 0 to 6 inches (0 to 15 cm) using these same procedures as outlined above. Sediments, which are located near shore and are not submerged, will be collected with a decontaminated trowel or disposable sampling tool.

12.2 Deep Water Sediment Samples

Sediment sampling in deeper water and samples requiring retrieval from deeper depths will be obtained using a barge-mounted drilling system or similar watercraft. Either a tripod and cat-head assembly or a Vibracore system will be used on the barge to advance the sampling apparatus into the bottom sediments. The tripod and cat-head assembly will be equipped either with a five-foot long "California" split-spoon sampler or a standard 2-foot long split-spoon sampler for sample collection. Split spoon samplers can be fitted with a sediment sampling head or shoe to ensure adequate recovery of the sample. To keep the hole open for subsequent samples and to minimize cross-contamination, 3-inch spin casing will be advanced, with plug, into the sediment. The spin casing will be advanced in 2-foot increments prior to sampling. The sediment sampler will then be pushed ahead or below the base of the 3-inch spin casing. The spin casing will be pumped free of sediment after each sample is collected. When the casing is free of sediment, it will be advanced 2 additional feet in preparation for the next sample collection.

The Vibracore uses a vibrating motion to advance a barrel and flexible plastic liner to achieve sample collection. A "core catcher" retains the sediment sample upon retrieval. Samples will be obtained by cutting the plastic liner longitudinally using a knife, then the sediment samples will be placed in sampling jars, based on sampling interval compensating for compression.

Sediment samples will be visually classified for texture and screened for the evolution of organic vapors with a PID. Samples will be collected or biased toward the collection of that portion of the sample that exhibits the highest PID reading or as otherwise detailed in the Site-Specific Work Plan. The sediment samples will be collected from the 2-foot sampling interval (assuming full recovery) of the split-spoon. Visible staining or contamination will be noted in the field logbook.

12.3 Sediment Probing

When identified in the Site-Specific Work Plan, sediment probing will be utilized to evaluate the presence of NAPL in the stream bedding. The near-shore sediment probing will be performed on a Site by Site basis. The use of standard visual observance techniques to evaluate the possible presence of sheens on the adjacent water bodies, with out disturbance of the sediments, will be conducted as part of the initial Site Investigation. The Sediment probing activities can be used to supplement the information collected during the initial Site investigation by focusing the probing activities in the area of the observed sheens.

Implementation of a sediment probing investigation will involve the use of multiple sections of 3/8-inch to ½-inch threaded rod and associated threaded female couplings. The threaded rod will be pushed into the sediment at multiple locations in an attempt to disturb the near surface sediments as well as deeper sediments. Upon detection of any sheen a stake will be located along the shoreline to provide a marker for the subsequent location by a survey crew, if require by the Site-Specific Work Plan. Sediment probing can also be used to provide information on the depth of competent material below the soft surface sediments.

Personnel will stand downstream of the sampling point to minimize disturbance of the bottom sediments prior to utilizing the probe. Equipment will be decontaminated prior to use in the stream and post use, following procedures outlined in Section 3.2. Field data regarding the location, depth, odor, and description of the sheen will be recorded on the field logbook.

Sediment probing in deeper water and samples requiring retrieval from deeper depths will be obtained by utilizing a rowboat or similar watercraft.

13.0 AIR MONITORING

13.1 Ambient Air Monitoring

Air monitoring will be conducted with a photoionization detector (PID) and combustible gas indicator (CGI) during all drilling and intrusive activities. The PID will be used to monitor for organic vapors in the breathing zone, borehole, and along the Site's perimeter and to screen samples for analysis. The CGI measures the concentration of combustible gas or vapor in air, indicating the results as a percentage of the lower explosive limit (LEL) of the calibration gas. Action levels are identified in the Generic EHS Plan (Volume II).

PID and CGI readings will be recorded in the field logbook and on the soil-boring log during drilling activities. The PID and CGI are calibrated at least once each day and more frequently if needed with the manufacturer specified calibration gas. The detailed procedures for the PID and CGI operation and calibration are included in the Generic EHS Plan (Volume II).

13.2 Perimeter Air Sampling

Perimeter air sampling may be required during field activities at the Site. Air sampling may be required during test pit excavation and/or during soil excavation/removal associated with an IRM. The basis for such sampling will be outlined in the Site-Specific Work Plan.

Prior to the collection of air samples, air-sampling stations, commonly one (1) upgradient and two (2) downgradient, will be set up at the Site perimeter. The location of these stations is based on daily wind direction during the field activities. A sample station would be setup so that the sample media (Summa canister, high volume sampler, whole air sampler or absorbent tube, etc.) would draw in air from approximately 2 to 4 feet above the ground surface. The sampling media would remain in place a maximum 24-hour period before it is shipped overnight to a laboratory for testing. Air samples are commonly analyzed for BTEX via Method TO-15 (summa canister using a whole air sampler) or TO-17 (using an absorbent tube) and PAHs via Method TO-13 (using a high volume sampler).

13.3 Building Interior Air Sampling for Volatile Organic Compounds (VOC)

When identified in the Site-Specific Work Plan, building air sampling will be performed in the on-site buildings during follow up investigations. Interior air sample collection will be performed in the basement and on the first floor of buildings potentially impacted by on-site contaminants. Various collection techniques will be used based on the type of contamination anticipated and the requirements set forth in the USEPA ERT SOP # 1704, #2121, and # 2119. Interior air sampling will also conform with NYSDOH indoor Air and Analysis guidance and the off-site Laboratory will have the New York State Environmental Laboratory Approval Program (ELAP) certification.

The following procedure will be used for air sampling of VOCs, based on USEPA ERT SOP

#1704:

I. Subatmospheric Pressure Sampling Using a Fixed Orifice, Capillary, or Adjustable Micrometering Valve

- Complete the appropriate information on the Canister Sampling Data Field Sheet.
- A canister, which is evacuated to 0.05 mm Hg and fitted with a flow restricting device, is opened to the atmosphere which contains the VOCs for sampling. The pressure differential causes the sample to flow into the canister.
- This technique can be used to collect grab samples having a duration of 10 to 30 seconds or time-integrated samples having a duration of 12 to 24 hours. The sampling duration is depends on the degree to which the flow is restricted.
- As the pressure approaches atmospheric pressure, a critical orifice flow regulator will cause a decrease in the flow rate.
- Record data on an appropriate data sheet and/or in the field logbook.

The following procedure will be used for air sampling of VOCs, and is based on USEPA ERT SOP #1704:

ii. Subatmospheric Pressure Sampling or Pressurized Sampling Using a Mass Flow Controller/Vacuum Pump Arrangement (Andersen Sampler Model 87-100)

- Complete the appropriate information on the Canister Sampling Data Field Sheet.
- Open a canister, which is evacuated to 0.05 mm Hg and connected in line with the sampler, to the atmosphere, which contains the VOCs for sampling.
- A whole air sample will be drawn into the system through a stainless steel inlet tube by a direct drive blower motor assembly. A small portion of this whole air sample is drawn from the inlet tube by a specially modified inert vacuum pump in conjunction with a mass flow controller.
- The initially evacuated canister is filled by the action of the flow controlled pump to near atmospheric pressure (subatmosphereic pressure sampling) or a positive pressure

not to exceed 25 psig (pressurized sampling).

- A digital time program is used to pre-select sample duration and start and stop times.
- Record data on an appropriate data sheet and/or in the field logbook.

The following procedure will be used for air sampling of SVOCs and/or pesticides/PCBs, and is based on USEPA ERT SOP #2121:

- Using a calibrated sampler, place the sampler in the desired location. The polyurethane foam (PUF) sampler should be in the breathing zone in order to prevent elevated results. It should be located in an unobstructed area, at a distance of twice the height of any obstruction to air flow but no closer than two meters to the obstacle.
- Assemble the sampling system by attaching the legs and magnehelic panel to the platform. Connect the motor to the platform, making sure that the gasket is placed between the motor and the platform. Plug the motor into the timer located on the magnehelic panel. Connect the magnehelic to the venturi with tubing. Adjust the exhaust hose to face downwind of the sampler.
- Put on clean surgical gloves.
- Place the loaded sampling module into the quick release fitting and engage by locking the two levers down securely. Remove the metal cover.
- Record the pump number, location, sample start time, time/counter at the start, and other pertinent information on an appropriate data sheet and/or in the field logbook.
- Plug in the unit. If necessary, adjust the magnehelic gauge by turning the ball valve in order to achieve the reading required to reach the target flow rate. Wait approximately two minutes for the magnehelic reading to stabilize.
- Allow the sampling system to operate for the predetermined duration. If the sampling system is in use for more than 24 hours, the initial calibration should be audited every 24 hours. If the resultant value for the check is +/- 7 percent of the initial calibration, the sampling system must be recalibrated.

The following procedure will be used for air sampling of metals, and is based on USEPA ERT SOP #2119:

- Assemble the sampling trains with clean filter cassettes. Verify the pump calibration by removing the inlet plug from the cassette, attaching a rotameter with Tygon tubing and turning on the sampling pump. Check to make sure all the connections are tight.

- Record the actual flow rate on an appropriate data sheet and/or in the field logbook. Replace the inlet plug until ready to sample.

- Set the sampling pump timer (low volume pumps) for the predetermined sampling time, or record the elapsed timer on the data sheet/logbook. This will be determined based on the type of pump being used.

- Deploy sampling pumps at sampling locations. Remove the cassette cap or inlet plug from the cassette. Sampling for elements can be conducted with the cassettes open-faced (cassette cap removed) or closed-faced (only inlet port plug removed). Open-faced is preferred because it allows even loading of the filter cassette and should be used whenever high particulate concentrations are expected in order to allow greater particulate loading of the filter. Closed-faced sampling is performed when there is a possibility that the sample may be shaken and particulates may be lost.

- Turn on the sampling pump and let it run for the predetermined sampling period.

- After the sampling period is over, verify the sampling period by reading the sample run time (low volume pumps) or by checking the elapsed time on the counter (medium volume pumps). Record the length of sampling time on the data sheet and/or in the field logbook. Turn off the pump.

- Verify the pump calibration by attaching a rotameter with Tygon tubing and turning on the sampling the inlet plug.

- Remove the sampling cassette from the sampling train and insert the outlet plug. Calculate sample volume.

14.0 GEOPHYSICAL AND SOIL GAS SURVEYS

When specified in the Site-Specific Work Plan, geophysical and soil gas surveys will be carried out at the site with the primary objective being to delineate areas of possible subsurface impacts from former MGP operations. Delineation of impacted areas will allow for a more focused and efficient sampling program during subsequent phases. Sampling locations may be located downgradient of potential historical MGP operations areas to determine if these areas act as contaminant sources. Also, boring locations can be adjusted to avoid large subsurface metallic bodies, thereby minimizing the potential for release of hazardous material from buried containers, and avoiding the expense associated with multiple boring attempts due to subsurface refusal. Furthermore, additional valuable subsurface information may be derived from this study, including:

- Delineation of underground structures(i.e. holder, and tar well);
- Mapping of existing site utilities and former MGP utilities; and,
- Detection of underground storage tanks (USTs) and/or other potential contaminant source areas.

If potential historical MGP operations areas prove to act as contaminant sources, the results of the geophysical investigation may also provide important information necessary for an Interim Removal action.

14.1 Geophysical Survey GPR and TDEMI

Two geophysical methods can be used for the geophysical survey: Time-domain Electromagnetic Induction (TDEMI) and ground penetrating radar (GPR). TDEMI can detect ferrous and non-ferrous metallic objects, such as a single 55-gallon drum, at a depth of up to 3 m (10 ft) bgs; GPR can detect both metallic and non-metallic subsurface targets at depths varying from several centimeters up to 20 m (65 ft bgs) or more, dependent upon frequency of induced waves, soil conductivity, and presence of extremely reflective interfaces. GPR can also be utilized to locate void spaces, detect disturbed soil or differential fill, and map Site Stratigraphy.

The TDEMI system utilized at the site will be the Geonics EM61 High Sensitivity Metal Detector or similar equipment. The EM61 is a one-person portable system designed primarily for industrial site assessment. The EM61 is relatively insensitive to nearby surface cultural interferences such as buildings, powerlines, and fences, and has the ability to record digital data at 0.17 second intervals, which translates to a spatial sample density of approximately 0.17 m (0.55 ft) along the ground surface.

The GPR system utilized at the site will be the Geophysical Survey Systems, Inc. (GSSI) SIR-2, or equivalent and will be equipped with both 200 and 500 MHZ antennas. The GSSI SIR-2 is a

monostatic GPR system, in which a single antenna is used as the transmitter and receiver. The antennas are shielded to ensure a high proportion of the energy produced is focused into the subsurface, decreasing noise from surrounding fences, buildings, and other features. The GPR reflection section is displayed in real time as data is acquired, and an analog record is output by an in-the-field printer. Data is also digitally logged to a high-capacity drive at a rate of 32 scans/second, which translates to a spatial sample density of approximately 0.03 m (0.1 ft) along the ground surface.

Geophysical Survey Ground Penetrating Radar (GPR) and Time-Domain Electromagnetic Induction (TDEMI)

The geophysical investigation will encompass all areas suspected of former MGP operations. The survey area will be run over both paved and vegetative cover and will be divided into four (4) subplots ranging in size from 0.2 to 0.5 acres. The EM61 data will be acquired using a Leica system 530 Global Positioning System (GPS), or equivalent equipment, for navigational control. GPS data will be captured in one second intervals, utilizing the real-time kinematic (RTK) mode, which provides centimeter-grade positional accuracy. GPR data will be acquired along a pre-established orthogonal grid system, with line and station spacing appropriate for detection of targets of interest.

Concurrent with geophysical data acquisition, cultural features maps will be developed which will detail the location of potential interferences such as buildings, fences, utilities, etc. These maps will be utilized in the interpretation stage to more accurately assess the significance of geophysical anomalies observed in the data.

TDEMI data will be processed and interpreted using manufacturer-supplied software. TDEMI data will be interpolated to accurate State Name Planar coordinates with appropriate shifts and filters applied, and data extrapolated to a regularly spaced grid system using accepted mathematical methods. These data will then be displayed as high-resolution color maps. Proprietary software will then be utilized to isolate and characterize subsurface anomalies potentially related to steel structures or buried drums.

GPR data will be processed and interpreted using WINRAD and/or GRADIX software packages or equivalent. Processing may include "rubber sheeting" of data to appropriate coordinates, application of appropriate gains and filters, display of color-coded GPR sections, and advanced processing techniques, such as migration and deconvolution. Diffraction hyperbolas or other discrete anomalies will be identified and characterized and compared with locations of EM61 anomalies. GPR anomalies, which occur in areas free of EM61 anomalies can be attributed to non-metallic targets, and may be associated with plastic barrels.

A final report including description of data collected, maps of the geophysical data, and interpretation of these data will be included in the Final Report.

Geophysical Survey Ground Penetrating Radar (GPR) and Time-Domain Electromagnetic Induction (TDEMI) Procedure

The geophysical survey will be conducted using the following procedure:

1. Clear the surface of the area to be surveyed (performed by clearing and grubbing subcontractor). This may include cutting underbrush to a height less than 0.3m (1 foot), removing trees less than 7.5 cm (3 inches) in diameter, removing brush, and mowing grasses greater than 0.6m (2 feet) in height. A sweep for metal objects on the ground surface will be conducted, and surficial metal identified will be noted and removed from the area of investigation.

2. Establish survey control within the investigation area. Survey markers will be installed both within and around the boundary of the survey area, and these points will be utilized to establish and calibrate the GPS base station.

3. Acquire data from each instrument from a test line prior to commencement of each day's activities. This test line will be performed over a known subsurface object or over a pre-placed object (such as a steel pipe).

4. Obtain GPS reading at a known survey point.

5. Begin survey at the southwest corner of the investigation area (or a subdivision of the investigation area) and progress northward (or eastward) until the area boundary or a major obstruction is encountered. TDEMI data will be acquired at a sampling rate of approximately 6 samples per second, which translates to a sample density of 1 sample every 0.17 meters (0.55 feet) based on an average walking pace. GPS data will be acquired concurrently with TDEMI data, at a rate of [1 sample] per second. GPR readings will be acquired at a sampling rate of approximately 32 scans per second, which translates to a sample density of 1 sample every 0.03 meters (0.1 feet) based on an average walking pace.

6. After reaching the grid boundary or obstruction, reverse direction, and acquire survey data in the opposite direction along a parallel line at the following line spacing: 1 meter (3 ft) for TDEMI readings and 2-meters (6 ft) for GPR readings.

7. Continue acquiring data in opposing directions, until the entire investigation area has been covered.

8. Acquire several lines of TDEMI data over a known linear metallic object placed upon the

ground surface. This procedure will allow for accurate time shifting of geophysical data necessary for merging the geophysical and GPS data.

9. Acquire data from the test line subsequent to each day's activities, for quality assurance comparison.

10. Obtain GPS reading at known survey point for QA comparison.

14. 2 Geophysical Survey Magnetometer and FDEMI

A geophysical investigation to delineate areas of possible subsurface impacts can be performed by utilizing two geophysical methods: magnetometry and frequency-domain electromagnetic induction (FDEMI).

Geophysical data will be collected using two instruments: a Geometrics G-858G magnetometer (configured as a vertical gradiometer and including a continuous-recording base station) and a Geonics EM31-MK2 ground conductivity meter or equivalent equipment. Positional data will be verified by utilizing a Leica System 530 GPS system, or equivalent, for navigational control. GPS data will be captured at one second intervals, utilizing the real-time kinematic (RTK) mode, which provides centimeter-grad positional accuracy.

Geophysical Survey Magnetometry and Frequency-Domain Electromagnetic Induction (FDEMI) Procedure

The geophysical survey will be conducted using the following data collection procedure:

1. Clear the surface of the area to be surveyed (performed by clearing and grubbing subcontractor). This may include cutting underbrush to a height less than 1 foot, removing trees less than 3 inches in diameter, removing brush, and mowing grasses greater than 2 feet in height. A sweep for metal objects on the ground surface will be conducted, and surficial metal identified will be noted and removed from the area of investigation.

2. Establish survey control within the investigation area. Survey markers will be installed both within and around the boundary of the survey area, and these points will be utilized to establish positional control, as well as calibrate the GPS base station.

3. Acquire data from a test line prior to commencement of each day's activities. This test line will be performed over a known subsurface object or over a pre-placed object (such as a steel pipe).

4. Set up magnetometer base station.

5. Begin survey at the southwest corner of the investigation area (or a subdivision of the investigation area) and progress northward (or eastward) until the area boundary or a major obstruction is encountered. Magnetometry data will be acquired at a sampling rate of approximately 10 samples per second, which translates to a sample density of 1 sample every 0.1 meters (0.33 feet) based on an average walking pace. FDEMI conductivity readings will be acquired at a sampling rate of approximately 2.5 samples per second, which translates to a sample density of 1 sample every 0.4 meters (1.3 feet) based on an average walking pace. GPS data will be acquired concurrently with geophysical data, at a rate of 1 sample per second.

6. After reaching the boundary or obstruction, reverse direction, and acquire survey data in the opposite direction along a parallel line at the following line spacing: 1 meter for magnetometer readings and 2 meters for conductivity readings.

7. Continue acquiring data in opposing directions, until the entire investigation area has been covered.

8. Acquire several lines of geophysical data for a known linear metallic object placed upon the ground surface. This procedure will allow for accurate time shifting of geophysical data necessary for merging the geophysical and GPS data.

9. Repeatedly (at least 3 times per day) revisit a calibration station and collect data with the EM31, in order to provide for an instrument drift correction.

10. Acquire data from the test line subsequent to each day's activities, for quality assurance comparison.

The geophysical data will be processed and interpreted using manufacturer-supplied software. Data will be interpolated to NYS State Plane coordinates, filtered as appropriate, extrapolated to a grid system, and displayed on maps of the Site.

14.3 Downhole Geophysics

Downhole gamma-ray geophysical logging, if required in the Site Specific Work Plan, will be conducted by a utilizing existing wells or soil borings as they are completed. Gamma-ray logging may be conducted in cased as well as uncased boreholes, and, because clays typically contain a higher

percentage of gamma emitting minerals, can be useful for identification and correlation of clayey zones. The gamma-ray log can provide information on stratigraphic changes in the subsurface soils.

1. Be certain that the well has ample clearance for the gamma probe to pass without obstruction or binding. A dummy cylinder with the same diameter as the gamma log tool may be lowered downhole as a test for obstructions. Downhole may be performed if significant uncertainty exists. Wear appropriate health and safety equipment.

2. Set the tripod over the wellhead and park the mobile unit at a convenient location.

3. Slowly and carefully lower the probe to the bottom of the well with the logger recording the counts per second (cps) of gamma radiation. The descent is a "dry" run until the well bottom is attained.

4. Set the plotter so the gamma-ray logging is recorded on a graph. Set the upward speed at a constant rate. Bring the probe to the surface.

5. If the graph is successfully plotted, perform appropriate decontamination on the probe and the line and proceed to the next logging location.

14.4 Soil Gas Survey

A soil gas survey, if required by the Site-Specific Work Plan, will be performed around the Site to delineate areas of possible subsurface impacts and potential source areas. A sampling grid of approximately 100 feet by 100 feet or depending on the size of the investigation area, will be utilized across a majority of the Site, with soil gas samples collected at the grid nodes. Additional soil gas samples will be collected at 25 foot by 25 foot grid nodes in the vicinity of the potential test pit locations, and at any other additional areas determined during the field investigation (e.g., elevated levels present during real-time sampling, etc.). Actual sampling locations will be adjusted in the field to ensure sample targeting of all suspected areas of subsurface impacts. A field gas chromatograph (GC) will be used to determine sample screening concentrations of volatile organic compounds (VOCs). Water table, barometric, and temperature changes can vary the results.

The FOL or his designee, will be present on-site during active soil gas collection activities. The following soil gas survey activities will occur:

- Location of the soil gas survey locations;
- Comparison of the field GC data with applicable quality assurance data to determine acceptability of results;

- Determination of the need for additional or a reduction in the number of soil gas survey points;
- Supervision of the topographic surveying to locate the sampling points;
- Review of the data analysis and evaluation from the soil gas survey report; and
- Recommendation for movement of the proposed field investigation sampling locations based on the soil gas survey results.

Soil Gas Survey Procedure

1. Record ambient air temperature and barometric pressure.

2. Drill a hole into the soil either by hand auger, rotary hammer, or driven rod (as conditions dictate), to roughly 4 to 5 feet in depth. The depth may be reduced based upon conditions at the Site at the time of sampling; all changes will be noted on Field Change Requests (see Section 13.0 of the QAPP).

3. Insert a probe, slightly smaller in diameter than the borehole, into the hole, and the hole will be sealed by packing soil around the expansion bulb at the probe top. The probe assembly will be selected by the soil gas crew and FOL, to provide the best probe assembly for the Site conditions. A typical assembly would consist of a 1/4-inch O.D. stainless steel probe, approximately 5-feet in length, and Teflon tubing, with a reducing tee and cap attached to the fitting.

4. Ensure/test vacuum with a gauge attached to the probe.

5. Extract soil gas through the probe via a vacuum pump connected to the tubing. Purge approximately 3 to 5 sample volumes prior to sampling to remove any introduced ambient contamination.

6. Remove the soil gas sample with a 500 uL gas-tight syringe or equivalent device, inserted into the tubing in front of the pump. This volume is adequate for achieving the required detection limit of 25 ug/L. If necessary, due to field conditions, the sample can be stored in a pressurized container.

7. Immediately inject the sample into the calibrated GC (see Step 8), and plot the chromatogram. Identify and quantify, based on standard peaks, any contaminants present in the soil gas

sample.

8. Calibrate the GC prior to sample analysis. Initial instrument calibration should consist of a minimum of 3 concentration points (5 points are preferred), to demonstrate the working range and linearity. Linearity will be assumed if the ratio of the area response to the amount injected is constant over the working range (i.e., less than 20 percent Relative Standard Deviation). In addition, an initial verification of a less than 25 ug/L detection limit shall be run.

9. Check the sample probe for contamination between each sample location, by drawing ambient air through the probe via the pump, and checking that the response is not greater than background levels. If necessary, decontaminate the probes using methanol and deionized water, and then air drying.

Calibration standards will be run at the beginning and end of each sampling day, and a method blank shall be analyzed every 12 hours and after any highly contaminated samples to check for carry-over. In addition, an environmental field duplicate will be chosen and analyzed every 20 samples.

15.0 FIELD INSTRUMENTS

All field analytical equipment will be calibrated immediately prior to each day's use and more frequently if required. A calibration log will be created on which all equipment calibration will be

recorded. Further details on calibration, precision, accuracy, etc. are provided in the Generic QAPP (Volume II). The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. If an equipment malfunction is identified during calibration then the malfunctioning equipment will be replaced or repaired within 24-hours or applicable fieldwork will be terminated as necessary until the malfunctioning equipment is repaired or replaced. Records of all instrument calibration will be maintained by the Field Operations Leader (FOL) and will be subject to audit by the Project Quality Assurance Manager (PQAM). Copies of all of the instrument manuals will be maintained on-site by the FOL.

15.1 Portable Photoionization Detector

The photoionization detector (PID) will be equipped with a minimum 10.6 eV lamp. The PID should be capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the volatile organic compounds on the NYSDEC ASP Target Compound List. Calibration will be performed at the beginning and end of each day of use with a standard calibration gas specified by the manufacturer. If the unit experiences abnormal perturbation or erratic readings, additional calibration will be required. All calibration data will be recorded in field logbooks and on calibration log sheets to be maintained on-site by the FOL.

A battery check will be completed at the beginning and end of each working day. If erratic readings are experienced, the battery will be checked for proper voltage. This information will also be recorded in field logbooks and on the calibration log sheets.

15.2 pH Meter

Calibration of the pH meter will be performed at the start of each day of use, and after very high or very low readings. National Institute of Standards and Technology - traceable standard buffer solutions, which bracket the expected pH range, will be used. The standards will most likely be pH of 7.0 and 10.0 standard units. The use of the pH calibration and slope knobs will be used to set the meter to display the value of the standard being checked. The pH meter readings during calibration must be within 0.1 of the reference solution. The calibration data will be recorded on calibration sheets maintained on-site by the FOL.

15.3 Specific Conductivity Meter

Calibration checks using the conductivity standard will be performed at the start of each day of use, after five to ten readings or after very high or low readings. The portable conductivity meter will be calibrated on a daily basis using a reference solution specified by the manufacturer. Readings must be within 5 percent to be acceptable. The thermometer of the meter will be calibrated against the field laboratory thermometer on a weekly basis.

15.4 Turbidity Meter

Calibration using a turbidity standard will be performed at the start of each day of use and after very high or low readings. The portable turbidity meter will be calibrated using a reference solution specified by the manufacturer. The turbidity reading must be within ±2 NTU of the standard to be acceptable.

15.5 DO Meter

Calibration using a DO standard will be performed at the start of each day of use. The portable DO meter will be calibrated using a calibration solution specified by the manufacturer. The DO reading must be within 5% of the standard to be acceptable.

15.6 Combustible Gas Indicator

Calibration of the CGI will conform to the procedures prescribed in the Generic Environmental Health and Safety Plan (Volume II). Calibration will occur at the start of each day of use.

16.0 MANAGEMENT OF INVESTIGATION DERIVED WASTE

During the implementation of field activities, investigation derived wastes (IDW) will be generated at the Site. These IDWs will include the following: soil drilling mud/water, development and purge water, decontamination wash water, PPE, polysheeting, spent decontamination fluids, etc. Following the generation of these IDWs, they will be properly containerized in 55-gallon drums, frac tanks, agricultural poly tanks, and/or roll-off containers. PPE will be bagged and placed in 55-gallon drums. The containers will be properly labeled with the date of generation, the Site name, client name and address, contents of the containers, etc. Upon generation the IDW will be immediately containerized. The containers will be secured at the end of each day at the Site. The containers will be segregated on-site in a temporary fenced area and signs stating "Do Not Enter" will be posted on the fencing. Upon completion of the field activities, the containers will be sampled for disposal characteristics. IDW materials will be removed from the Site and shipped to an approved facility. Waste handling procedures and regulations will be strictly adhered to during all phases of waste handling.

17.0 REFERENCES:

Atlas of Community Water System Sources

Bouwer and Rice, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, Water Resources Research, v. 12, pp. 423-428.

Cooper, Bredehoeft, and Papadopulos, 1967: Response of a Finite Diameter Well to an Instantaneous Charge of Water. Water Resources Research, vol. 3, no. 1, pp. 263-269.

Haling and Weaver, 1991: Dense Nonaqueous Phase Liquids, EPA Groundwater Issue. March, 1991.

Leupold & Stevens, Inc. 1978: Stevens Water Resources Data Book, 3rd Edition.

USEPA, 1998: Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures. 540/5-95/504.

TABLES

Table 1
METHOD FOR IDENTIFYING AND LABELING SAMPLES

LLLL*	LL*	NN*	NN/NNNN*
Site	Sample Type	Sample Location	Depth/Time

Site :

Sample Type: Monitoring Well (MW), Surface Soil (SS), Subsurface Soil (SB), Sediment (SD), Surface Water (SW), Waste Water (WW), Solid Waste (WA)

Sample Number: Number referenced to a sample location map illustrated in the Site-Specific Work Plan.

* L = Letter
* N = Number

FIGURES

Figure 1

LOG OF BORING

(Page 1 of 1)

PROJECT:	DATE STARTED:	GW DEPTH:	
PROJECT NO.:	DATE COMPLETED:	ELEVATION:	
LOCATION:	GEOLOGIST:		
	DRILLER:		
	DRILLING METHOD:		

Depth in feet	RECOVERY	USCS	GRAPHIC	DESCRIPTION	TIME	DATE	PID (ppm)	Sample I.D.	COMMENTS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

LOG OF BORING

(Page 1 of 1)

PROJECT:
PROJECT NO.:
LOCATION:

DATE STARTED: :
DATE COMPLETED: :
GEOLOGIST: :
DRILLER: :
DRILLING METHOD: :

GW DEPTH: :
ELEVATION: :

Depth in feet	RECOVERY	USCS	GRAPHIC	DESCRIPTION	TIME	DATE	PID (ppm)	Sample I.D.	COMMENTS
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

Notes:

FOSTER WHEELER

10-18-2001 P:\Front Street\Boring Logs\Blank BOR

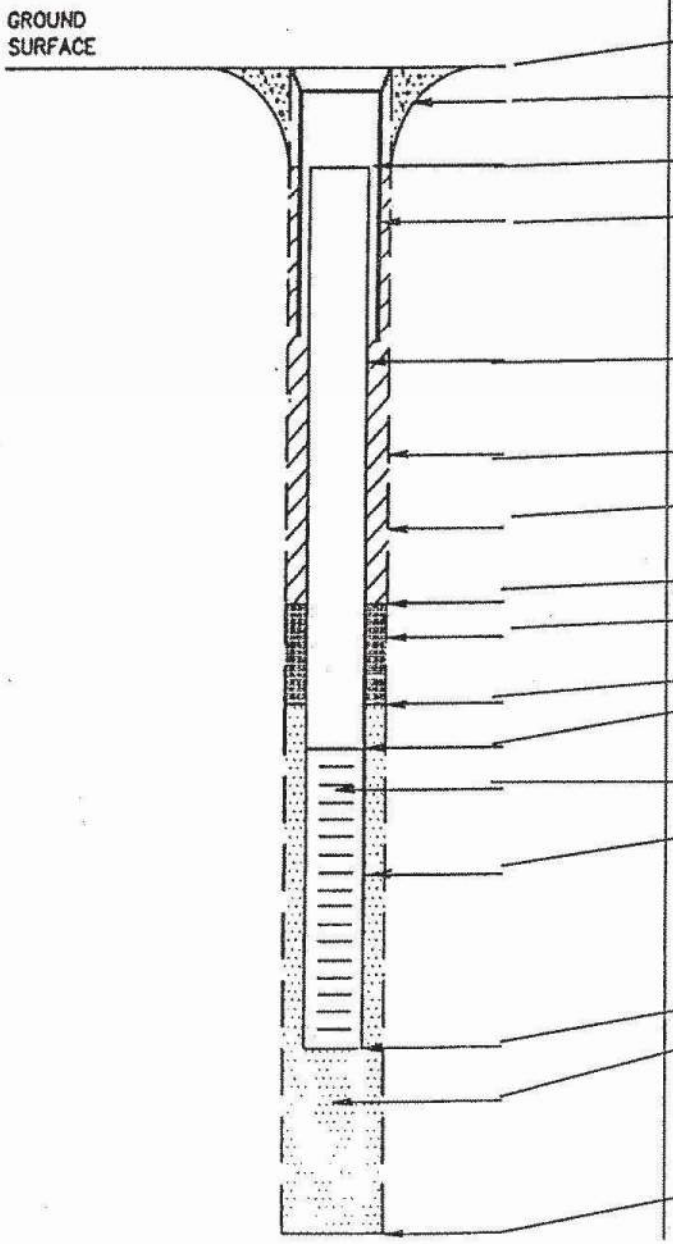
Figure 2

UNCONSOLIDATED WELL NO. _____

MONITORING WELL CONSTRUCTION DIAGRAM

PROJECT _____
PROJECT NO. _____
DATE _____ BORING NO.: _____
ELEVATION _____
LOGGED BY: _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF SURFACE CASING: _____
TYPE OF SURFACE SEAL: _____
GROUND SURFACE ELEVATION: _____
ELEVATION OF TOP OF RISER: _____

I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____

RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____

BOREHOLE DIAMETER: _____

TYPE OF BACKFILL: _____

ELEVATION/DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____

ELEVATION/DEPTH TOP OF SAND PACK: _____
ELEVATION/DEPTH TOP OF SCREEN: _____

TYPE OF SCREEN: _____
SLOT SIZE X LENGTH: _____
TYPE OF SAND PACK: _____

ELEVATION/DEPTH BOTTOM OF SCREEN: _____

ELEVATION/DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____

ELEVATION/DEPTH OF HOLE:

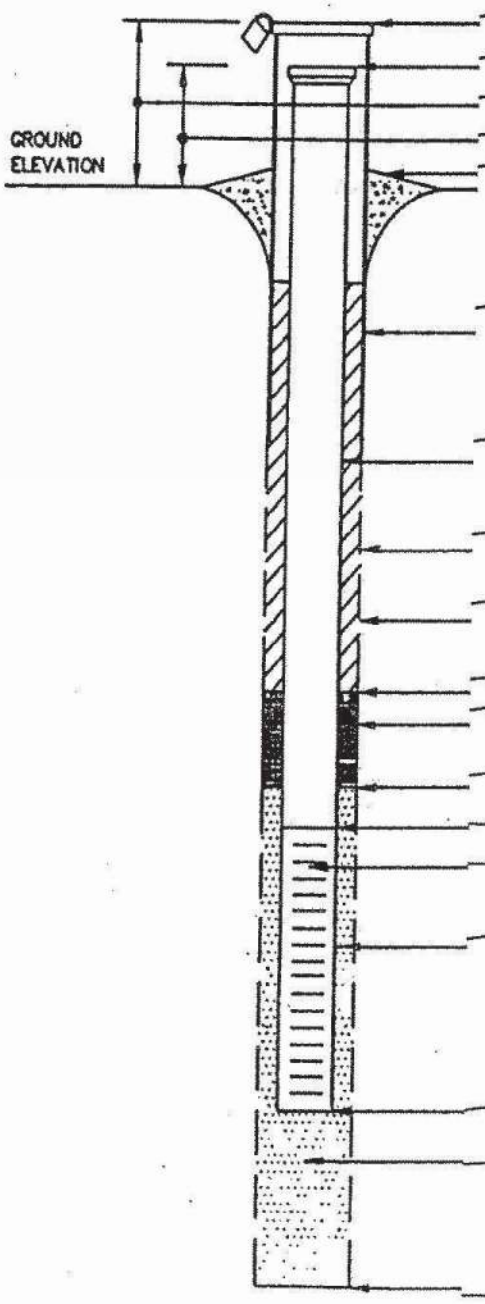
Figure 3

OVERBURDEN
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. _____

PROJECT _____
PROJECT NO. _____
DATE _____ BORING NO.: _____
ELEVATION _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF SURFACE CASING: _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK-UP TOP OF SURFACE CASING: _____
STICK-UP RISER PIPE: _____
TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____

RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____

BOREHOLE DIAMETER: _____

TYPE OF BACKFILL: _____

ELEVATION/DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____

DEPTH TOP OF SAND PACK: _____

ELEVATION/DEPTH TOP OF SCREEN: _____
TYPE OF SCREEN: _____
SLOT SIZE X LENGTH: _____
TYPE OF SAND PACK: _____

ELEVATION/DEPTH BOTTOM OF SCREEN: _____
ELEVATION/DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____

ELEVATION/DEPTH OF HOLE: _____

NOT TO SCALE

NOT TO SCALE

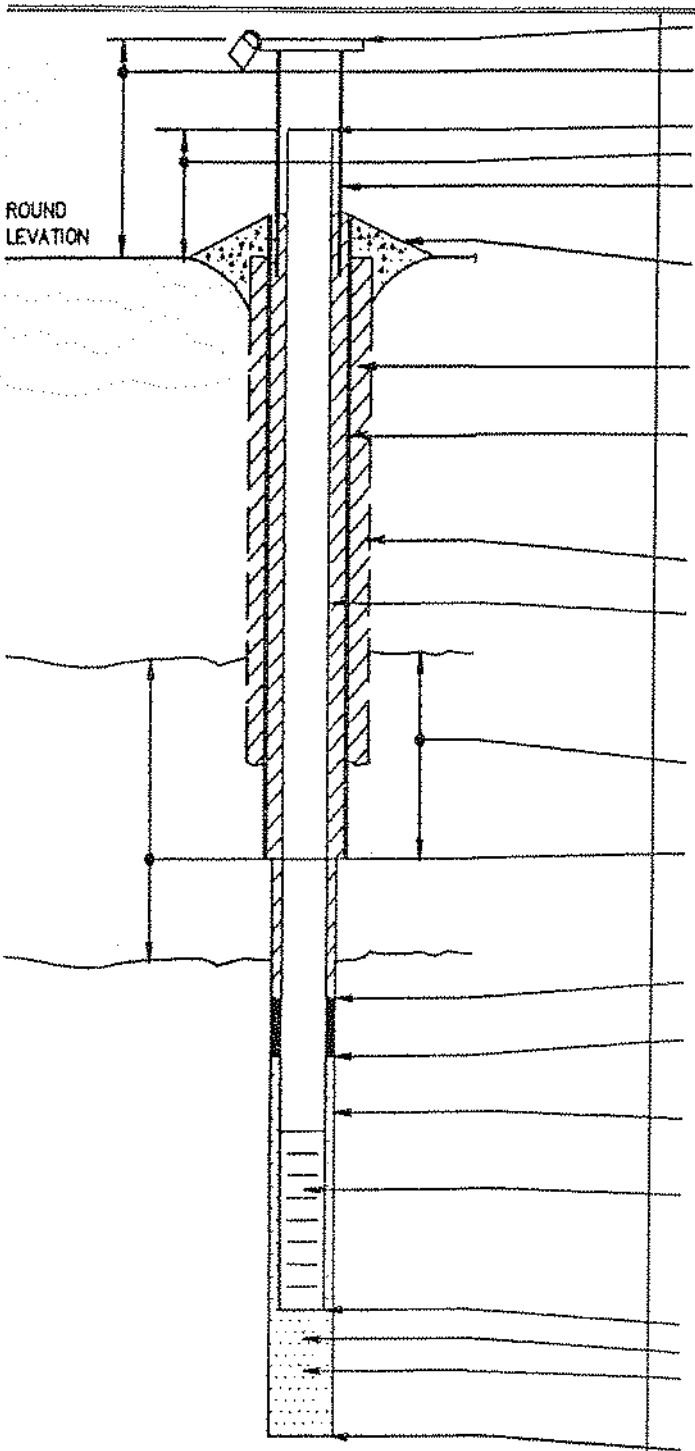
Figure 4

DOUBLE CASED
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. _____

PROJECT _____
PROJECT NO. _____
DATE _____ BORING NO.: _____
ELEVATION _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF CASING: _____
STICK-UP OF CASING ABOVE GROUND SURFACE _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK-UP RISER PIPE: _____
I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____
TYPE OF SURFACE SEAL: _____

TYPE OF BACKFILL: _____
I.D. OF UPPER AQUIFER CASING: _____
TYPE OF UPPER AQUIFER CASING: _____

BOREHOLE DIAMETER/DEPTH: _____

I.D.OF RISER: _____
TYPE OF RISER: _____

DEPTH CASING IS SET IN CONFINING LAYER: _____

APPROXIMATE THICKNESS OF CONFINING LAYER: _____

ELEVATION/DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____
DEPTH TOP OF SAND PACK: _____
TYPE OF SAND PACK: _____
BOREHOLE DIAMETER: _____

TYPE OF SCREEN: _____
SLOT SIZE X LENGTH: _____
I.D. OF SCREEN: _____

ELEVATION/DEPTH BOTTOM OF SCREEN: _____
ELEVATION/DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____
ELEVATION/DEPTH OF HOLE: _____

Figure 5

WELL PURGE DATA SHEET

PROJECT NAME: _____
PROJECT No.: _____
DATE: _____

Well I.D.: _____

Casing Volume
Well Diameter (d) = _____ ft

Well Radius (r_w) = _____ ft

Well Depth (TD) = _____ ft

Static Water Level (WL)= _____ ft

Filter Pack Volume
Borehole Diameter (d_b) = _____ ft

Borehole Radius (r_b) = _____ ft

Depth to Top of Filter Pack (D_f) = _____ ft

P = estimated porosity of filter pack

Height of Water in Well (T):
T = TD (ft) - WL (ft)
T = _____ - _____
T = _____ ft

Height of Water in Filter Pack (T_F)
T_F = TD - WL[1](or TFP[2])
T_F = _____ - _____
T_F = _____ ft

Gallons of Water per Well Volume (Casing):
$V_C = 0.163 \times T(ft) \times r_w(in)^2$
$V_C = 0.163 \times$ ___ x ___ [2]
V_C = _____ gallons

Gallons of Water per Filter Pack Volume
$V_F = (0.163 \times r_b^2 - 0.163 \times r_w^2) \times T_F \times P$

$$V_T = V_C + V_F$$

Total Volume Purged: **Design** = _____ **gallons**
Actual = _____ **gallons**

Water Quality:	pH (SU)	Spec. Conduct (umhos/cm)	Temp. (°C)	Eh (mV)	D.O. (ml/L)
Initial					
Volume 1					
Volume 2					
Volume 3					
Volume 4					
Volume 5					

Purge Method: ____ Suction Pump ____ Submersible Pump ____ Bailer ____ Other_____

Notes/Observations: _____

_____

_____

~~FWENC~~ Sampler(s) Present: _____

1. From Top of Inner Casing
2. Top of Filter Pack - used if entire filter pack saturated

Figure 6

SAMPLE LOG SHEET

I. SAMPLE IDENTIFICATION

Project: _____ Project No.:
Client: _____ Project Manager: _____
Sample Name/Number: _____ Date: _____ Time: _____ Hrs
Sampling Location/Depth: _____ Type: _____ Grab _____ Composite
Sample Matrix: _____ Surface Water _____ Groundwater _____ Sediment
_____ Soil _____ Waste
_____ Other (Specify) _____

Sampled By: _____

II. SAMPLE SOURCE

_____ Well _____ Outfall _____ Leachate
_____ Drum _____ Boring _____ River/Stream
_____ Bldg/Structures _____ Tank _____ Impoundment
_____ Test Pit/Trench _____ Other (Specify) _____

Source Description _____

III. FIELD OBSERVATIONS/MEASUREMENTS

Appearance/Color: _____
Volatile Organic Analysis (VOA): _____ HNU _____ OVA _____ Other
VOA Readings: Off Sample _____ Respiratory Zone _____
LEL/O_2/H_2S Readings: LEL _____ O_2 _____ H_2S _____
Radioactivity (mR/hr): _____
pH: _____ Conductivity: _____ Temperature: _____
Salinity: _____ Other: _____
Observations: _____

IV. SAMPLE DISPOSITION

Preservation: _____
Laboratory Name: _____
Laboratory Location: _____ On-Site _____ Off-Site
Forwarded to Laboratory: Date: _____ Time: _____ Hrs
Laboratory Sample No.: _____
Chain of Custody No.: _____ Airbill No.: _____

V. ADDITIONAL REMARKS

ATTACHMENTS

ATTACHMENT A

GROUNDWATER ISSUE – DENSE NONAQUEOUS PHASE LIQUIDS

Environmental Protection Agency | Research and Development | Office of Solid Waste and Emergency Response | EPA/540/4-91-002 March 1991

EPA Ground Water Issue

DENSE NONAQUEOUS PHASE LIQUIDS

Scott G. Huling* and James W. Weaver**

Background

The Regional Superfund Ground Water Forum is a group of EPA professionals representing EPA's Regional Superfund Offices, committed to the identification and the resolution of ground water issues impacting the remediation of Superfund sites. The forum is supported by and advises the Superfund Technical Support Project. Dense nonaqueous phase liquids is an issue identified by the Forum as a concern of Superfund decision-makers. For further information contact Scott G. Huling (FTS:743-2313), Jim Weaver (FTS:743-2420), or Randall R. Ross (FTS: 743-2355).

Introduction

Dense nonaqueous phase liquids (DNAPLs) are present at numerous hazardous waste sites and are suspected to exist at many more. Due to the numerous variables influencing DNAPL transport and fate in the subsurface, and consequently, the remaining complexity, DNAPLs are largely undetected and yet are likely to be a significant limiting factor in site remediation. This issue paper is a literature evaluation focusing on DNAPLs and provides an overview from a conceptual fate and transport point of view, DNAPL phase distribution, monitoring, site characterization, remediation, and modeling.

A nonaqueous phase liquid (NAPL) is a term used to describe the physical and chemical differences between a hydrocarbon liquid and water which result in a physical interface between a mixture of the two liquids. The interface is a physical dividing surface between the bulk phases of the two liquids, but compounds found in the NAPL are not prevented from solubilizing into the ground water. Immiscibility is typically determined based on the visual observation of a physical interface in a water- hydrocarbon mixture. There are numerous methods, however, which are used to quantify the physical and chemical properties of hydrocarbon liquids (31).

Nonaqueous phase liquids have typically been divided into two general categories, dense and light. These terms describe the specific gravity, or the weight of the nonaqueous phase liquid relative to water. Correspondingly, the dense nonaqueous phase liquids have a specific gravity greater than water, and the light nonaqueous phase liquids (LNAPL) have a specific gravity less than water.

Several of the most common compounds associated with DNAPLs found at Superfund sites are included in Table 1. These compounds are a partial list of a larger list identified by a national screening of the most prevalent compounds found at Superfund sites (65). The general chemical categories are halogenated/non-halogenated semi-volatiles and halogenated volatiles. These compounds are typically found in the following wastes and waste-producing processes: solvents, wood preserving wastes (creosote, pentachlorophenol), coal tars, and pesticides. The most frequently cited group of these contaminants to date are the chlorinated solvents.

DNAPL Transport and Fate - Conceptual Approach

Fate and transport of DNAPLs in the subsurface will be presented from a conceptual point of view. Figures have been selected for various spill scenarios which illustrate the general behavior of DNAPL in the subsurface. Following the conceptual approach, detailed information will be presented explaining the specific mechanisms, processes, and variables which influence DNAPL fate and transport. This includes DNAPL characteristics, subsurface media characteristics, and saturation dependent parameters.

Unsaturated Zone

Figure 1 indicates the general scenario of a release of DNAPL into the soil which subsequently migrates vertically under both the forces of gravity and soil capillarity. Soil capillarity is also responsible for the lateral migration of DNAPL. A point is reached at which the DNAPL no longer holds together as a continuous phase, but rather is present as isolated residual globules. The fraction of the hydrocarbon that is retained by capillary forces in the porous media is referred to as residual

* Environmental Engineer, ** Research Hydrologist, U.S. Environmental Protection Agency, Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma.

Superfund Technology Support Center for Ground Water

Robert S. Kerr Environmental Research Laboratory
Ada, Oklahoma

Technology Innovation Office
Office of Solid Waste and Emergency Response, US EPA, Washington, D.C.

Walter W. Kovalick, Jr., Ph.D.
Director

Table 1. Most prevalent chemical compounds at U.S. Superfund Sites (65) with a specific gravity greater than one.

Compound	Density [1]	Dynamic[2] Viscosity	Kinematic Viscosity[3]	Water[4] Solub.	Henry's Law Constant[5]	Vapor[6] Pressure
Halogenated Semi-volatiles						
1,4-Dichlorobenzene	1.2475	1.2580	1.008	8.0 E+01	1.58 E-03	6 E-01
1,2-Dichlorobenzene	1.3060	1.3020	0.997	1.0 E+02	1.88 E-03	9.6 E-01
Aroclor 1242	1.3850			4.5 E-01	3.4 E-04	4.06 E-04
Aroclor 1260	1.4400			2.7 E-03	3.4 E-04	4.05 E-05
Aroclor 1254	1.5380			1.2 E-02	2.8 E-04	7.71 E-05
Chlordane	1.6	1.1040	0.69	5.6 E-02	2.2 E-04	1 E-05
Dieldrin	1.7500			1.86 E-01	9.7 E-06	1.78 E-07
2,3,4,6-Tetrachlorophenol	1.8390			1.0 E+03		
Pentachlorophenol	1.9780			1.4 E+01	2.8 E-06	1.1 E-04
Halogenated Volatiles						
Chlorobenzene	1.1060	0.7560	0.683	4.9 E+02	3.46 E-03	8.8 E+00
1,2-Dichloropropane	1.1580	0.8400	0.72	2.7 E+03	3.6 E-03	3.95 E+01
1,1-Dichloroethane	1.1750	0.3770	0.321	5.5 E+03	5.45 E-04	1.82 E+02
1,1-Dichloroethylene	1.2140	0.3300	0.27	4.0 E+02	1.49 E-03	5 E+02
1,2-Dichloroethane	1.2530	0.8400	0.67	8.69 E+03	1.1 E-03	6.37 E+01
Trans-1,2-Dichloroethylene	1.2570	0.4040	0.321	6.3 E+03	5.32 E-03	2.65 E+02
Cis-1,2-Dichloroethylene	1.2480	0.4670	0.364	3.5 E+03	7.5 E-03	2 E+02
1,1,1-Trichloroethane	1.3250	0.8580	0.647	9.5 E+02	4.08 E-03	1 E+02
Methylene Chloride	1.3250	0.4300	0.324	1.32 E+04	2.57 E-03	3.5 E+02
1,1,2-Trichloroethane	1.4436	0.1190	0.824	4.5 E+03	1.17 E-03	1.88 E+01
Trichloroethylene	1.4620	0.5700	0.390	1.0 E+03	8.92 E-03	5.87 E+01
Chloroform	1.4850	0.5630	0.379	8.22 E+03	3.75 E-03	1.6 E+02
Carbon Tetrachloride	1.5947	0.9650	0.605	8.0 E+02	2.0 E-02	9.13 E+01
1,1,2,2-Tetrachloroethane	1.6	1.7700	1.10	2.9 E+03	5.0 E-04	4.9 E+00
Tetrachloroethylene	1.6250	0.8900	0.54	1.5 E+02	2.27 E-02	1.4 E+01
Ethylene Dibromide	2.1720	1.6760	0.79	3.4 E+03	3.18 E-04	1.1 E+01
Non-halogenated Semi-volatiles						
2-Methyl Napthalene	1.0058			2.54 E+01	5.06 E-02	6.80 E-02
o-Cresol	1.0273			3.1 E+04	4.7 E-05	2.45 E-01
p-Cresol	1.0347			2.4 E+04	3.5 E-04	1.08 E-01
2,4-Dimethylphenol	1.0360			6.2 E+03	2.5 E-06	9.8 E-02
m-Cresol	1.0380	21.0	20	2.35 E+04	3.8 E-05	1.53 E-01
Phenol	1.0576		3.87	8.4 E+04	7.8 E-07	5.293E-01
Naphthalene	1.1620			3.1 E+01	1.27 E-03	2.336E-01
Benzo(a)Anthracene	1.1740			1.4 E-02	4.5 E-06	1.16 E-09
Flourene	1.2030			1.9 E+00	7.65 E-05	6.67 E-04
Acenaphthene	1.2250			3.88 E+00	1.2 E-03	2.31 E-02
Anthracene	1.2500			7.5 E-02	3.36 E-05	1.08 E-05
Dibenz(a,h)Anthracene	1.2520			2.5 E-03	7.33 E-08	1 E-10
Fluoranthene	1.2520			2.65 E-01	6.5 E-06	E-02 E-06
Pyrene	1.2710			1.48 E-01	1.2 E-05	6.67 E-06
Chrysene	1.2740			6.0 E-03	1.05 E-06	6.3 E-09
2,4-Dinitrophenol	1.6800			6.0 E+03	6.45 E-10	1.49 E-05
Miscellaneous						
Coal Tar	1.028[7]	18.98[7]				
Creosote	1.05	1.08[8]				

[1] g/cc
[2] centipoise (cp), water has a dynamic viscosity of 1 cp at 20°C.
[3] centistokes (cs)
[4] mg/l
[5] atm-m³/mol
[6] mm Hg
[7] 45° F (70)
[8] 15.5°C, varies with creosote mix (62)

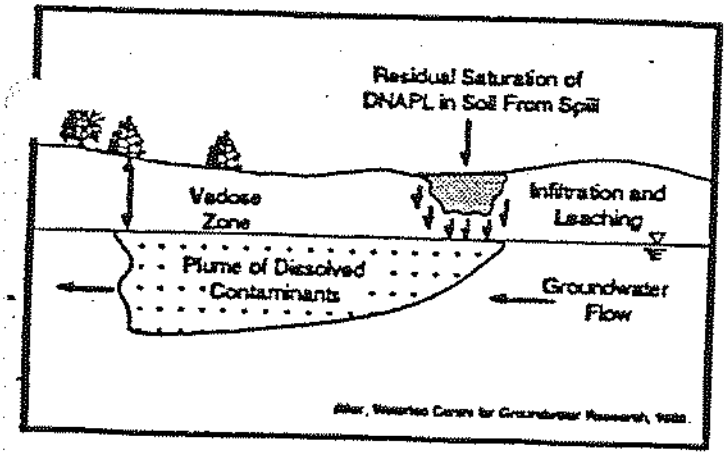


Figure 1. The entire volume of DNAPL is exhausted by residual saturation in the vadose zone prior to DNAPL reaching the water table. Soluble phase compounds may be leached from the DNAPL residual saturation and contaminate the ground water.

saturation. In this spill scenario, the residual saturation in the unsaturated zone exhausted the volume of DNAPL, preventing it from reaching the water table. This figure also shows the subsequent leaching (solubilization) of the DNAPL residual saturation by water percolating through the unsaturated zone (vadose zone). The leachate reaching the saturated zone results in ground-water contamination by the soluble phase components of the hydrocarbon. Additionally, the residual saturation at or near the water table is also subjected to ching from the rise and fall of the water table (seasonal, sea , etc.).

Increasing information is drawing attention to the importance of the possibility that gaseous-phase vapors from NAPL in the unsaturated zone are responsible for contaminating the ground water and soil (18,47). It is reported that the greater "relative vapor density" of gaseous vapors to air will be affected by gravity and will tend to sink. In subsurface systems where lateral spreading is not restricted, spreading of the vapors may occur as indicated in Figure 2. The result is that a greater amount of soils and ground water will be exposed to the DNAPL vapors and may result in further contamination. The extent of contamination will depend largely on the partitioning of the DNAPL vapor phase to the aqueous and solid phases.

DNAPL Phase Distribution - Four Phase System

It is apparent from Figures 1 and 2 that the DNAPL may be present in the subsurface in various physical states or what is referred to as phases. As illustrated in Figure 3, there are four possible phases: gaseous, solid, water, and immiscible hydrocarbon (DNAPL) in the unsaturated zone. Contaminants associated with the release of DNAPL can, therefore, occur in four phases described as follows:

1. Air phase - contaminants may be present as vapors;
2. Solid phase - contaminants may adsorb or partition onto the soil or aquifer material;
3. Water phase - contaminants may dissolve into the water according to their solubility; and

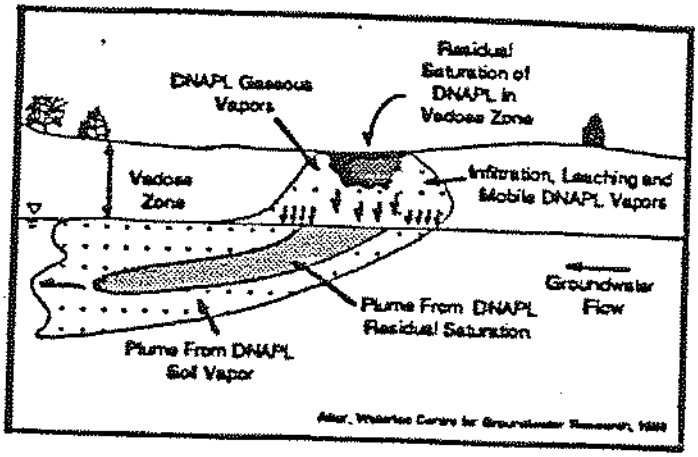


Figure 2. Migration of DNAPL vapors from the spill area and subsequent contamination of the soils and ground water.

4. Immiscible phase - contaminants may be present as dense nonaqueous phase liquids.

The four phase system is the most complex scenario because there are four phases and the contaminant can partition between any one or all four of these phases, as illustrated in Figure 4. For example, TCE introduced into the subsurface as a DNAPL may partition onto the soil phase, volatilize into the soil gas, and solubilize into the water phase resulting in contamination in all four phases. TCE can also partition between the water and soil, water and air, and between the soil and air. There are six pathways of phase distribution in the unsaturated zone. The distribution of a contaminant between these phases can be represented by empirical relationships referred to as partition coefficients. The partition coefficients, or the distribution of the DNAPL between the four phases, is highly site-specific and highly dependent on the characteristics of both the soil/aquifer matrix and the DNAPL. Therefore, the distribution between phases may change with time and/or location at the same site and during different stages of site remediation.

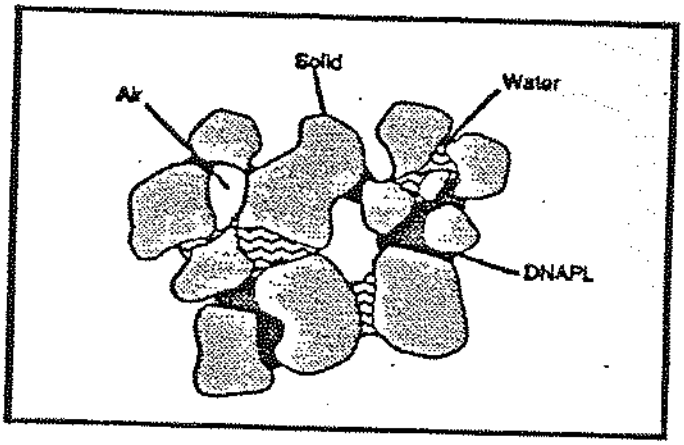


Figure 3. A DNAPL contaminated unsaturated zone has four physical states or phases (air, solid, water, immiscible). The contaminant may be present in any one, or all four phases.

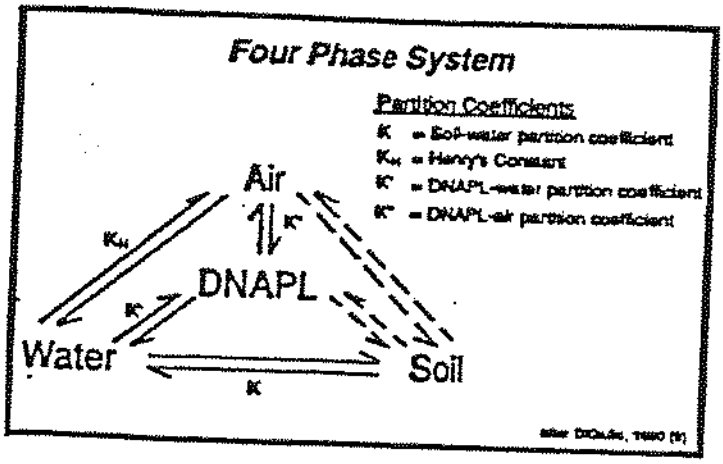


Figure 4. Distribution of DNAPL between the four phases found in the vadose zone.

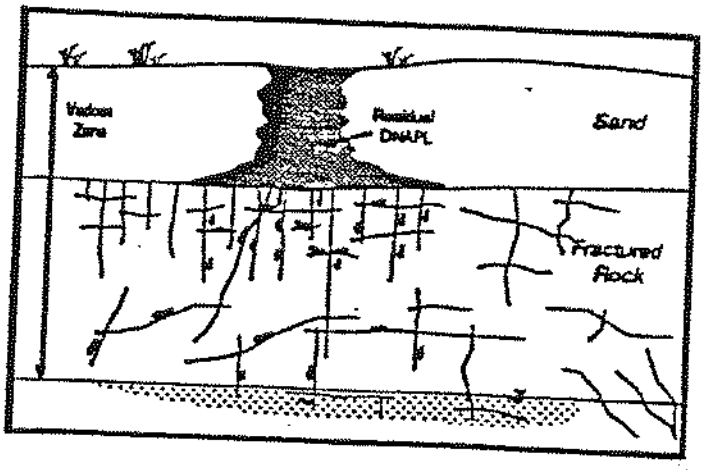


Figure 5. DNAPL spilled into fractured rock systems may follow a complex distribution of the preferential pathways.

The concept of phase distribution is critical in decision-making. Understanding the phase distribution of a DNAPL introduced into the subsurface provides significant insight in determining which tools are viable options with respect to site characterization and remediation.

DNAPL represented by residual saturation in the four phase diagram is largely immobile under the usual subsurface pressure conditions and can migrate further only: 1) in water according to its solubility; or 2) in the gas phase of the unsaturated zone (47). DNAPL components adsorbed onto the soil are also considered immobile. The mobile phases are, herefore, the soluble and volatile components of the DNAPL n the water and air, respectively.

The pore space in the unsaturated zone may be filled with one r all three fluid phases (gaseous, aqueous, immiscible). The resence of DNAPL as a continuous immiscible phase has the otential to be mobile. The mobility of DNAPL in the ubsurface must be evaluated on a case by case basis. The aximum number of potentially mobile fluid phases is three. imultaneous flow of the three phases (air, water, and nmiscible) is considerably more complicated than two-phase ow (46). The mobility of three phase flow in a four-phase ystem is complex, poorly understood, and is beyond the cope of this DNAPL overview. The relative mobility of the two hases, water and DNAPL, in a three-phase system is esented below in the section entitled "Relative Permeability."

enerally, rock aquifers contain a myriad of cracks (fractures) various lengths, widths, and apertures (32). Fractured rock stems have been described as rock blocks bounded by screte discontinuities comprised of fractures, joints, and ear zones which may be open, mineral-filled, deformed, or y combination thereof (61). The unsaturated zone overlying ese fractured rock systems also contain the myriad of eferential pathways. DNAPL introduced into such formations igure 5) follow complex pathways due to the heterogeneous stribution of the cracks, conduits, and fractures', i.e., eferential pathways. Transport of DNAPL may follow non-rcian flow in the open fractures and/or Darcian flow in the rous media filled fractures. Relatively small volumes of APL may move deep, quickly into the rock because the retention capacity offered by the dead-end fractures and the immobile fragments and globules in the larger fractures is so small (32). Currently, the capability to collect the detailed information for a complete description of a contaminated fractured rock system is regarded as neither technically possible nor economically feasible (61).

Low permeability stratigraphic units such as high clay content formations may also contain a heterogeneous distribution of preferential pathways. As illustrated in Figure 6, DNAPL transport in these preferential pathways is correspondingly complex. Typically, it is assumed that high clay content formations are impervious to DNAPL. However, as DNAPL spreads out on low permeable formations it tends to seek out zones of higher permeability. As a result, preferential pathways allow the DNAPL to migrate further into the low permeable formation, or through it to underlying stratigraphic units. It is apparent from Figures 5 and 6 that the complexity of DNAPL transport may be significant prior to reaching the water table.

Saturated Zone

The second general scenario is one in which the volume of DNAPL is sufficient to overcome the fraction depleted by the residual saturation in the vadose zone, as illustrated in Figure 7. Consequently, the DNAPL reaches the water table and contaminates the ground water directly. The specific gravity of DNAPL is greater than water, therefore, the DNAPL migrates into the saturated zone. In this scenario, DNAPL continues the vertical migration through the saturated zone until the volume is eventually exhausted by the residual saturation process or until it is intercepted by a low permeable formation where it begins to migrate laterally.

DNAPL Phase Distribution - Three Phase System

Due to the lack of the gaseous phase, the saturated zone containing DNAPL is considered a three-phase system consisting of the solid, water, and immiscible hydrocarbon (Figure 8). Contaminant distribution in the three-phase system is less complex than the four-phase system. Again, this is highly dependent on the characteristics of both the aquifer

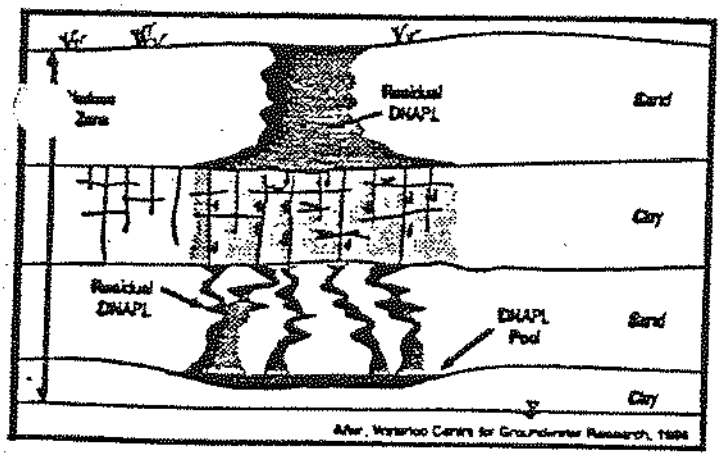


Figure 6. DNAPL spilled into a low permeable formation may follow a complex distribution of preferential pathways. The volume of DNAPL is exhausted in the vadose zone prior to reaching the water table.

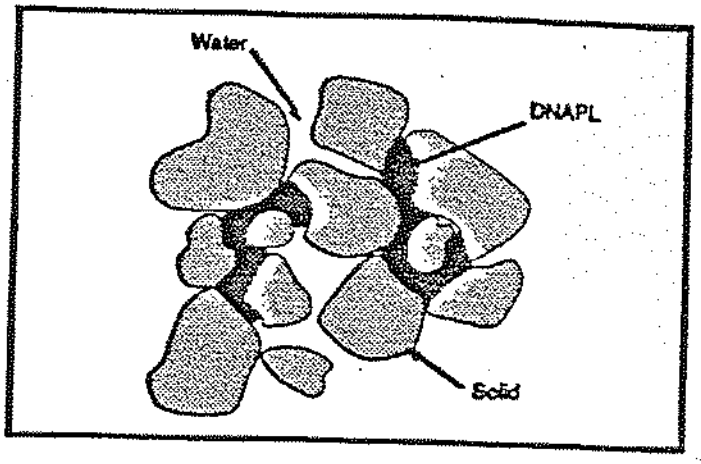


Figure 8. A DNAPL contaminated saturated zone has three phases (solid, water, immiscible). The contaminant may be present in any one, or all three phases.

matrix and the DNAPL. Figure 9 indicates the three phases and the transfer of the mass of contaminant between the phases. In this scenario, there are only three pathways of phase distribution in the saturated zone.

Note that when the DNAPL is represented by residual saturation in the three-phase system, the mobile phase of the contaminant is the water soluble components of the DNAPL and the immobile phases are the residual saturation and the adsorbed components of the DNAPL associated with the [illegible]r material. The main mobilization mechanism of the [illegible]ual saturation is removal of soluble phase components into the ground water. When the DNAPL is present as a continuous immiscible phase, it too is considered one of the mobile phases of the contaminant. While the continuous phase DNAPL has the potential to be mobile, immobile continuous phase DNAPL may also exist in the subsurface. Although the saturated zone is considered a three-phase system, gaseous vapors from DNAPL in the unsaturated zone does have the potential to affect ground-water quality, as was indicated earlier in Figure 2.

Assuming the residual saturation in the saturated zone does not deplete the entire volume of the DNAPL, the DNAPL will continue migrating vertically until it encounters a zone or stratigraphic unit of lower permeability. Upon reaching the zone of lower permeability, the DNAPL will begin to migrate laterally. The hydraulic conductivity in the vertical direction is typically less than in the horizontal direction. It is not uncommon to find vertical conductivity that is one-fifth or one-tenth the horizontal value (4). It is expected that DNAPL spilled into the subsurface will have a significant potential to migrate laterally. If the lower permeable boundary is "bowl shaped", the DNAPL will pond as a reservoir (refer to Figure 10). As illustrated in Figure 11, it is not uncommon to observe a perched DNAPL reservoir where a discontinuous impermeable layer; i.e., silt or clay lens, intercepts the vertical migration of DNAPL. When a sufficient volume of DNAPL has been released and multiple discontinuous impermeable layers exist, the DNAPL may be present in several perched reservoirs as well as a deep

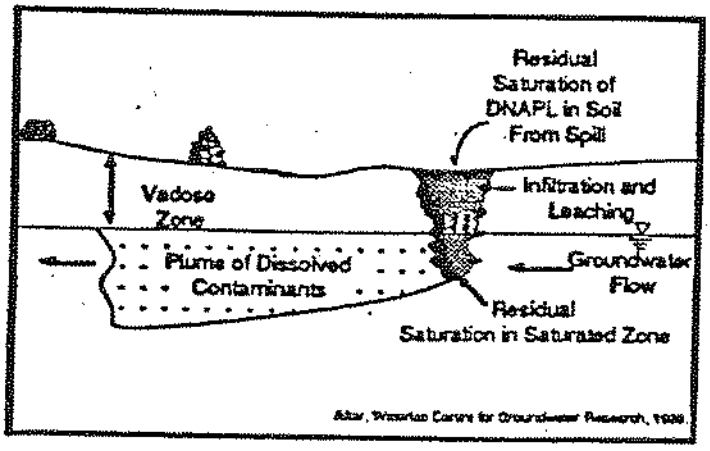


Figure 7. The volume of DNAPL is sufficient to overcome the residual saturation in the vadose zone and consequently penetrates the water table.

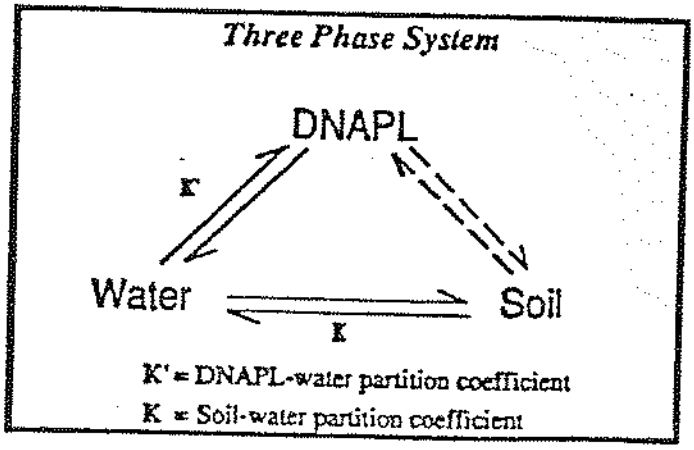


Figure 9. Distribution of DNAPL between the three phases found in the saturated zone.

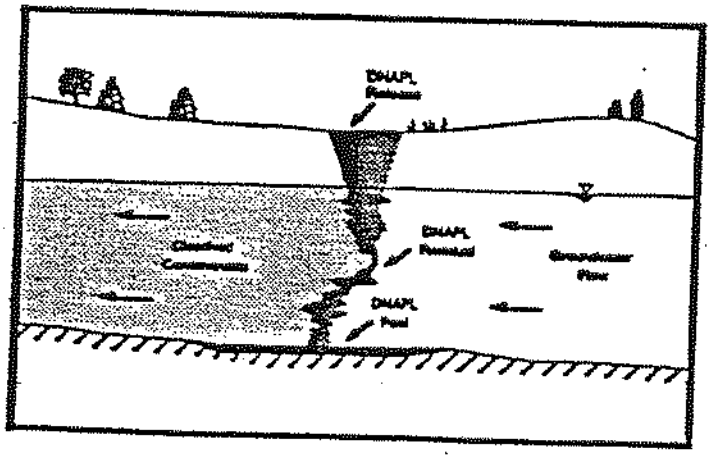


Figure 10. Migration of DNAPL through the vadose zone to an impermeable boundary.

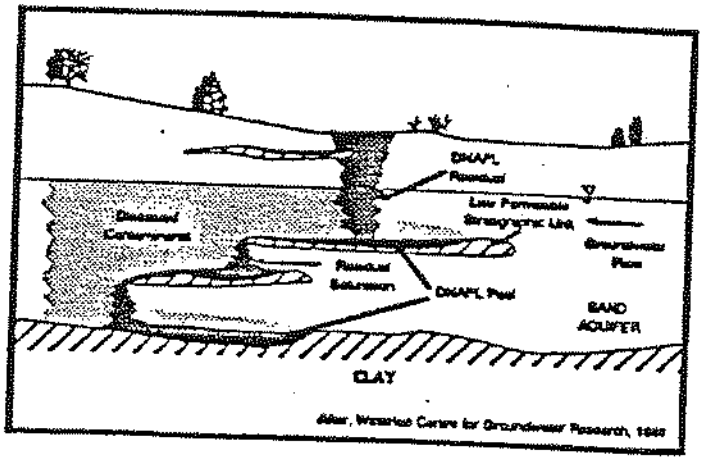
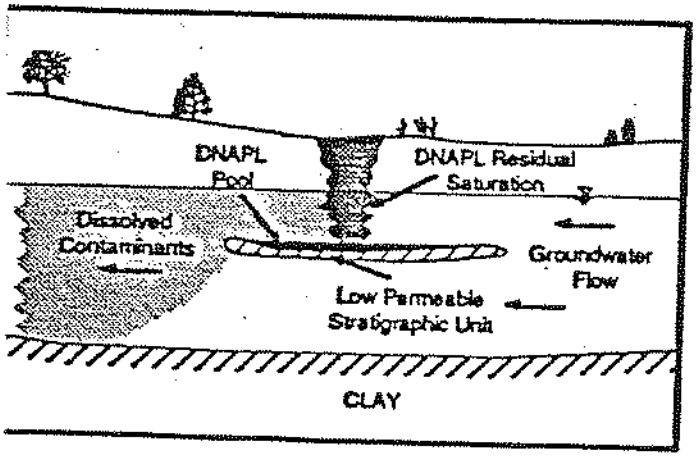


Figure 12. Perched and deep DNAPL reservoirs.

reservoir (refer to Figure 12). Lateral migration continues until either the residual saturation depletes the DNAPL or an impermeable depression immobilizes the DNAPL in a reservoir type scenario. Soluble-phase components of the DNAPL will partition into the ground water from both the residual saturation or DNAPL pools. The migration of DNAPL vertically through the aquifer results in the release of soluble-phase components of the DNAPL across the entire thickness of the aquifer. Note, that ground water becomes contaminated as it flows through, and around, the DNAPL contaminated zone.

As indicated earlier, DNAPL will migrate laterally upon reaching a stratigraphic unit of lower permeability. Transport of DNAPL will therefore be largely dependent on the gradient of the stratigraphy. Occasionally, the directional gradient of an impermeable stratigraphic unit may be different than the direction of ground-water flow as illustrated in Figure 13a. This may result in the migration of the continuous phase DNAPL in a direction different from the ground-water flow. Nonhorizontal stratigraphic units with varying hydraulic conductivity may also convey DNAPL in a different direction than ground-water flow, and at different rates (refer to Figure 13b). Determination of the direction of impermeable stratigraphic units will therefore provide useful information concerning the direction of DNAPL transport.



igure 11. Perched DNAPL reservoir.

Similar to the unsaturated zone, the saturated zone also contains a complex distribution of preferential pathways from cracks, fractures, joints, etc. DNAPL introduced into such formations correspondingly follow the complex network of pathways through an otherwise relatively impermeable rock material. Other pathways which may behave as vertical conduits for DNAPL include root holes, stratigraphic windows, disposal wells, unsealed geotechnical boreholes, improperly sealed hydrogeological investigation sampling holes and monitoring wells, and old uncased/unsealed water supply wells (72). Transport of the DNAPL may migrate very rapidly in these open conduits or follow Darcian flow in the surrounding porous media or porous media filled fractures. A relatively small volume of DNAPL can move deep into a fractured system due to the low retentive capacity of the fractured system. Consequently, fractured clay or rock stratigraphic units, which are often considered lower DNAPL boundary conditions, may have preferential pathways leading to lower formations, as depicted in Figure 14. Careful inspection of soil cores at one Superfund site indicated that DNAPL flow mainly occurred through preferential pathways and was not uniformly distributed throughout the soil mass (8). Due to the complex

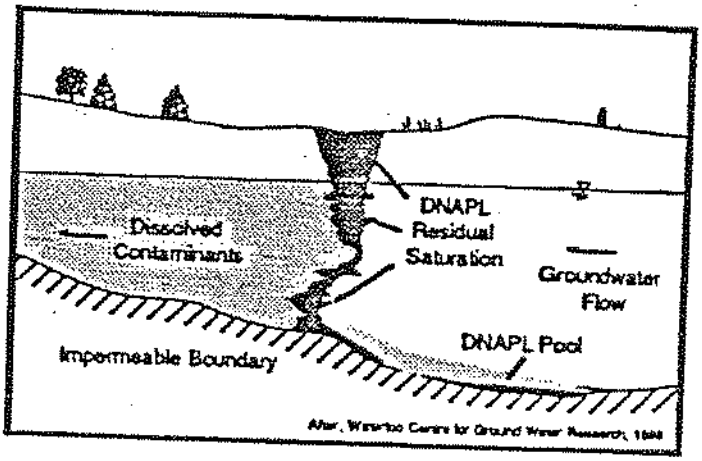


Figure 13a. Stratigraphic gradient different from ground water gradient results in a different direction of flow of the ground water and continuous phase DNAPL.

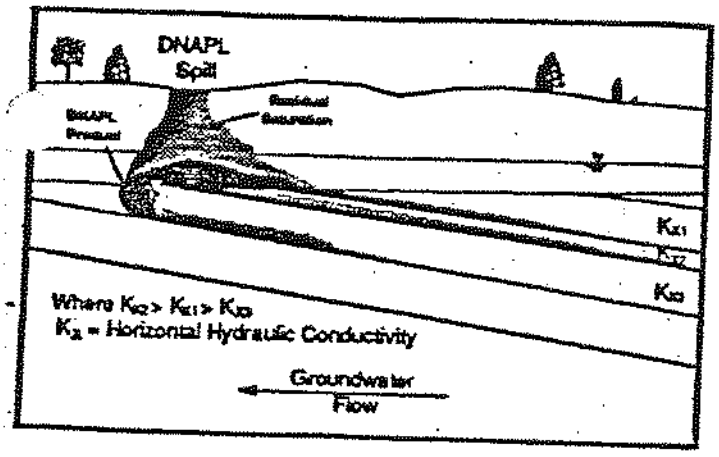


Figure 13b. Non-horizontal stratigraphic units with variable hydraulic conductivity may convey DNAPL in a different direction than the ground water flow direction.

distribution of preferential pathways, characterization of the volume distribution of the DNAPL is difficult.

Important DNAPL Transport and Fate Parameters

There are several characteristics associated with both the subsurface media and the DNAPL which largely determine the fate and transport of the DNAPL. A brief discussion of these ameters is included to help identify the specific details of PL transport mechanisms. Several of the distinctive DNAPL phenomena observed on the field-scale relates back to phenomena at the pore-scale. Therefore, it is important to understand the principles from the pore-scale level to develop an understanding of field-scale observations, which is the scale at which much of the Superfund work occurs in. A more complete and comprehensive review of these parameters is available (2,36,71).

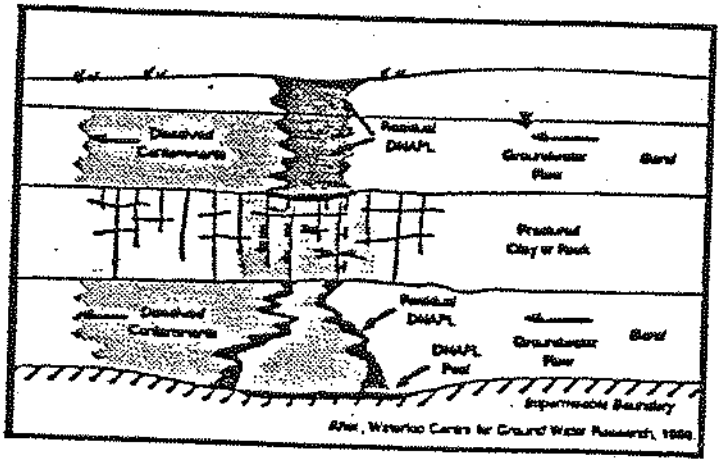


Figure 14. DNAPL transport in fracture and porous media stratigraphic units.

DNAPL Characteristics

Density

Fluid density is defined as the mass of fluid per unit volume, i.e. g/cm³. Density of an immiscible hydrocarbon fluid is the parameter which delineates LNAPL's from DNAPL's. The property varies not only with molecular weight but also molecular interaction and structure. In general, the density varies with temperature and pressure (2). Equivalent methods of expressing density are specific weight and specific gravity. The specific weight is defined as the weight of fluid per unit volume, i.e. lb/ft³. The specific gravity (S.G.) or the relative density of a fluid is defined as the ratio of the weight of a given volume of substance at a specified temperature to the weight of the same volume of water at a given temperature (31). The S.G. is a relative indicator which ultimately determines whether the fluid will float (S.G.< 1.0) on, or penetrate into (S.G.>1.0) the water table. Table 1 contains a list of compounds with a density greater than one that are considered DNAPL's. Note, however, that while the specific gravity of pentachlorophenol and the non-halogenated semi-volatiles is greater than 1.00, these compounds are a solid at room temperature and would not be expected to be found as an immiscible phase liquid at wood preserving sites but are commonly found as contaminants. Pentachlorophenol is commonly used as a wood preservant and is typically dissolved (4-7%) in No. 2 or 3 fuel oil.

Viscosity

The viscosity of a fluid is a measure of its resistance to flow. Molecular cohesion is the main cause of viscosity. As the temperature increases in a liquid, the cohesive forces decrease and the absolute viscosity decreases. The lower the viscosity, the more readily a fluid will penetrate a porous media. The hydraulic conductivity of porous media is function of both the density and viscosity of the fluid as indicated in equation [1]. It is apparent from this equation that fluids with either a viscosity less than water or fluids with a density greater than water have the potential to be more mobile in the subsurface, than water.

$$K = \frac{k \rho g}{\mu}$$ where, K = hydraulic conductivity, k = intrinsic permeability, ρ = fluid mass density, g = gravity, μ = dynamic (absolute) viscosity [1]

Results from laboratory experiments indicated that several chlorinated hydrocarbons which have low viscosity (methylene chloride, perchloroethylene, 1,1,1-TCA, TCE) will infiltrate into soil notably faster than will water (47). The relative value of NAPL viscosity and density, to water, indicates how fast it will flow in porous media (100% saturated) with respect to water. For example, several low viscosity chlorinated hydrocarbons (TCE, tetrachloroethylene, 1,1,1-TCA, Methylene Chloride, Chloroform, Carbon Tetrachloride, refer to Table 1) will flow 1.5-3.0 times as fast as water and higher viscosity compounds including light heating oil, diesel fuel, jet fuel, and crude oil (i.e. LNAPL's) will flow 2-10 times slower than water (45). Both coal tar and creosote typically have a specific gravity greater than one and a viscosity greater than water. It is interesting to note

that the viscosity of NAPL may change with time (36). As fresh crude oils lose the lighter volatile components from evaporation, the oils become more viscous as the heavier components compose a larger fraction of the oily mixture resulting in an increase in viscosity.

Solubility

When an organic chemical is in physical contact with water, the organic chemical will partition into the aqueous phase. The equilibrium concentration of the organic chemical in the aqueous phase is referred to as its solubility. Table 1 presents the solubility of several of the most commonly found DNAPL's at EPA Superfund Sites. The solubility of organic compounds varies considerably from the infinitely miscible compounds, including alcohols (ethanol, methanol) to extremely low solubility compounds such as polynuclear aromatic compounds.

Numerous variables influence the solubility of organic compounds. The pH may effect the solubility of some organic compounds. Organic acids may be expected to increase in solubility with increasing pH, while organic bases may act in the opposite way (31). For example, pentachlorophenol is an acid which is ionized at higher pH's. In the ionized form, pentachlorophenol would be more soluble in water (59). Solubility in water is a function of the temperature, but the strength and direction of this function varies. The presence of dissolved salts or minerals in water leads to moderate decreases in solubility (31). In a mixed solvent system, consisting of water and one or more water-miscible compounds, as the fraction of the cosolvent in the mixture increases, the solubility of the organic chemical increases exponentially (12). In general, the greater the molecular weight and structural complexity of the organic compound, the lower he solubility.

Organic compounds are only rarely found in ground water at oncentrations approaching their solubility limits, even when rganic liquid phases are known or suspected to be present. he observed concentrations are usually more than a factor of 0 lower than the solubility presumably due to diffusional nitations of dissolution and the dilution of the dissolved rganic contaminants by dispersion (74). This has also been tributed to: reduced solubility due to the presence of other oluble compounds, the heterogeneous distribution of DNAPL the subsurface, and dilution from monitoring wells with long take lengths (10). Detection of DNAPL components in the bsurface below the solubility should clearly not be terpreted as a negative indicator for the presence of DNAPL.

a DNAPL spill scenario where the DNAPL or its vapors are contact with the ground water, the concentration of the luble phase components may range from non-detectable up the solubility of the compound. The rate of dissolution has en expressed as a function of the properties of the DNAPL mponents (solubility), ground water flow conditions, ncentration differential between the actual and solubility, and contact area between the DNAPL and the ground water 0). The contact area is expected to be heterogeneous and ficult to quantify. Additionally, as the time of contact reases between the DNAPL and the water, the ncentration in the aqueous phase increases.

Vapor Pressure

The vapor pressure is that characteristic of the organic chemical which determines how readily vapors volatilize or evaporate from the pure phase liquid. Specifically, the partial pressure exerted at the surface by these free molecules is known as the vapor pressure (30). Molecular activity in a liquid tends to free some surface molecules and this tendency towards vaporization is mainly dependent on temperature. The vapor pressure of DNAPL's can actually be greater than the vapor pressure of volatile organic compounds. For example, at 20 C, the ratio of the vapor pressures of TCE and benzene is 1.4 (1).

Volatility

The volatility of a compound is a measure of the transfer of the compound from the aqueous phase to the gaseous phase. The transfer process from the water to the atmosphere is dependent on the chemical and physical properties of the compound, the presence of other compounds, and the physical properties (velocity, turbulence, depth) of the water body and atmosphere above it. The factors that control volatilization are the solubility, molecular weight, vapor pressure, and the nature of the air-water interface through which it must pass (31). The Henry's constant is a valuable parameter which can be used to help evaluate the propensity of an organic compound to volatilize from the water. The Henry's law constant is defined as the vapor pressure divided by the aqueous solubility. Therefore, the greater the Henry's law constant, the greater the tendency to volatilize from the aqueous phase, refer to Table 1.

Interfacial Tension

The unique behavior of DNAPLs in porous media is largely attributed to the interfacial tension which exists between DNAPL and water, and between DNAPL and air. These interfacial tensions, result in distinct interfaces between these fluids at the pore-scale. When two immiscible liquids are in contact, there is an interfacial energy which exists between the fluids resulting in a physical interface. The interfacial energy arises from the difference between the inward attraction of the molecules in the interior of each phase and those at the surface of contact (2). The greater the interfacial tension between two immiscible liquids; the less likely emulsions will form; emulsions will be more stable if formed, and the better the phase separation after mixing. The magnitude of the interfacial tension is less than the larger of the surface tension values for the pure liquids, because the mutual attraction of unlike molecules at the interface reduces the large imbalance of forces (31). Interfacial tension decreases with increasing temperature, and may be affected by pH, surfactants, and gases in solution (36). When this force is encountered between a liquid and a gaseous phase, the same force is called the surface tension (66).

The displacement of water by DNAPL and the displacement of DNAPL by water in porous media often involves a phenomena referred to as immiscible fingering. The lower the interfacial tension between immiscible fluids, the greater the instability of the water:DNAPL interface and thus the greater the immiscible fingering (27). The distribution of the fingering effects in porous media has been reported to be a function of the density, viscosity, surface tension (27) and the displacement velocity

(13) of the fluids involved as well as the porous media heterogeneity (28).

Vettability

Wettability refers to the relative affinity of the soil for the various fluids - water, air, and the organic phase. On a solid surface, exposed to two different fluids, it can be inferred from the contact angle (66), also referred to as the wetting angle, refer to Figure 15. In general, if the wetting angle is less than 90 degrees, the fluid is said to be the wetting fluid. In this scenario, water will preferentially occupy the smaller pores and will be found on solid surfaces (14). When the wetting angle is near 90 degrees, neither fluid is preferentially attracted to the solid surfaces. If the wetting angle is greater than 90 degrees, the DNAPL is said to be the wetting fluid. The wetting angle is an indicator used to determine whether the porous material will be preferentially wetted by either the hydrocarbon or the aqueous phase (71). Wettability, therefore, describes the preferential spreading of one fluid over solid surfaces in a two-fluid system. The wetting angle, which is a measure of wettability, is a solid-liquid interaction and can actually be defined in terms of interfacial tensions (71). Several methods have been developed to measure the wetting angle (36,71). In most natural systems, water is the wetting fluid, and the immiscible fluid is the non-wetting fluid. Coal tar may be the exception (i.e. contact angle greater than 90 degrees), which is mainly attributed to the presence of surfactants (70). The wetting fluid will tend to coat the surface of grains and occupy smaller spaces (i.e. pore throats) in porous media, the non-wetting fluid will tend to be restricted to the largest openings (47).

The wetting angle depends on the character of the solid face on which the test is conducted. The test is conducted flat plates composed of minerals which are believed representative of the media, or on glass. Contact angle measurements for crude oil indicates that the wetting angles vary widely depending on the mineral surface (53). Soil and aquifer material are not composed of homogeneous mineral composition nor flat surfaces. The measured wetting angle can only be viewed as a qualitative indicator of wetting behavior.

The reader is recommended to refer to reference No. 82 for review of the basic principles and for various techniques to

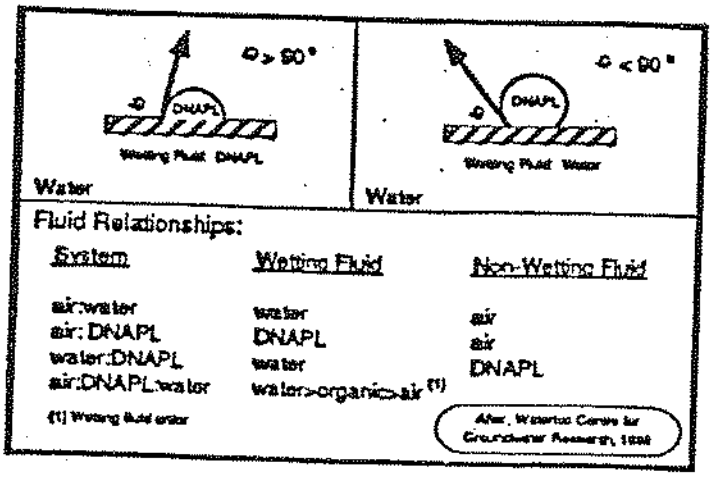


Figure 15. Wetting angle and typical wetting fluid relationships.

measure the following DNAPL parameters: density, viscosity, interfacial tension, solubility, vapor pressure, and volatility.

Subsurface Media Characteristics

Capillary Force/Pressure

Capillary pressure is important in DNAPL transport because it largely determines the magnitude of the residual saturation that is left behind after a spill incident. The greater the capillary pressure, the greater the potential for residual saturation. In general, the capillary force increases in the following order; sand, silt, clay. Correspondingly, the residual saturation increases in the same order. Capillary pressure is a measure of the tendency of a porous medium to suck in the wetting fluid phase or to repel the nonwetting phase (2). Capillary forces are closely related to the wettability of the porous media. The preferential attraction of the wetting fluid to the solid surfaces cause that fluid to be drawn into the porous media. Capillary forces are due to both adhesion forces (the attractive force of liquid for the solids on the walls of the channels through which it moves) and cohesion forces (the attraction forces between the molecules of the liquid) (32). The capillary pressure depends on the geometry of the void space, the nature of solids and liquids, the degree of saturation (2) and in general, increases with a decrease the wetting angle and in pore size, and with the increase in the interfacial tension (71). All pores have some value of capillary pressure. Before a non-wetting fluid can enter porous media, the capillary pressure of the largest pores (smallest capillary pressure) must be exceeded. This minimum capillary pressure is called the entry pressure.

In the unsaturated zone, pore space may be occupied by water, air (vapors), or immiscible hydrocarbon. In this scenario, capillary pressure retains the water (wetting phase) mainly in the smaller pores where the capillary pressure is greatest. This restricts the migration of the DNAPL (non-wetting phase) through the larger pores unoccupied by water. Typically, DNAPL does not displace the pore water from the smaller pores. It is interesting to note that the migration of DNAPL through fine material (high capillary pressure) will be impeded upon reaching coarser material (low capillary pressure).

The capillary fringe will obstruct the entry of the DNAPL into the saturated zone. When a sufficient volume of DNAPL has been released and the "DNAPL pressure head" exceeds the water capillary pressure at the capillary fringe (entry pressure), the DNAPL will penetrate the water table. This is why DNAPL is sometimes observed to temporarily flatten out on top of the water table. Similarly, laboratory experiments have been conducted in which DNAPL (tetrachloroethylene) infiltrating through porous media was found to flow laterally and cascade off lenses too fine to penetrate (28), (refer to Figure 11). This was attributed to the inability of the DNAPL to overcome the high capillary pressure associated with the lenses. Logically, when "DNAPL pressure head" exceeds the capillary pressure, the DNAPL will penetrate into the smaller pores. These laboratory experiments are important because they illustrate that small differences in the capillary characteristics of porous media can induce significant lateral flow of non-wetting fluids.

A comprehensive investigation of capillary trapping and multiphase flow of organic liquids in unconsolidated porous media revealed many intricacies of this process in the vadose

and saturated zone (66). An important note is that while capillary pressure is rarely measured at hazardous waste sites, the soil texture (sand, silt, clay) is usually recorded during drilling operations and soil surveys. This information, along with soil core analyses will help to delineate the stratigraphy and the volume distribution of NAPL.

Pore Size Distribution/Initial Moisture Content

In natural porous media, the geometry of the pore space is extremely irregular and complex (2). The heterogeneity of the subsurface environment i.e. the variability of the pore size distribution, directly affects the distribution of the capillary pressures along the interfaces between the aqueous and immiscible phases (50). In saturated column experiments, it was observed that NAPL preferentially traveled through strings of macropores, almost completely by-passing the water filled micropores (66). In the same study, a heterogeneous distribution of coarse and fine porous material was simulated. Most of the incoming organic liquid preferentially traveled through the coarse lens material.

In short term column drainage experiments, results indicated that the particle grain size is of primary importance in controlling the residual saturation of a gasoline hydrocarbon (19). Fine and coarse sands (dry) were found to have 55% and 14% residual saturation, respectively. The finer the sand, the greater the residual saturation. During these experiments, the residual saturation was reduced 20-30% in a medium sand and 50% in a fine sand when the sands were initially wet. Soil pore water held tightly by capillary forces in the small pores will limit the NAPL to the larger pores, and thus, result in lower residual saturation. In a similar laboratory (unsaturated) column study, the smaller the grain size used in the experiment, the greater the residual saturation of the NAPL (74). The residual saturation in the saturated column experiments was found to be greater than the unsaturated columns and was independent of the particle size distribution.

These observations follow traditional capillary force theory. Residual saturation resulting from a DNAPL spill in the unsaturated zone is highly dependent on the antecedent moisture content in the porous media. When the moisture content is low, the strong capillary forces in the smaller pores will tenaciously draw in and hold the DNAPL. When the moisture content is high, the capillary forces in the smaller pores will retain the soil pore water, and DNAPL residual saturation will mainly occur in the larger pores. Therefore, greater residual saturation can be expected in dryer soils. Correspondingly, NAPL will migrate further in a wetter soil, and displacement of NAPL from small pores is expected to be more difficult than from large pores.

Stratigraphic Gradient

DNAPL migrating vertically will likely encounter a zone or stratigraphic unit of lower vertical permeability. A reduction in the vertical permeability of the porous media will induce lateral flow of the DNAPL. The gradient of the lower permeable stratigraphic unit will largely determine the direction in which the DNAPL will flow. This is applicable to both the saturated and unsaturated zones. As depicted in Figures 13a and 13b, the lateral direction of DNAPL flow may be in a different direction than ground-water flow.

Ground Water Flow Velocity

The ground water flow velocity is a dynamic stress parameter which tends to mobilize the hydrocarbon (39). As the ground water velocity increases, the dynamic pressure and viscous forces increase. Mobilization of DNAPL occurs when the viscous forces of the ground water acting on the DNAPL exceeds the porous media capillary forces retaining the DNAPL.

Saturation Dependent Functions

Residual Saturation

Residual saturation is defined as the volume of hydrocarbon trapped in the pores relative to the total volume of pores (38) and therefore is measured as such (74). Residual saturation has also been described as the saturation at which NAPL becomes discontinuous and is immobilized by capillary forces (36). The values of residual saturation vary from as low as 0.75 - 1.25% for light oil in highly permeable media to as much as 20% for heavy oil (50). Residual saturation values have also been reported to range from 10% to 50% of the total pore space (39,74). Other researchers reported that residual saturation values appear to be relatively insensitive to fluid properties and very sensitive to soil properties (and heterogeneities) (66). Laboratory studies conducted to predict the residual saturation in soils with similar texture and grain size distribution yielded significantly different values. It was concluded that minor amounts of clay or silt in a soil may play a significant role in the observed values.

In the unsaturated zone during low moisture conditions, the DNAPL residual saturation will wet the grains in a pendular state (a ring of liquid wrapped around the contact point of a pair of adjacent grains). During high moisture conditions, the wetting fluid, which is typically water, will preferentially occupy the pendular area of adjacent grains and the hydrocarbon will occupy other available pore space, possibly as isolated droplets. In the saturated zone, the DNAPL residual saturation will be present as isolated drops in the open pores (47). Furthermore, results of laboratory experimentation indicated that residual saturation increased with decreasing hydraulic conductivity in both the saturated and unsaturated zones and that the residual saturation is greatest in the saturated zone. Laboratory experiments indicated that vadose zone residual saturation was roughly one third of the residual saturation in the saturated zone (66). The increase in residual saturation in the saturated zone is due to the following: [1] the fluid density ratio (DNAPL:air versus DNAPL:water above and below the water table, respectively) favors greater drainage in the vadose zone; [2] as the non-wetting fluid in most saturated media, NAPL is trapped in the larger pores; and, [3] as the wetting fluid in the vadose zone, NAPL tends to spread into adjacent pores and leave a lower residual content behind, a process that is inhibited in the saturated zone (36). Thus, the capacity for retention of DNAPLs in the unsaturated zone is less than the saturated zone.

Relative Permeability

Relative permeability is defined as the ratio of the permeability of a fluid at a given saturation to its permeability at 100% saturation. Thus it can have a value between 0 and 1 (71).

Figure 16 illustrates a relative permeability graph for a two fluid phase system showing the relationship between the observed permeability of each fluid for various saturations to that of the observed permeability if the sample were 100% saturated with that fluid (73). The three regions of this graph are explained as follows (71): Region I has a high saturation of DNAPL and is considered a continuous phase while the water is a discontinuous phase, therefore, water permeability is low. Assuming the DNAPL is the non-wetting fluid, water would fill the smaller capillaries and flow through small irregular pores. In Region II, both water and DNAPL are continuous phases although not necessarily in the same pores. Both water and

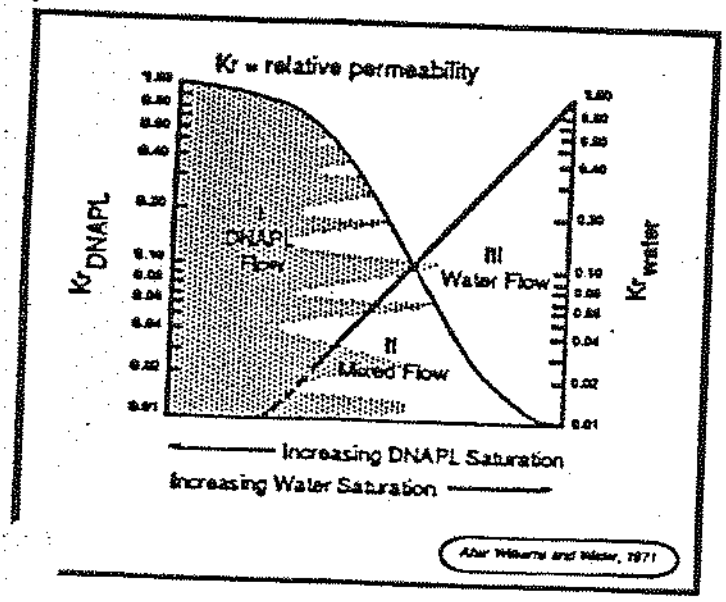


Figure 16. Relative permeability graph.

NAPL flow simultaneously. However, as saturation of either phase increases, the relative permeability of the other phase correspondingly decreases. Region III exhibits a high saturation of water while the DNAPL phase is mainly discontinuous. Water flow dominates this region and there is little or no flow of DNAPL.

Both fluids flow through only a part of the pore space and thus only a part of the cross section under consideration is available for flow of each fluid. Therefore, the discharge of each fluid must be lower corresponding to its proportion of the cross sectional area (46).

Figure 17 is another relative permeability graph which demonstrates several points. Small increases in DNAPL saturation results in a significant reduction in the relative permeability of water. However, a small increase in water saturation does not result in a significant reduction in DNAPL relative permeability. This figure identifies two points, SO1 and SO2, where the saturation of the DNAPL and the water are greater than 0 before there is a relative permeability for this fluid. The two fluids hinder the movement of the other to different degrees and both must reach a minimum saturation before they achieve any mobility at all (47). These minimum saturations, for the water and DNAPL, are identified as irreducible and residual saturation, respectively.

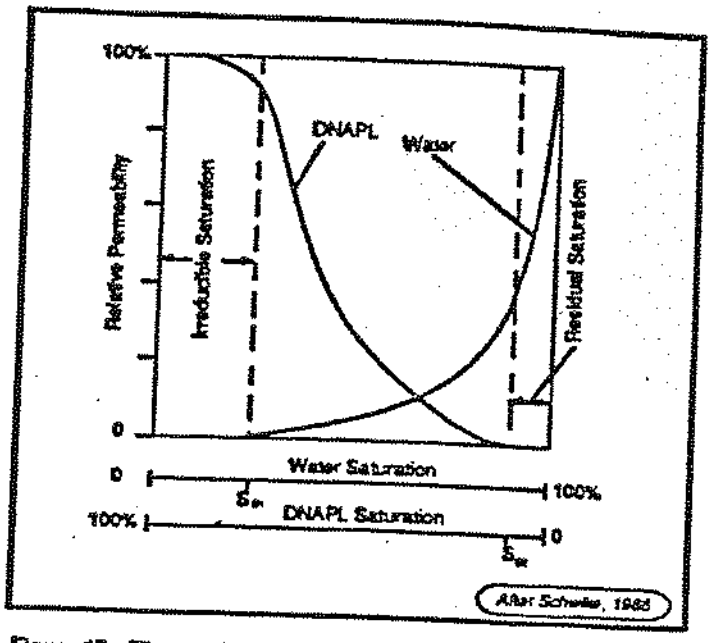


Figure 17. The relative permeability curves for water and a DNAPL in a porous medium as a function of the pore space saturation.

Site Characterization for DNAPL

Characterization of the subsurface environment at hazardous waste sites containing DNAPL is complex and will likely be expensive. Specific details associated with the volume and timing of the DNAPL release are usually poor or are not available and subsurface heterogeneity is responsible for the complicated and unpredictable migration pathway of subsurface DNAPL transport. As discussed previously, slight changes in vertical permeability may induce a significant horizontal component to DNAPL migration.

Site characterization typically involves a significant investment in ground-water analyses. Although analysis of ground water provides useful information on the distribution of the soluble components of the DNAPL, the presence of other phases of the DNAPL may go unrecognized. The investigation must, therefore, be more detailed to obtain information concerning the phase distribution of the DNAPL at a site. Site characterization may require analyses on all four phases (aqueous, gaseous, solid, immiscible) to yield the appropriate information (refer to Table 2). In brief, data collected on the various phases must be compiled, evaluated and used to help identify: where the contaminant is presently located; where it has been; what phases it occurs in; and what direction the mobile phases may be going. A comprehensive review of site characterization for subsurface investigations is available (68). Development of monitoring and remediation strategies can be focused more effectively and efficiently after a clear definition of the phase distribution has been completed.

Ground Water

Ground water analyses for organic compounds, in conjunction with ground water flow direction data, has repeatedly been used to: delineate the extent of ground water contamination from DNAPL; determine the direction of plume migration; and

Table 2 - Phase Distribution of DNAPL in the Subsurface

MATRIX	PHASE
1. ground water	aqueous - soluble components of DNAPL
2. soil/aquifer material	solid - adsorbed components of DNAPL on solid phase material
3. DNAPL	immiscible - continuous phase (mobile), residual saturation (immobile)
4. soil gas	gaseous - volatile components

to identify probable DNAPL source area(s). While this approach has been used successfully to characterize the distribution of contaminants in the subsurface, there are limitations. For example, since DNAPL and ground water may flow in different directions, as indicated in Figures 13a and 13b, ground water analyses may not necessarily identify the direction of DNAPL migration.

Ground water analyses may be useful to identify probable DNAPL source areas, but, estimating the volume of DNAPL in the subsurface is limited using this approach. Soluble phase components of DNAPL are rarely found in excess of 10% of the solubility even when organic liquids are known or suspected to be present. The concentration of soluble DNAPL components in the ground water is not only a function the amount of DNAPL present, but also the chemical and physical characteristics of the DNAPL, the contact area and time between the ground water and DNAPL, and numerous transport and fate parameters (retardation, biodegradation, dispersion, etc.). One technique has been developed using chemical ratios in the ground water as a means of source identification and contaminant fate prediction (18).

Soil/Aquifer Material

Exploratory Borings

Physical and chemical analyses of soil and aquifer material (drill cuttings, cores) from exploratory borings will provide useful information in the delineation of the horizontal and vertical mass distribution of DNAPL. While simple visual examination for physical presence or absence of contamination might seem like a worthwhile technique, it can be deceiving and does nothing to sort out the various liquid phases and their relationship to each other (71). A quantitative approach is necessary to determine DNAPL distribution.

Drill cuttings or core material brought to the surface from exploratory borings can be screened initially to help delineate the depth at which volatile components from the various phases of the hydrocarbon exists. The organic vapor analyzer and the HNU are small portable instruments that can detect certain volatile compounds in the air. These methods are used to initially screen subsurface materials for volatile components of DNAPL. Identification of individual compounds and their concentrations may be confirmed by other, more precise, analyses.

Analysis of the soil or aquifer material by more accurate means, such as gas chromatography or high pressure liquid chromatography, will take longer but will provide more specific information on a larger group of organic compounds, i.e., volatile/non-volatile, and on specific compounds. This information is necessary to help fix the horizontal and vertical mass distribution of the contaminant and to help delineate the phase distribution. These analyses do not distinguish between soluble, sorbed or free-phase hydrocarbon, however; a low relative concentration indicates that the contaminant may mainly be present in the gaseous or aqueous phases; and a high relative concentration indicates the presence of sorbed contaminant or free phase liquid either as continuous-phase or residual saturation. A more rigorous set of analyses is required to distinguish between the various phases.

Additional tests to identify the presence of NAPL in soil or aquifer core sample are currently undeveloped and research in this area is warranted. Squeezing and immiscible displacement techniques have been used to obtain the pore water from cores (40). Other methods of phase separation involving vacuum or centrifugation may also be developed for this use. A paint filter test was proposed in one Superfund DNAPL field investigation where aquifer cores were placed in a filter/funnel apparatus, water was added, and the filtrate was examined for separate phases. These core analysis techniques have potential to provide valuable field data to characterize NAPL distribution.

Cone Penetrometer

The cone penetrometer (ASTM D3441-86)(69) has been used for some time to supply data on the engineering properties of soils. Recently, the application of this technology has made the leap to the hazardous waste arena. The resistance of the formation is measured by the cone penetrometer as it is driven vertically into the subsurface. The resistance is interpreted as a measure of pore pressure, and thus provides information on the relative stratigraphic nature of the subsurface. Petroleum and chlorinated hydrocarbon plumes can be detected most effectively when the cone penetrometer is used in conjunction with in-situ sensing technologies (48). Features of the cone penetrometer include: a continuous reading of the stratigraphy/ permeability; in-situ measurement; immediate results are available; time requirements are minimal; vertical accuracy of stratigraphic composition is high; ground-water samples can be collected in-situ; and the cost is relatively low.

Data from the cone penetrometer can be used to delineate probable pathways of DNAPL transport. This is accomplished by identifying permeability profiles in the subsurface. A zone of low permeability underlying a more permeable stratigraphic unit will likely impede vertical transport of the DNAPL. Where such a scenario is found, a collection of DNAPL is probable and further steps can be implemented to more accurately and economically investigate and confirm such an occurrence. This general approach has successfully been implemented at one Superfund site (8).

DNAPL

Well Level Measurements

In an effort to delineate the horizontal and vertical extent of the DNAPL at a spill site, it is important to determine the elevation

of DNAPL in the subsurface. Monitoring DNAPL elevation over time will indicate the mobility of the DNAPL. There are several methods that can be used to determine the presence of DNAPL in a monitoring well. One method relies on the difference in electrical conductivity between the DNAPL and water. A conductivity or resistivity sensor is lowered into the well and a profile is measured. The interface of the DNAPL is accurately determined when the difference in conductivity is detected between the two fluids. This instrument may also be used to delineate LNAPL, also. A transparent, bottom-loading bailer can also be used to measure the thickness (and to sample) of DNAPL in a well (36). The transparent bailer is raised to the surface and the thickness of the DNAPL is made by visual measurement.

Several laboratory and field studies have been performed which investigate the anomaly between the actual and measured LNAPL levels in ground-water wells (15,16,24,25). The anomaly between actual and measured NAPL thickness in the subsurface is also applicable to DNAPL, but for different reasons. The location of the screening interval is the key to understanding both scenarios. First, if the well screen interval is situated entirely in the DNAPL layer, and the hydrostatic head (water) in the well is reduced by pumping or bailing, then to maintain hydrostatic equilibrium, the DNAPL will rise in the well (36,44,71) (refer to Figure 18). Secondly, if the well screen extends into the barrier layer, the DNAPL measured thickness will exceed that in the formation by the length of the well below the barrier surface (36) (refer to Figure 19). Both of these scenarios will result in a greater DNAPL thickness in the well and thus a false indication (overestimate) of the actual DNAPL thickness will result. One of the main purposes of the monitoring well in a DNAPL investigation is to provide information on the thickness of the DNAPL in the aquifer. Therefore, construction of the well screen should intercept the ground water:DNAPL interface and the lower end of the screen should be placed as close as possible to the impermeable stratigraphic unit.

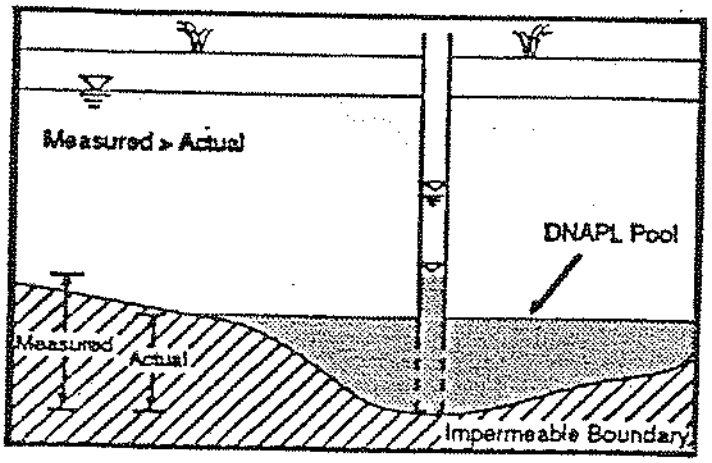


Figure 18. A well screened only in the DNAPL in conjunction with lower hydrostatic head (i.e. water) in the well may result in an overestimation of DNAPL thickness.

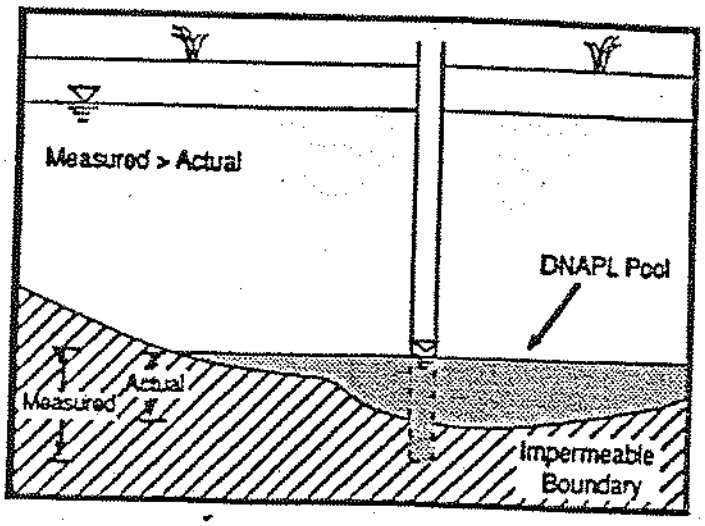


Figure 19. A well screened into an impermeable boundary may result in an over-estimation of the DNAPL thickness.

DNAPL Sampling

Sampling of DNAPL from a well is necessary to perform chemical and physical analyses on the sample. Two of the most common methods used to retrieve a DNAPL sample from a monitoring well are the peristaltic pump and the bailer. A peristaltic pump can be used to collect a sample if the DNAPL is not beyond the effective reach of the pump, which is typically less than 25 feet. The best method to sample DNAPL is to use a double check valve bailer. The key to sample collection is controlled, slow lowering (and raising) of the bailer to the bottom of the well (57). The dense phase should be collected prior to purging activities.

Soil-Gas Surveys

A soil-gas survey refers to the analysis of the soil air phase as a means to delineate underground contamination from volatile organic chemicals and several techniques have been developed (34,52). This investigative tool is mainly used as a preliminary screening procedure to delineate the areal extent of volatile organic compounds in the soil and ground water. This method is quick, less expensive than drilling wells and can provide greater plume resolution (33).

Data from a soil-gas survey is a valuable aid in the development of a more detailed subsurface investigation where ground water monitoring wells and exploratory borings are strategically located for further site characterization. There are limitations to soil-gas surveys (26,52) and data interpretation must be performed carefully (35,49). Soil-gas investigations have mainly been conducted to identify the location of the organic contaminants in ground water. At the time of this publication, the scientific literature did not contain information specifically applicable to the delineation of DNAPL from soil-gas survey data. However, it is surmisable that soil-gas surveys can be used to help delineate DNAPL residual saturation in the unsaturated zone or the location of perched DNAPL reservoirs.

Miscellaneous

The vertical migration of DNAPL in the saturated zone will eventually be challenged by a low permeability stratigraphic unit. According to the principles of capillary pressure, the lower permeability unit will exhibit a greater capillary pressure. Displacement of water by DNAPL requires that the hydrostatic force from the mounding DNAPL exceed the capillary force of the low permeability unit. The Hobson formula is used to compute the critical height calculation to overcome the capillary pressure under different pore size conditions (70).

In an effort to minimize further DNAPL contamination as a result of drilling investigations, precautionary steps should be taken. Penetration of DNAPL reservoirs in the subsurface during drilling activities offers a conduit for the DNAPL to migrate vertically into previously uncontaminated areas. It is very easy to unknowingly drill through a DNAPL pool and the bed it sits on, causing the pool to drain down the hole into a deeper part of the aquifer or into a different aquifer (32). Special attention to grouting and sealing details during and after drilling operations will help prevent cross-contamination.

Precautionary efforts should also be considered when a DNAPL reservoir is encountered during drilling operations. The recommended approach is to cease drilling operations and install a well screen over the DNAPL zone and cease further drilling activities in the well. If it is necessary to drill deeper, construction of an adjacent well is recommended. Alternatively, if it is not necessary to screen off that interval, it is recommended to carefully seal off the DNAPL zone prior to drilling deeper.

Well construction material compatibility with DNAPL should be investigated to minimize downhole material failure. A construction material compatibility review and possible testing will prevent the costly failure of well construction material. The manufacturers of well construction material are likely to have the most extensive compatibility data and information available.

Remediation

Remediation of DNAPL mainly involves physical removal by either pumping or trench-drainline systems. Removal of DNAPL early in the remediation process will eliminate the main source of contaminants. This step will substantially improve the overall recovery efficiency of the various DNAPL phases including the long term pump and treat remediation efforts for soluble components. Remediation technologies such as vacuum extraction, biodegradation, ground water pumping, and soil flushing is mainly directed at the immobile DNAPL and the various phases in which its components occur. Physical barriers can be used in an effort to minimize further migration of the DNAPL.

Clean-up of DNAPL can involve sizable expenditures: they are difficult to extract and the technology for their removal is just evolving (43). Historically, field recovery efforts usually proceed with a poor understanding of the volume distribution of the DNAPL. This reflects the difficulties involved in adequate site characterization, poor documentation of the release, and the complexity associated with the DNAPL transport in the subsurface.

Pumping Systems

Pumping represents an important measure to stop the mobile DNAPL from migrating as a separate phase by creating a hydraulic containment and by removal of DNAPL (44). Very simply, DNAPL recovery is highly dependent on whether the DNAPL can be located in the subsurface. The best recovery scenario is one in which the DNAPL is continuous and has collected as a reservoir in a shallow, subsurface impermeable depression. Once the DNAPL has been located and recovery wells are properly installed, pumping of pure phase DNAPL is a possible option but depends largely on site specific conditions which include, but are not limited to: DNAPL thickness, viscosity, and permeability.

Many DNAPL reservoirs in the subsurface are of limited volume and areal extent. Therefore, it can be expected that both the level of DNAPL (saturated thickness) in the well will decline from the prepumping position and the percentage of DNAPL in the DNAPL:water mixture will decrease rather rapidly. Correspondingly, DNAPL recovery efficiency decreases. Field results indicate that recovery wells screened only in the DNAPL layer will maintain maximum DNAPL:water ratios (102). Well diameter was not found to influence long term DNAPL recovery; however, large diameter wells allow high volume pumping for short durations; and small diameter wells result in lower DNAPL:water mixtures and greater drawdown.

An enhanced DNAPL recovery scheme may be used to improve recovery efficiency. An additional well is constructed with a screen interval in the ground water zone located vertically upward from the DNAPL screen intake. Ground water is withdrawn from the upper screen which results in an upwelling of the DNAPL (70), refer to Figure 20. The upwelling of the DNAPL, coal tar in this case, improved the rate (twofold) at which the coal tar was recovered resulting in a more efficient operation. The ground water withdrawal rate must be carefully determined; too much will cause the coal tar from rising excessively and being either mixed (emulsions) with or suppressed by the higher water velocity above; too low will not

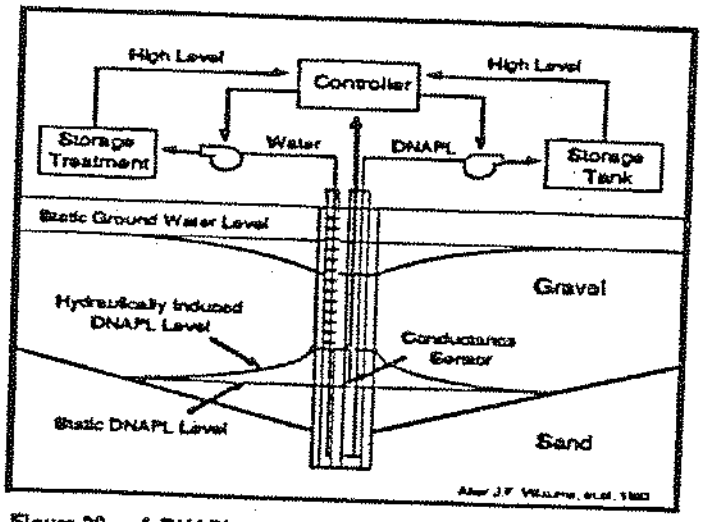


Figure 20. A DNAPL recovery system where deliberate upwelling of the static coal-tar surface is used to increase the flow of product into the recovery wells.

caused upwelling. An estimate of this upwelling can be calculated using the simplified Ghyben-Herzberg Principle for ideal conditions (4). Laboratory studies indicated that ...ethyl phthalate (1.19 g/cc) recovery rate was doubled or tripled over the conventional, non-upconing, recovery scheme (75). A similar application of this technique was used to increase the level of DNAPL (solvents) in a sandstone bedrock formation (11). Other enhanced DNAPL recovery techniques were implemented utilizing both water flooding and wellbore vacuum. Essentially, this minimized drawdown, allowing a maximum pumping rate of the DNAPL:water mixture. Both techniques offered significant advantages in terms of the rate and potential degree of DNAPL removal (8).

The highly corrosive nature of some DNAPL's may increase maintenance problems associated with the recovery system. A design consideration during any DNAPL recovery program should include a material compatibility review to minimize downhole failures. This is applicable to the well construction material and the various appurtenances of the recovery system. Manufacturers of the construction material would most likely have the best compatibility information available.

While most researchers agree that the residual saturation of immiscible hydrocarbon droplets in porous media are immobile, researchers have investigated the mobility of residual saturation in porous media for enhanced oil recovery and for NAPL remediation at spill sites. Specifically, this includes a complex interplay between four forces (viscous, gravity, capillary, buoyancy). These forces are dependent on both the chemical and physical characteristics of the DNAPL and porous media. The mobilization of residual saturation ...ly hinges on either increasing the ground water velocity ...n increases the viscous forces between the residual saturation and the ground water, or decreasing the interfacial tension between the residual saturation and the ground water which decreases the capillary forces.

The capillary number is an empirical relationship which measures the ratio between the controlling dynamic stresses (absolute viscosity and ground water velocity) and static stresses (interfacial tension) of the residual saturation (39). The former are the viscous stresses and the dynamic pressure in the water which tend to move the oil. The latter are the capillary stresses in the curved water/oil interfaces which tend to hold the oil in place. As the capillary number is increased, the mobility of the residual saturation increases. In a laboratory column study, the capillary number had to be increased two orders of magnitude from when motion was initiated to complete displacement of the hydrocarbon in a sandstone core (74). In a glass bead packed column, only one order of magnitude increase was required. However, a higher capillary number was required to initiate mobility. The difference in mobility between the two columns was attributed to the pore geometry, i.e. size, shape.

There are limitations to residual saturation mobilization. The ground water gradient (dh/dl) necessary to obtain the critical capillary number to initiate blob mobilization would be 0.24. To obtain complete NAPL removal would require a gradient of 18 (3). Ground water gradients of this magnitude are unrealistic. Another estimate of the gradient necessary to mobilize carbon t... chloride in a fine gravel and medium sand was 0.09 and 0... respectively (74). The former gradient is steep but not u...asonable and the latter gradient is very steep and impractical to achieve in the field. The same researchers concluded from more recent, comprehensive studies, that the earlier predictions were optimistic, and that the gradient necessary to mobilize residual organic liquid is clearly impractical (66). Another limitation is that along with residual saturation mobilization, the NAPL blobs disperse into smaller blobs and that the blob distribution was dependent on the resulting capillary number (6). Recovery of the NAPL residual saturation by pumping ground water may be more feasible where the porous media is coarse and capillary forces are low, i.e. coarse sands and gravel. However, even in this scenario, it is expected that the radius of residual saturation mobilization would be narrow.

It is held in petroleum engineering theory that the only practical means of raising the capillary number dramatically is by lowering the interfacial tension (39) and that this can be achieved by using surfactants (66). Surfactants reduce the interfacial tension between two liquids, and therefore, are injected into the subsurface for enhanced recovery of immiscible hydrocarbons. In laboratory experiments, surfactant flushing solutions produced dramatic gains in flushing even after substantial water flushing had taken place (54). Unfortunately, surfactants can be quite expensive and cost prohibitive in NAPL recovery operations. Surfactants are usually polymeric in nature and a surfactant residue may be left behind in the porous media which may not be environmentally acceptable. Additionally, surfactants may be alkaline and thus effect the pH of the subsurface environment. It has been suggested that such a surfactant may inhibit bacterial metabolism and thus preclude subsequent use of biological technologies at the site. Significant research in this area is currently underway which may uncover information improving the economics and feasibility of this promising technology.

In summary, practical considerations and recommendations in mobilization and recovery of residual saturation include the following: more effective in very coarse porous media i.e. coarse sands and gravel; installation of recovery wells at the source to minimize flow path distance; large volume of water to treat/dispose at the surface; compounds with high interfacial tension or viscosity will be difficult to mobilize; implementation of linear one-dimensional sweeps through the zones of residual saturation (74) and surfactants will optimize recovery.

Pumping the soluble components (aqueous phase) of DNAPL from the immiscible (continuous and residual saturation), solid (sorbed), and gaseous phases has been perhaps one of the most effective means to date to both recover DNAPL from the subsurface and to prevent plume migration. Recovery of soluble components quite often has been the only remediation means available. This is attributed to the inability to locate recoverable DNAPL pools and due to low DNAPL yielding formations. The basic principles and theory of pump and treat technology and the successes and failures have been summarized in other publications (64,67) and is beyond the scope of this publication.

Pumping solubilized DNAPL components from fractured rock aquifers historically has been plagued with a poor recovery efficiency. Although the rock matrix has a relatively small intergranular porosity, it is commonly large enough to allow dissolved contaminants from the fractures to enter the matrix by diffusion and be stored there by adsorption (32). The

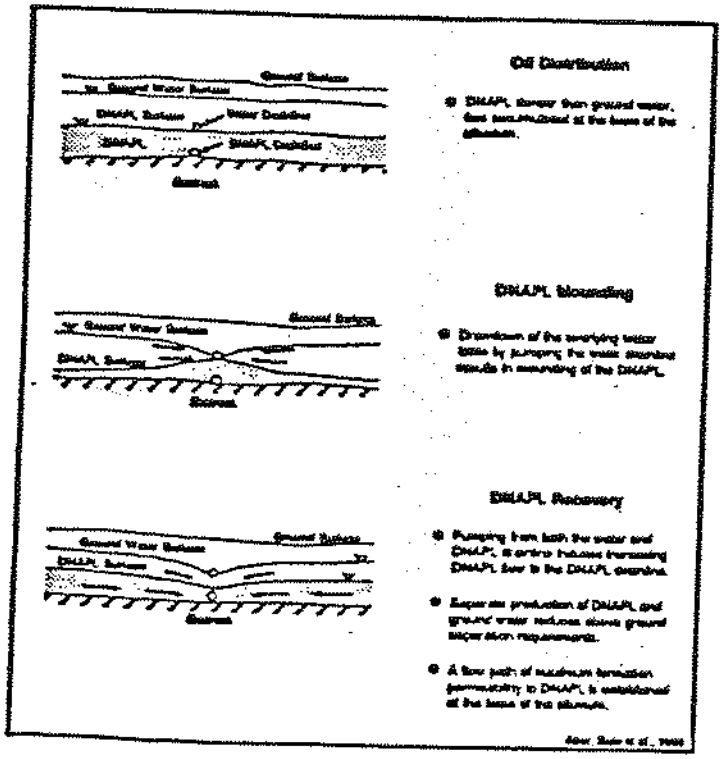


Figure 21. Trench recovery system of DNAPL utilizing the dual drainline concept.

release of these components is expected to be a slow diffusion dominated process. This is because little or no water flushes through dead-end fracture segments or through the porous, impervious rock matrix. Therefore, clean-up potential is estimated to be less than that expected for sand and gravel aquifers.

Trench Systems

Trench systems have also been used successfully to recover DNAPL and are used when the reservoir is located near the ground surface. Trench systems are also effective when the DNAPL is of limited thickness. Recovery lines are placed horizontally on top of the impermeable stratigraphic unit. DNAPL flows into the collection trenches and seep into the recovery lines. The lines usually drain to a collection sump where the DNAPL is pumped to the surface. Similar to the pumping system, an enhanced DNAPL recovery scheme may be implemented using drain lines to improve recovery efficiency. This "dual drain line system" (41) utilizes a drain line located in the ground water vertically upward from the DNAPL line. Ground water is withdrawn from the upper screen which results in an upwelling of the DNAPL which is collected in the lower line, refer to Figure 21. This increases the hydrostatic head of the DNAPL. Excessive pumping of either single or dual drain line systems may result in the ground water "pinching off" the flow of DNAPL to the drain line. An advantage of the dual drain system is that the oil:water separation requirements at the surface are reduced.

Vacuum Extraction

Soil vacuum extraction (SVE) is a remediation technology which involves applying a vacuum to unsaturated subsurface strata to induce air flow. Figure 22 illustrates that the volatile contaminants present in the contaminated strata will evaporate and the vapors are recovered at the surface and treated. Common methods of treatment include granular activated carbon, catalytic oxidation, and direct combustion. SVE can effectively remove DNAPL present as residual saturation. In general, vacuum extraction is expected to be more applicable for the chlorinated solvents (PCE, TCE, DCE) than the polycyclic aromatic compounds (wood preserving wastes, coal tars, etc.). This technology is most effective to remove DNAPL residual saturation and soluble components in the unsaturated zone. When DNAPL is present in perched pools (Figure 12) it is more effective to remove DNAPL in the unsaturated zone prior to the implementation of SVE. The same strategy is applicable in the saturated zone where DNAPL removal by SVE is attempted concomitantly with lowering the water table. Upon lowering the water table, SVE can be used to remove the remnant volatile wastes not previously recovered. Often, the precise location of the DNAPL is unknown; therefore, SVE can be used to remediate the general areas where the presence of DNAPL is suspected. Removal of DNAPL by SVE is not expected to be as rapid as direct removal of the pure phase compound. One advantage of SVE however, is that he precise location of the DNAPL need not be known.

Important parameters influencing the efficacy of SVE concern both the DNAPL and porous media. Porous media specific parameters include: soil permeability, porosity, organic carbon, moisture, structure, and particle size distribution. DNAPL specific parameters include: vapor pressure, Henry's constant, solubility, adsorption equilibrium, density, and viscosity (20). These parameters and their relationships must be evaluated on a site specific basis when considering the feasibility of vacuum extraction and a practical approach to the design, construction, and operation of venting systems (22). Additionally, soil gas surveys which delineate vapor concentration as a function of depth is critical in locating the contaminant source and designing an SVE system.

Historically, SVE has been used to remove volatile compounds from the soil. Recently it has been observed that SVE enhances the biodegradation of volatile and semivolatile organic compounds in the subsurface. While SVE removes volatile components from the subsurface, it also aids in supplying oxygen to biological degradation processes in the unsaturated zone. Prior to soil venting, it was believed that biodegradation in the unsaturated zone was limited due to inadequate concentrations of oxygen (17). In a field study where soil venting was used to recover jet fuel, it was observed that approximately 15% of the contaminant removal was from the result of microbial degradation. Enhanced aerobic biodegradation during SVE increases the cost effectiveness of the technology due to the reduction in the required above ground treatment.

Vacuum extraction is one form of pump and treat except that the fluid is a gas mixture and that it occurs in the unsaturated zone. Therefore, many of the same limitations to pump and treat are also applicable to vacuum extraction. While the application of vacuum extraction is conceptually simple, its success depends on understanding complex subsurface

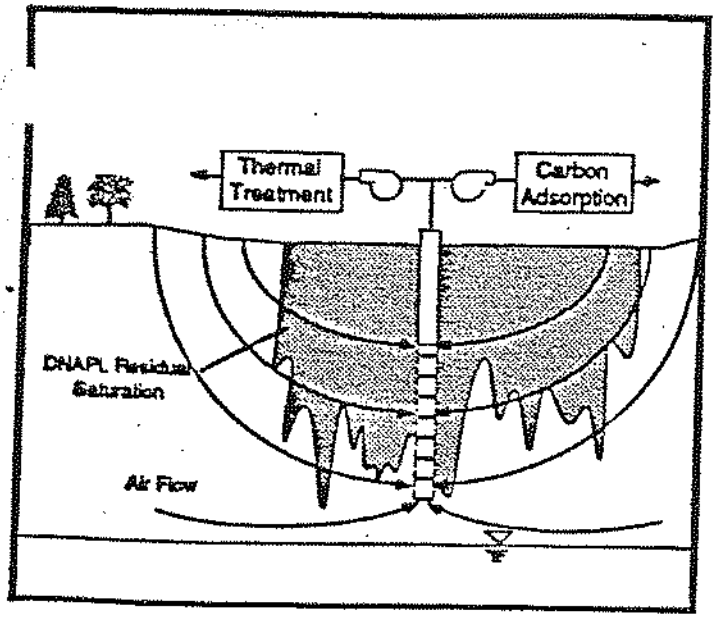


Figure 22. Vacuum extraction of DNAPL volatile components in the unsaturated zone. As shown here, vapors are treated by thermal combustion or carbon adsorption and the air is discharged to the atmosphere.

chemical, physical, and biological processes which provide insight into factors limiting its performance (9).

degradation

The potential for biodegradation of immiscible hydrocarbon is highly limited for several reasons. First, pure phase hydrocarbon liquid is a highly hostile environment to the survival of most microorganisms. Secondly, the basic requirements for microbiological proliferation (nutrients, electron acceptor, pH, moisture, osmotic potential, etc.) is difficult if not impossible to deliver or maintain in the DNAPL. A major limitation to aerobic bioremediation of high concentrations of hydrocarbon is the inability to deliver sufficient oxygen. A feasible remediation approach at sites where immiscible hydrocarbon is present is a phased technology approach. Initial efforts should focus on pure phase hydrocarbon recovery to minimize further migration and to decrease the volume of NAPL requiring remediation. Following NAPL recovery, other technologies could be phased into the remediation effort. Bioremediation may be one such technology that could be utilized to further reduce the mass of contaminants at the site. NAPL recovery preceding bioremediation will improve bioremediation feasibility by reducing the toxicity, time, resources, and labor.

Similar to other remediation technologies, a comprehensive feasibility study evaluating the potential effectiveness of bioremediation is critical and must be evaluated on a site specific basis. A comprehensive review of biodegradation of surface soils, ground water, and subsoils of wood preserving wastes, i.e. PAH's (29,37,51,62,63) are available. A
c rehensive review of microbial decomposition of
c nated aromatic compounds is also available (58).

Soil Flushing

Soil flushing utilizing surfactants is a technology that was developed years ago as a method to enhance oil recovery in the petroleum industry. This technology is new to the hazardous waste arena and available information has mainly been generated from laboratory studies. Surfactant soil flushing can proceed on two distinctly different mechanistic levels: enhanced dissolution of adsorbed and dissolved phase contaminants, and displacement of free-phase nonaqueous contaminants. These two mechanisms may occur simultaneously during soil flushing (42).

Surfactants, alkalis, and polymers are chemicals used to modify the pore-level physical forces responsible for immobilizing DNAPL. In brief, surfactants and alkalis reduce the surface tension between the DNAPL and water which increases the mobility. Polymers are added to increase the viscosity of the flushing fluid to minimize the fingering effects and to maintain hydraulic control and improve flushing efficiency. Based on successful laboratory optimization studies where an alkali-polymer-surfactant mixture was used, field studies were conducted on DNAPL (creosote) which resulted in recovery of 94% of the original DNAPL (42). Laboratory research has also been conducted which indicated that aqueous surfactants resulted in orders of magnitude greater removal efficiency of adsorbed and dissolved phase contaminants than water flushing (55).

Depth to contamination, DNAPL distribution, permeability, heterogeneities, soil/water incompatibility, permeability reduction, and chemical retention are important factors when considering soil flushing (42). Prior to this technology being cost effective in the field, surfactant recycling will be necessary to optimize surfactant use (55). Soil flushing is complex from a physical and chemical point of view; is relatively untested in the field; and will likely be challenged regulatorily. Considerable research currently being conducted in this area may result in the increased use of this technology to improve DNAPL recovery in the future.

Thermal methods of soil flushing involve injecting hot water or steam in an effort to mobilize the NAPL. The elevated temperature increases volatilization and solubilization and decreases viscosity and density. A cold-water cap is used to prevent volatilization. The mobile phases of the DNAPL are then recovered using a secondary approach, i.e. pumping, vacuum extraction etc. This approach (Contained Recovery of Oily Wastes) to enhance recovery of DNAPL is currently under EPA's Superfund Innovative Technology Evaluation Program and a pilot-scale demonstration is forthcoming (21). A limitation in the use of thermal methods is that the DNAPL may be converted to LNAPL due to density changes (36). The adverse effects from this are that the DNAPL, existing as a thin layer, becomes buoyant and mobilizes vertically resulting in a wider dispersal of the contaminant. Other limitations involve the high energy costs associated with the elevated water temperature and the heat loss in the formation (36).

Physical Barriers

Physical barriers may be used to prevent the migration of DNAPL's in the subsurface and are typically used in conjunction with other recovery means. One feature of physical

barriers is the hydraulic control it offers providing the opportunity to focus remediation strategies in treatment cells. Unfortunately, physical barriers, while satisfactory in terms of ground water control and containment of dissolved-phase plumes, may contain small gaps or discontinuities which could permit escape of DNAPL (7). Chemical compatibility between physical barriers and construction material must agree to insure the physical integrity of the barrier. The history of the performance of these containment technologies is poorly documented and is mainly offered here for completeness of review. A more complete review of these physical barriers is available (5,56).

Sheet piling involves driving lengths of steel that connect together into the ground that form an impermeable barrier to lateral migration of DNAPL. Ideally, the bottom of the sheet pile should be partially driven into an impermeable layer to complete the seal. Slurry walls involve construction of a trench which is backfilled with an impermeable slurry (bentonite) mixture. Grouting is a process where an impermeable mixture is either injected into the ground or is pumped into a series of interconnected boreholes which together form an impermeable boundary. Again, the main feature of these techniques is to physically isolate the DNAPL.

In summary, site characterization and remediation options for sites containing DNAPL are limited. Field results from site characterization and remediation efforts are also limited. This s largely due to the complexity of DNAPL transport and fate in he subsurface; poorly developed techniques currently vailable to observe and predict DNAPL in the subsurface, and lue to the fact that this issue has not been widely recognized, ntil recently. Clearly, there is a growing realization within the cientific and regulatory community that DNAPL is a significant ctor in limiting site remediation. Correspondingly, current esearch efforts within the private industrial, and public sectors re focusing on both the fundamentals and applications spects of DNAPL behavior in subsurface systems. dditionally, the number of field investigations reflecting an creased awareness of DNAPLs, is growing.

NAPL Modeling

modeling overview report identified nineteen (numeric and alytic) multiphase flow models which are currently available). Most of these models were developed for salt water usion, LNAPL transport, and heat flow. Four models are alitatively described as immiscible flow models but do not ecifically indicate DNAPL. A more recent model has been veloped which simulates density driven, three phase flow, t is capable of modeling DNAPL transport (23). Presently, y little information is available on DNAPL modeling in the ntific literature.

ltiphase flow modeling involves modeling systems where re than one continuous fluid phase (NAPL, water, gaseous) resent. Modeling any subsurface system requires a ceptual understanding of the chemical, physical, and ogical processes occuring at the site. Modeling of ultaneous flow of more than one fluid phase requires a ceptual understanding of the fluids and the relationship veen the fluid phases. The significance of multiphase flow r single phase flow is the increased complexity of fluid flow the additional data requirements necessary for modeling.

As presented earlier, numerous variables strongly influence DNAPL transport and fate, and consequently, the mathematical relationship of these variables is complex. Therefore, it follows that DNAPL modeling presents paramount technical challenges.

Presently, it is exceedingly difficult to obtain accurate field data which quantitatively describes DNAPL transport and fate variables within reasonable economic constraints. DNAPL transport is highly sensitive to subsurface heterogeneities (8,27,28) which compounds the complexity of modeling. Heterogeneities are, by nature, difficult to identify and quantify and models are not well equipped to accommodate the influence of heterogeneities. Additionally, relative permeability and capillary pressure functions must be quantified to identify the relationship between fluids and between the fluids and the porous media. Unfortunately, these parameters are very difficult to measure, particularly in three phase systems. Prior to an investment of time and money to model a given site, a careful evaluation of the specific objectives and the confidence of the input and anticipated output data should be performed. This will help illuminate the costs, benefits, and therefore, the relative value of modeling in the Superfund decision making process.

In summary, DNAPL modeling at Superfund sites is presently of limited use. This is mainly due to: the fact that very little information is available in the scientific literature to evaluate previous work; accurate and quantitative input data is expected to be costly; the sensitivity of DNAPL transport to subsurface heterogeneities; and, the difficulty in defining the heterogeneities in the field and reflecting those in a model. However, multiphase flow models are valuable as learning tools.

References

1. Baehr, A.L., Selective Transport of Hydrocarbons in the Unsaturated Zone Due to Aqueous and Vapor Phase Partitioning, Water Resources Research, Vol. 23, No. 10, pp. 1926-1938, 1987.

2. Bear, J., 1972, Dynamics of Fluids in Porous Media, American Elsevier Publishing Co., New York, 763 p.

3. Bouchard, D., Contaminant Transport in the Subsurface: Sorption Equilibrium and the Role of Nonaqueous Phase Liquids, in, Intermedia Pollutant Transport: and Field Measurement, (David T. Allen, Yoram Cohen and Isaac R. Kaplan, Eds.), New York, Plenum Pub. Corp., pp. 189-211.

4. Bower, H., Groundwater Hydrology, McGraw-Hill Book Co., 1978, 480 pp.

5. Canter, L. W. and R. C. Knox, Ground Water Pollution Control, Lewis Publishers Inc., Chelsea, Mich., 1986, 526 pp.

6. Chatzis, I., M.S. Kuntamukkula, and N.R. Morrow, Blob-size Distribution as a Function of Capillary Number in Sandstones, Paper 13213, Presented at SPE Annual Tech. Conference and Exhibition, Houston, TX, 1984.

7. Cherry, J.A., S. Feenstra, B.H. Kueper and D.W. McWhorter, "Status of In Situ Technologies for Cleanup of Aquifers Contaminated by DNAPL's Below the Water Table," in, International Specialty Conference on How Clean is Clean? Cleanup Criteria for Contaminated Soil and Groundwater, Air and Waste Management Association, pp. 1-18, November 6-9, 1990.

8. Connor, J.A., C.J. Newell, D.K. Wilson, Assessment, Field Testing, Conceptual Design for Managing Dense Nonaqueous Phase Liquids (DNAPL) at a Superfund Site, in, Proceedings of Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, A Conference and Exposition, The Westin Galleria, Houston, TX, Vol. 1, pp. 519-533, 1989.

9. DiGiulio, D.C. and J.S. Cho, Conducting Field Tests for Evaluation of Soil Vacuum Extraction Application, in, Proceedings of the Fourth National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring, and Geophysical Methods, Las Vegas, NV, May 14-17, 1990, pp. 587-601.

10. Feenstra, S., Evaluation of Multi-Component DNAPL Sources by Monitoring of Dissolved-Phase Concentrations, in, Proceedings of the Conference On Subsurface Contamination by Immiscible Fluids, International Association of Hydrogeologists, Calgary, Alberta, April 18-20, 1990.

11. Ferry, J.P. and P.J. Dougherty, Occurrence and Recovery of a DNAPL in a Low-Yielding Bedrock Aquifer, in, Proceedings of the NWWA/API Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water - Prevention, Detection and Restoration, Nov. 12-14, Houston, TX., 1986, pp. 722-733.

12. Fu, J.K. and R.G. Luthy, Effect of Organic Solvent on Sorption of Aromatic Solutes onto Soils, Journal of Environmental Engineering, Vol. 112, No. 2, pp. 346-366, 1986.

13. Glass, R.J., T.S. Steenhuis, and J.Y. Parlange, Mechanism for Finger Persistence in Homogeneous Unsaturated Porous Media: Theory and Verification, Soil Science, 148(1), pp. 60-70, 1989.

14. Hall, A.C., S.H. Collins, and J.C. Melrose, Stability of Aqueous Wetting Films, Society of Petroleum Engineering Journal, 23(2), pp. 249-258, 1983.

15. Hall, R.A., S.B. Blake, and S.C. Champlin, Jr., Determination of Hydrocarbon Thickness in Sediments Using Borehole Data, in, Proceedings of the 4th National Symposium and Exposition on Aquifer Restoration and Ground Water Monitoring, Columbus, OH, pp. 300-304, May 23-25, 1984.

16. Hampton, D.R., and P.D.G. Miller, Laboratory Investigation of the Relationship Between Actual and Apparent Product Thickness in Sands, in, Proceedings of Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, A Conference and Exposition, The Westin Galleria, Houston, Texas, Vol. 1, pp. 157-161, November 9-11, 1988.

17. Hinchee, R.E., D.C. Downey, R.R. Dupont, P. Aggarwal, and R.N. Miller, Enhancing Biodegradation of Petroleum Hydrocarbon Through Soil Venting, Journal of Hazardous Materials, (accepted) 1990.

18. Hinchee, R.E. and H.J. Reisinger, A Practical Application of Multiphase Transport Theory to Ground Water Contamination Problems, Ground Water Monitoring Review, pp. 84-92, Winter, 1987.

19. Hoag, G.E. and M.C. Marley, Gasoline Residual Saturation in Unsaturated Uniform Aquifer Materials, Journal of Environmental Engineering, Vol. 112, No. 3, pp. 586-604, 1989.

20. Hutzler, N.J., B.E. Murphy, and J.S. Gierke, Review of Soil Vapor Extraction System Technology, Presented at Soil Vapor Extraction Technology Workshop, June 28-29, 1989, Edison, New Jersey.

21. Johnson, L.A. and F.D. Guffey, "Contained Recovery of Oily Wastes, Annual Progress Report." Western Research Institute, Laramie, Wyoming, June, 1989.

22. Johnson, P.C., C.C. Stanley, M.W. Kemblowski, D.L. Byers, and J.D. Colthart, A Practical Approach to the Design, Operation, and Monitoring of In Situ Soil-Venting Systems, Ground Water Monitoring Review, pp. 159-178, Spring 1990.

23. Katyal, A.K., J.J. Kaluarachchi, and J.C. Parker, MOFAT: A Two-Dimensional Finite Element Program for Multiphase Flow and Multicomponent Transport, Program Documentation, Version 2.0, Virginia PolyTechnic Institute and State University, 58 pp., August, 1990.

24. Kemblowski, M.W. and C.Y. Chiang, Analysis of the Measured Free Product Thickness in Dynamic Aquifers, in, Proceedings of Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, A Conference and Exposition, The Westin Galleria, Houston, Texas, Vol. 1, pp. 183-205, November 9-11, 1988.

25. Kemblowski, M.W. and C.Y. Chiang, Hydrocarbon Thickness Fluctuations in Monitoring Wells, Ground Water, Vol. 28, No. 2, pp. 244-252, 1990.

26. Kerfoot, H.B., Is Soil-Gas Analysis an Effective Means of Tracking Contaminant Plumes in Ground Water? What are the Limitations of the Technology Currently Employed? Ground Water Monitoring Review, pp. 54-57, Spring 1988.

27. Kueper, B.H. and E.O. Frind, An Overview of Immiscible Fingering in Porous Media, Journal of Contaminant Hydrology, Vol. 2, pp. 95-110, 1988.

28. Kueper, B.H., W. Abbott, and G. Farquhar, Experimental Observations of Multiphase Flow in Heterogeneous Porous Media, Journal of Contaminant Hydrology, Vol. 5, pp. 83-95, 1989.

29. Lee, M.D., J.M. Thomas, R.C. Borden, P.B. Bedient, J.T. Wilson, and C.H. Ward, Biorestoration of Aquifers Contaminated with Organic Compounds, National Center for Ground Water Research, CRC Critical Reviews in Environmental Contrl, Vol. 18, Issue 1, pp. 29-89, 1988.

30. Lindeburg, M.R., 1986, Civil Engineering Reference Manual, 4th edition, Professional Publications Inc. Belmont, CA.

31. Lyman, W.J., W.F. Reehl, and D.H. Rosenblatt, Handbook of Chemical Property Estimation Methods, McGraw-Hill Book Company, 1982.

32. Mackay, D.M. and J.A. Cherry, Ground-Water Contamination: Pump and Treat Remediation, Environmental Science & Technology, Vol. 23, No. 6, pp. 630-636, 1989.

33. Marrin, D.L. and G.M. Thompson, Gaseous Behavior of TCE Overlying a Contaminated Aquifer, Ground Water, Vol. 25, No. 1, pp. 21-27, 1987.

34. Marrin, D., Kerfoot, H, Soil-gas surveying techniques Environmental Science & Technology, Vol. 22, No. 7, pp. 740-745, 1988.

35. Marrin, D.L., Soil-Gas Sampling and Misinterpretation, Ground Water Monitoring Review, pp. 51-54, Spring 1988.

36. Mercer, J.W. and R.M. Cohen, A Review of Immiscible Fluids in the Subsurface: Properties, Models, Characterization and Remediation, Journal of Contaminant Hydrology, Vol. 6, pp. 107-163, 1990.

37. Mississippi Forest Products Laboratory, Proceedings of the Bioremediation of Wood Treating Waste Forum, Mississippi State University, March 14-15, 1989.

38. Morrow, N.R., Interplay of Capillary, Viscous and Bouyancy Forces in the Mobilization of Residual Oil, The Journal of Canadian Petroleum, Vol. 18, No. 3, pp. 35-46, 1979.

39. Ng, K.M., H.T. Davis, and L.E. Scriven, Visualization of Blob Mechanics in Flow Through Porous Media, Chemical Engineering Science, Vol. 33, pp. 1009-1017, 1978.

40. Patterson, R.J., S.K. Frape, L.S. Dykes, and R.A. McLeod, A Coring and Squeezing Technique for the Detailed Study of Subsurface Water Chemistry, Canadian Journal Earth Science, Vol. 15, pp. 162-169, 1978.

41. Sale, T., CH2M Hill, and Kuhn, B., Recovery of Wood-Treating Oil from an Alluvial Aquifer Using Dual Drainlines, In, Proceedings of Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, A Conference and Exposition, The Westin Galleria, Houston, Texas, Vol. 1, pp. 419-442, November 9-11, 1988.

42. Sale, T., K. Piontek, and M. Pitts, Chemically Enhanced In-Situ Soil Washing, in Proceedings of the Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, Houston, TX, November 15-17, 1989.

43. Schmidtke, K., E. McBean, and F. Rovers, Drawdown Impacts in Dense Non-Aqueous Phase Liquids, in NWWA Ground Water Monitoring Symposium, Las Vegas, Nevada, pp. 39-51, May, 1987.

44. Schmidtke, K., E. McBean, and F. Rovers, Evaluation of Collection Well Parameters for DNAPL, Journal of Environmental Engineering, accepted, August, 1990.

45. Schwille, F., Groundwater Pollution in Porous Media by Fluids Immiscible With Water, The Science of the Total Environment, Vol. 21, pp. 173-185, 1981.

46. Schwille, F., Migration of Organic Fluids Immiscible with Water in the Unsaturated Zone, in, Pollutants in Porous Media: The Unsaturated Zone Between Soil Surface and Groundwater, (B. Yaron, G. Dagan, J. Goldshmid, Eds.) Springer-Verlag, New York, pp. 27-48, 1984.

47. Schwille, F., Dense Chlorinated Solvents in Porous and Fractured Media: Model Experiments (English Translation), Lewis Publishers, Ann Arbor, MI 1988.

48. Seitz, W.R., In-Situ Detection of Contaminant Plumes in Ground Water, Special Report 90-27, U.S. Army Corps of Engineers, Cold Regions Research & Engineering Laboratory, August 1990, 12 pp.

49. Silka, L., Simulation of Vapor Transport Through the Unsaturated Zone - Interpretation of Soil-Gas Surveys, Ground Water Monitoring Review, pp. 115-123, Spring 1988.

50. Sitar, N., J.R. Hunt, and K.S. Udell, Movement of Nonaqueous Liquids in Groundwater, in, Proceedings of a Speciality Conference, Geotechnical Practice for Waste Disposal '87, University of Michigan, Ann Arbor, MI, pp. 205-223, June 15-17, 1987.

51. Sims, R., Soil Remediation Techniques at Uncontrolled Hazardous Waste Sites, Air & Waste Management Association, Vol. 40, No. 5, pp. 704-732, May 1990.

52. Thompson, G., and Marrin, D., Soil Gas Contaminant Investigations: A Dynamic Approach, Ground Water Monitoring Review, pp. 88-93, Summer, 1987.

53. Treiber, L.E., D.L. Archer, and W.W. Owens, A Laboratory Evaluation of Wettability of Fifty Oil-Producing Reservoirs, Society of Petroleum Engineering Journal, 12(6), 531-540.

54. Tuck, D.M., P.R. Jaffe, and D.A. Crerar, Enhancing Recovery of Immobile Residual Non-Wetting Hydrocarbons from the Unsaturated Zone Using Surfactant Solutions, in, Proceedings of Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, A Conference

and Exposition, The Westin Galleria, Houston, Texas, Vol. 1, pp. 457-478, November 9-11, 1988.

55. U.S. EPA,. Treatment of Contaminated Soils with Aqueous Surfactants, EPA/600/2-85/129, NTIS PB86-122561, 84 pp., 1985.

56. U.S. EPA, Handbook Remedial Action at Waste Disposal Sites, EPA/625/6-85/006, October, 1985.

57. U.S. EPA, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD), OSWER Directive 9950.1, 1986c.

58. U.S. EPA, Microbial Decomposition of Chlorinated Aromatic Compounds, EPA/600/2-86/090, September 1986.

59. U.S. EPA, Characterization and Laboratory Soil Treatability Studies for Creosote and Pentachlorophenol Sludges and Contaminated Soil, EPA/600/2-88/055 or NTIS Publication #PB89-109920, 138 p., 1988.

60. U.S. EPA, Ground Water Modeling: An Overview and Status Report, EPA/600/2-89/028, December, 1988.

61. U.S. EPA, Contaminant Transport in Fractured Media: Models for Decision Makers, EPA/600/SF-88/002, October, 1988.

62. U.S. EPA, Characterization and Laboratory Soil Treatability Studies for Creosote and Pentachlorophenol Sludges and Contaminated Soil, EPA/600/2-88/055, September 1988.

U.S. EPA, Bioremediation of Contaminated Surface Soils, EPA-600/9-89/073, 23 pp., August 1989.

64. U.S. EPA, Performance Evaluations Of Pump And Treat Remediations, Superfund Ground Water Issue, EPA/540/4-89/005, 19 pp.,1989.

65. U.S. EPA, Subsurface Contamination Reference Guide, EPA/540/2-90/011, October, 1990.

66. U.S. EPA, Laboratory Investigation of Residual Liquid Organics from Spills, Leaks, and Disposal of Hazardous Wastes in Groundwater, EPA/600/6-90/004, April, 1990.

67. U.S. EPA, Basics of Pump and Treat Ground Water Remediation Technology, EPA-600/8-90/003, 31 pp., March 1990.

68. U.S. EPA, Site Characterizations for Subsurface Remediations, EPA/625/ - /(in press) 1990.

69. U.S. Federal Highway Administration, Guidelines for Cone Penetration Test: Performance and Design, FHWA-TS-78-209 (TS 78 No. 209) February, 1977.

70. Villaume, J.F., P.C. Lowe, and D.F. Unites, Recovery of Coal Gasification Wastes: An Innovative Approach, in, Proceedings Third National Symposium on Aquifer Restoration and Ground Water Monitoring, National Water Well Association, Worthington, OH, pp. 434-445, 1983.

71. Villaume, J.F., Investigations at Sites Contaminated with Dense, Non-Aqueous Phase Liquids (NAPLs), Ground Water Monitoring Review, Vol. 5, No. 2, pp. 60-74, 1985.

72. Waterloo Centre for Ground Water Research, University of Waterloo Short Course, "Dense Immiscible Phase Liquid Contaminants in Porous and Fractured Media," Kitchener, Ontario, Canada, Nov. 6-9, 1989.

73. Williams, D.E. and D.G. Wilder, Gasoline Pollution of a Ground- Water Reservoir - A Case History, Ground Water, Vol. 9, No. 6, pp. 50- 54, 1971.

74. Wilson, J.L. and S.H. Conrad, Is Physical Displacement of Residual Hydrocarbons a Realistic Possibility in Aquifer Restoration?, in, Proceedings of the NWWA/API Conference on Petroleum Hydrocarbons and Organic Chemicals in Ground Water—Prevention, Detection, and Restoration, The Intercontinental Hotel, Houston, Texas, pp. 274-298, November 5-7, 1984.

75. Wisniewski, G.M., G.P. Lennon, J.F. Villaume, and C.L. Young, Response of a Dense Fluid Under Pumping Stress, in, Proceedings of the 17th Mid-Atlantic Industrial Waste Conference, Lehigh, University, pp. 226-237, 1985.

ATTACHMENT B

PACKER TEST PROCEDURE

PACKER TEST PROCEDURES

I. Introduction

Packer testing is a method used to estimate the hydraulic conductivity of discrete bedrock zones within an open-bedrock corehole or open-bedrock well/piezometer. A packer test involves tightly sealing off a selected interval in the bedrock hole, pumping clean water into the test interval under a specified head for a specified duration, and recording the volume of water pumped into the formation during the test duration. To allow interpretation of the flow characteristics (e.g., laminar or turbulent), the rock fracture response (e.g., dilation, washout, or void filling) and the representative conductivity value for the tested bedrock interval, five test increments are performed at three different head conditions. The hydraulic conductivity is calculated based on the observed test pumping rates, the total applied head values, the geometry of the tested interval, and the pattern of pumping rates achieved during each of the five test increments.

The following presents methods for both single and double packer testing.

II. Materials

The equipment used for packer testing consists of two assemblies:

(1) A packer apparatus consisting of inflatable rubber packer(s) and a length of perforated pipe; and

(2) A water system, including a water meter, pressure gauge and valves to adjust and maintain the water pressure and flow.

The following list of equipment to be used for packer testing is meant to serve only as a guide because actual site and borehole conditions may require modifications. The driller may provide much of the equipment. Typical equipment and materials used to perform packer testing include:

- Drill rig to install and remove the packer and water pipe;
- Packer (pneumatic or hydraulically actuated);
- Water pipe, ranging from 1 to 2 inches in diameter, depending on the permeability and surface area of the test section;
- Flow meter of the same diameter as the water pipe above;
- Pump, capacity to approximately 50 gpm;
- Storage tanks of appropriate volume for holding clean water for injection into test interval;
- Two pressure transducers, sized in accordance with the depth of the test interval and the excess injection pressure to be applied during the test;
- Compressed gas cylinders, regulators, and tubing for inflating pneumatic packers or alternative pressure source if hydraulically-actuated packers are used;
- Water swivel or elbow;
- Hose or piping of the same diameter as the water pipe;
- Electronic data logger for recording transducer output;

- Water level indicator or equivalent oil/water interface meter with 0.01 foot increments;
- Stopwatch;
- Constant-head injection data sheets (an example is provided in Figure 1);
- Personal Protective Equipment (PPE) as required by the Site-specific EHS Plan;
- Decontamination supplies (as needed); and
- Field logbook.

III. Packer Apparatus Configurations

Either single-packer or double-packer configurations may be used to perform the packer test. The single-packer test typically is performed after each core run during the drilling of corehole. The packer is seated at the top of the interval of rock core just removed, and the newly exposed section of bedrock is tested. To remove sediment from the corehole wall, the corehole may be bailed, surged or swabbed prior to packer testing. The test should not be initiated, however, until the water level in the drill casing returns to the static level.

Single-packer tests may provide more reliable results than double-packer tests because if water leaks past a single, upper packer, the leak may be discerned by the recognition of a rising water level in the corehole or drill casing above the packer or by the appearance of water in the casing at the ground surface. In contract, if a double-packer configuration is used, leakage past the lower packer may enter a permeable corehole section below the lower packer without being recognized as leakage.

The double-packer configuration is used if discrete rock intervals are to be tested in a previously-drilled long open corehole. Two packers are placed in the corehole and inflated with the perforated portion of the pipe between the packers. The spacing between the packers, corresponding to the test interval length, typically is 5 to 0 feet. Specified bedrock intervals are tested starting from the bottom of the hole and working upwards at intervals selected by the supervising geologist/engineer.

IV. Water System

The water system typically is assembled with a bypass valve and line connected to the main water line before the water meter valve. The purposes of the bypass valve are (1) to dampen the surge of water produced by the action of the pump, thus providing a relatively constant flow rate and water pressure; and (2) to allow a pressure bypass so that relatively low pressures may be applied to the tested rock interval, if appropriate. A surge suppression tank may also be plumbed into the water system before the bypass line to help dampen pump surge affects.

A water meter valve and the water meter follow the bypass valve and line. Flow to the tested rock interval passes through the water meter valve and is recorded by the water meter. The bypass and water meter valves are used simultaneously to maintain the water in the line at the desired pressure. The maximum water pressure for a particular pumping rate is achieved with the meter valve fully opened and the bypass valve fully closed. The bypass valve should be used as much as possible, however, to utilize its surge damping effect.

The remainder of the water system apparatus consists of a check valve, a relief valve and line, a water pressure gauge, and finally a length of riser pipe connecting the perforated pipe and packer assembly to the water supply apparatus. The pressure gauge indicates the water pressure in the apparatus at that location, rather than the pressure applied to the tested rock interval. The total head applied during a test consists of the gauge pressure plus the elevation head (the vertical distance between the pressure gauge and the static water level in the corehole), minus the frictional head loss between the pressure gauge and the perforated pipe where the water exits the apparatus and enters the tested rock interval. The magnitude of frictional head loss depends on the length of riser pipe used and the pumping rate, and is best determined empirically by calibrating the test assembly in the field. Alternately, frictional losses may be estimated based on hydraulics equation such as the Hazen-Williams equation (Meritt, 1983), which relates head loss to pipe geometry and flow rate.

V. Packer Test Apparatus Calibration

The frictional head loss in the riser pipe assembly should be determined in the field by a calibration process to obtain a reliable estimate of the total head applied to the test interval. The calibration is performed by pumping water through the apparatus at a constant pressure and flow rate for a specified duration, typically a few minutes. The gauge pressure, total flow volume, pumping duration, and riser pipe length are recorded, and the procedure is repeated at a different flow rate. The process is repeated at several flow rates that span the representative range of flow rates achievable by the pump.

The calibration is performed with the water system and packer apparatus laid out horizontally along the ground surface. The packer(s) remain deflated during the calibration procedure to avoid rupturing. The perforated section of pipe is supported slightly above the ground surface so that water may drain freely during pumping through the test assembly. The perforated pipe section and the pressure gauge are situated at approximately equal elevation during the calibration to eliminate the elevation head between the pressure gauge and the perforated pipe section. Because the elevation head is zero, the pressure gauge measurements obtained during calibration indicate only the frictional head loss in the pipe assembly.

The calibration process should be repeated and a separate set of gauge pressure versus pumping rate data generated for each total length of riser pipe used during actual packer testing. The calibration procedure may be performed after the appropriate riser-pipe lengths are identified by the performance of packer tests. The data of gauge pressure versus pumping rate are later plotted on a X-Y axis. A best-fit power-law regression curve is calculated for each data set to determine the mathematical relationship between pumping rate and frictional loss. During hydraulic conductivity calculation, frictional head loss for each observed flow rate is estimated from the plot of calibration data corresponding to the length of riser pipe used during the test.

VI. Test Gauge Pressure Calculation

Appropriate test pressures to be used during each of the five test increments are calculated as follows:

(1) Calculate the maximum gauge pressure, to be used during test increment #3 as:

$$P_3 \text{ (psi)} = 0.75 \times \text{Depth of Test Section Midpoint (feet)}$$

(2) Calculate the gauge pressures to be used during the other test increments as:

$P_1 = P_5 = 0.4 \times P_3$ and

$P_2 = P_4 = 0.7 \times P_3$.

VII. Packer Test Procedures

Prior to testing a given bedrock interval, the corehole identification number, the depth of the test interval, the static depth to water in the corehole, the gauge height above ground surface, and the length of riser pipe used in the apparatus are recorded on a packer test data log. After the packer(s) have been seated at the desired interval, the remainder of the test is performed as follows:

1. Open the bypass valve completely with the water meter valve closed.

2. Start the pump or open other water supply.

3. Open the meter valve slowly to allow water to flow and pressure to build. If this valve is completely opened and additional pressure is still needed, it may be obtained by slowly closing off the bypass valve, thus forcing more water through the water meter valve.

4. After the desired pressure for a desired given test increment has been achieved, record the time and volume form the totalizing water meter.

5. To perform a test increment, record the water meter reading at one minute intervals for 5 to 10 minutes of continuous pumping. Check the gauge to ensure the pressure remains constant throughout the test increment, and adjust the flow valves as needed to maintain constant pressure.

6. Adjust the valves in the water system to achieve the calculated appropriate pressure for the next test increment, and repeat steps #4 and #5 above.

7. If the appropriate test interval gauge pressure cannot be achieved due to a highly-permeable tested bedrock interval, the maximum achieved gauge pressure and the pumping rate data for the five minute test increment should be recorded.

8. The packer test for a given bedrock interval is complete after all five test increments have been performed.

9. Record the test data on the packer test data log.

VIII. Packer Test Data Reduction

Packer test data are reduced to develop estimates of hydraulic conductivity for each tested interval based on standard data reduction procedures (United States Bureau of Reclamation, 1974; Houlsby, 1976). Data are entered into an automatic packer-test data reduction spreadsheet program. The spreadsheet calculates the hydraulic conductivity from each of the five test increments for each tested bedrock interval as:

$$K = Cp\ Q/H$$

where:

K = hydraulic conductivity (feet per year);
Q = flow rate (gallons per minute);
H = total head applied during test (feet); and
Cp = packer coefficient.

Based on equations published in the Earth Manual (United States Bureau of Reclamation 1974), the packer coefficient can be calculated from:

$$Cp = [70267 \ln (L/r)] / 2\pi L$$

where:

L = length of the tested bedrock interval (feet); and
r = radius of tested bedrock corehole (feet).

In addition to the hydraulic conductivity value, the packer test reduction spreadsheet calculates a Ludgeon value (Houlsby, 1976) for each of the five test increments. The five Ludgeon values are evaluated to interpret the type of flow and bedrock formation response and most representative calculated hydraulic conductivity value for the tested bedrock interval from the following list:

(1) Laminar Flow
- Indication: Ludgeon values are approximately equal.
- Conductivity: Average of values from five test increments.

(2) Turbulent Flow
- Indication: Ludgeon value from increment #3 is less than those from the lower pressure increments, which are approximately equal in value.
- Conductivity: Value from increment #3.

(3) Dilation of Bedrock Fractures
- Indication: Ludgeon value from increment #3 is greater than those from the lower pressure increments which are approximately equal in value.
- Conductivity: Average value from increments #1 and #5.

(4) Wash-out of Fracture Filling Materials
- Indication: Progressive increase in five Ludgeon values without any return to lower values during increments #4 and #5.

Conductivity: Value from increment #1.

(5) Void Filling

Indication: Progressive decrease in five Ludgeon values without any return to values during increments #4 and #5.

Conductivity: Value from increment #5.

REFERENCES

Houlsby, A.C., 1976, Routine Interpretation of the Ludgeon Water-Test, Q. Jl. Engng. Geol. Vol. 9, pp. 303-313.

Meritt, F.S., 1983, Standard Handbook for Civil Engineers, McGraw-Hill, New York.

United States Bureau of Reclamation, 1974, Earth Manual, 2nd Edition, Department of the Interior, Denver, Colorado, pp. 573-578.

FIGURE 1
TYPICAL CONSTANT-HEAD INJECTION TEST
DATA SHEET

SITE:		ENV. CONSULTING FIRM:	
BOREHOLE NO.:		FIELD PERSONNEL:	
LOCATION:		DATE:	
		TEST NO:	
Pilot hole diameter:		Pretest water level:	
Top of test section:		Product layer thickness:	
Bottom of test section:		Reference point:	
ID of water pipe:		Elevation of reference point:	
Packer type:		Transducer type:	
Length of packer:		Transducer calibration:	
Depth to packer bottom:		Flowmeter:	
Pretest water pressure (Po):		Start reading:	
Packer inflation pressure:		End reading:	

S#	Pt	t	Q	delta Q
Step No.	Test Section Pressure (psi)	Time from Start of Test (min)	Flow Rate (gpm)	Change in Flow Rate between Readings (gpm)

GENERIC
SITE CHARACTERIZATION/IRM WORK PLAN

FOR

SITE INVESTIGATIONS

AT NON-OWNED FORMER MGP SITES

Prepared for:

Niagara Mohawk, a National Grid Company
300 Erie Boulevard West
Syracuse, New York

Prepared by:

Foster Wheeler Environmental Corporation
One Park Place
300 South State Street Suite 620
Syracuse, New York

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LIST OF ABBREVIATIONS AND ACRONYMS

ASP	Analytical Service Protocol
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	Benzene, toluene, ethylbenzene and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DOT	Department of Transportation
DQOs	Data Quality Objectives
DUSR	Data Usability Summary Report
EHS	Environmental Health and Safety
FOL	Field Operations Leader
FSP	Field Sampling Plan
FWIA	Fish and Wildlife Impact Analysis
IDW	Investigation Derived Waste
IRM	Interim Remedial Measure
LNAPL	Light Non-Aqueous Phase Liquid
MGP	Manufactured Gas Plant
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSDS	Material Safety Data Sheets
NAPL	Non-aqueous phase liquid
NCP	National Contingency Plan
NM	Niagara Mohawk
NMFS	National Marine Fisheries Service
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSECL	New York State Environmental Conservation Law
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SHPO	State Historic Preservation Office
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
UFPO	Underground Facilities Protective Organization
USCS	United Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCO	Voluntary Consent Order
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This document, herein referred to as the Work Plan ("the Generic SC/IRM Work Plan") for the Niagara Mohawk, a National Grid Company, (NM) Non-owned Former Manufactured Gas Plant (MGP) Sites, was prepared by Foster Wheeler Environmental Corporation on behalf of NM. Preparation of this Generic SC/IRM Work Plan has been conducted in response to and in accordance with the requirements of the Voluntary Consent Order (VCO) between the New York State Department of Environmental Conservation (NYSDEC) and NM (Index D0-0001-0011) dated July 3, 2001. Implementation of the Generic Work Plan will meet the spirit and intent of the New York State Environmental Conservation Law (NYSECL), the VCO, NYSDEC requirements, protocols and guidance, as well as applicable Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Contingency Plan (NCP) and United States Environmental Protection Agency (USEPA) guidelines, as appropriate.

The Site Characterizations conducted at each Non-owned Former MGP Site will consist of an initial Site Characterization (SC) and, if required, a Remedial Investigation (RI). If MGP-impacted media is encountered during the SC and it is determined that further investigation and/or remediation is needed to allow a particular site to be used for the contemplated use, a RI work plan will be prepared and submitted. The SC may consist of a soil and groundwater investigation; test pit excavations and a baseline ground survey. The Fish and Wildlife Resource Impact Analysis (FWRIA), and a Phase 1A Cultural Resource Survey will be completed during the RI. The detailed scope of work for the Site Characterization at each Site is presented in the respective Site-Specific SC/IRM Work Plan. In developing the Site-Specific Work Plan, NM's Engineering Consultant will review the specific and unique Site conditions and evaluate the specific objectives of the Site Characterization. Modifications to this Generic Plan as determined appropriate and necessary by the Engineering Consultant, are to be included in the Site-Specific Work Plan. To the extent discrepancies exist between this Generic SC/IRM Work Plan and the Site-Specific SC/IRM Work Plan, the Site-Specific SC/IRM Work Plan shall control. Following implementation of Site Characterization field activities, an evaluation regarding the necessity for implementation of an Interim Remedial Measure (IRM) to address MGP impacts, if any, will be performed at each Site.

1.1 Non-owned Former MGP Site Locations

This Generic SC/IRM Work Plan covers the implementation of standard tasks to be conducted at each of the Non-owned Former MGP Sites. Site-Specific information, including a Site description and history for each of the Non-owned Former MGP Sites is presented in the respective Site-Specific SC/IRM Work Plans.

1.2 Objective of the Site Characterization

The following are the specific objectives for each Site Characterization/IRM:

- Evaluate whether MGP-impacted soil or groundwater are present at the Site;
- Determine the potential presence of MGP-related non-aqueous phase liquid (NAPL) in on-site soil and groundwater;
- Evaluate, to the extent practicable, whether groundwater flow may be a pathway for off-site migration of MGP consituents (if present);
- Provide sufficient data to evaluate necessary interim remedial measures.

1.3 Work Plan Organization

Section 1 of this Generic Work Plan is the Introduction, providing information on the scope of work, and objectives of the Site Characterization/IRM. Section 2 is the Work Plan Rationale, which includes the specific data requirements in order to meet project objectives. This section also discusses the Data Quality Objectives for the project. Section 3 is the scope of work for the Site Characterization/IRM and the Site Characterization/IRM Report to be prepared upon completion of the field activities. Section 4 is the schedule of the Site Characterization/IRM for each of the sites. Section 5.0 lists the references used in preparation of the report.

This Generic Work SC/IRM Plan is presented as Appendix A (Volume II) to the Site-Specific Work Plan for each Site subject to the VCO. Appendix B is the Generic Field Sampling Plan (Generic FSP) that describes the field procedures to be employed during the project. Appendix C is the Environmental Health and Safety (EHS) Plan for the Sites. (Site-specific information such as an emergency contact list, route to the hospital, etc. for each Site is contained in the respective Site-Specific SC/IRM Work Plan.) Appendix D is the Generic Quality Assurance Project Plan (Generic QAPP), which provides information on the quality assurance/quality control (QA/QC) measures to be followed during all Site Characterization efforts. Site-Specific QA/QC measures (e.g. number of QC samples to be collected) are presented in the Site-Specific SC/IRM Work Plan for each Site.

2.0 WORK PLAN RATIONALE

2.1 Approach/Basis for Data Collection

This section of the Generic Work Plan provides the basis for the field activities.

- **Evaluate whether potential sources of MGP-Impacted soil or groundwater are present at the Site;**

During preparation of the Generic Work Plan, the Engineering Consultant should review historical information (i.e. Sanborn Fire Insurance maps, abstracts-of-title, and deed etc.) as well as perform a complete records search including: MacRae's Industrial Directory, Site Plans and as-built (if any), and Department Geographic Information Systems. Additionally, the Engineering Consultant should visit the Federal, State and local government offices to evaluate adjacent property information, evaluate the possible presence of storage tanks and locate any aerial photographic surveys. The completion of the historical review will result in the identification of structures associated with the former MGP operations. A component of Site Characterization field activities will be the excavation of test pits through the subgrade former holder walls or in the vicinity of former purifier(s), or both. The test pits, if proposed in the site-specific SC/IRM work plan, will be visually examined to aid with the evaluation of the location, dimensions, and construction of the former structures and whether impacts to surrounding media are evident.

- **Determine the potential presence of MGP-related non-aqueous phase liquid (NAPL) in on-site soil and groundwater;**

Soil borings will be located on-site in a modified grid pattern to identify locations representing potential sources of MGP-impacted groundwater, if any. The grid will be modified; however, so that soil in the vicinity of former MGP structures is characterized. Monitoring wells will be installed in some of the boring locations for the collection of groundwater samples for testing and for the collection of water level measurements to ascertain groundwater flow direction. A component of field activities will include the collection of groundwater samples for chemical analysis. The data generated will be the basis for evaluating whether former structures at the Site (e.g. gas holders, purifiers) contain residuals that are impacting local groundwater. Laboratory analyses were selected based on suspected chemical constituents.

The Engineering Consultant will also collect surface soil samples at Sites that are not currently (or formerly) covered with asphalt, from a depth interval of 0 to 2 inches below ground surface (bgs). The surface soil samples will determine if constituents (PAHs) that may have been associated with former Site operations are present in on-site surface soils. Samples will also be collected at off-site locations so that background conditions may be established. These background locations must be representative of the present/former use conditions at the site. The Engineering Consultant, in consultation with NM, NYSDEC and NYSDOH, will select locations for background samples.

- **Evaluate, to the extent practicable, whether groundwater flow may be a pathway for off-site migration of MGP constituents (if present);**

Based on the location of former MGP structures as identified above, locations of groundwater wells were placed in the most logical locations utilizing information collected prior to the start of field work, to provide upgradient and downgradient data, using an assumed direction of groundwater flow. Monitoring wells will be installed, gauged, and sampled in order to verify the direc-

tion of groundwater flow and to characterize constituents in groundwater. These data will be used to assess whether groundwater flow may be a pathway for the off-site migration of chemical constituents.

- **Provide sufficient data to evaluate necessary interim or long-term remedial measures.**

The Engineering Consultant will evaluate, based on data and visual observations at each Site, whether IRMs are necessary. At the discretion of NM, and in consultation with the NYSDEC and New York State Department of Health (NYSDOH), an IRM may be initiated while Site Characterization field activities are on going.

2.2 Data Quality Objectives

The Generic FSP (Appendix B) outlines the procedures to be implemented for collection of the data. The Generic QAPP (Appendix D) specifies the appropriate analytical methodologies to be utilized for the testing of the various media and the data quality necessary to meet the objectives of the Site Characterization.

3.0 SITE CHARACTERIZATION FIELD ACTIVITIES

This section provides an overview of the field activities to be performed as part of the Site Characterization at each of the Non-owned Former MGP Sites. Further details associated with the field activities are provided in the Generic FSP (see Appendix B), the Generic HSP (see Appendix C), and the Generic QAPP (see Appendix D).

3.1 Site Reconnaissance

The purpose of the Site reconnaissance task is to verify and mark proposed sampling locations, waste storage locations, and the location for placement of the temporary decontamination pad. In addition, the Site owner or company representative will be asked to identify the location of known subsurface utilities and/or structures on the Site. Site reconnaissance activities will be attended by the NM Project Manager, Engineering Consultant's Project Manager or Field Operations Leader (FOL), and a representative from the NYSDEC and/or NYSDOH. The Site meeting will be scheduled within (10) ten days of NM establishing an access agreement with the owner or tenant of the Site, as appropriate (assuming prior approval of the Site-Specific Work Plan by NYSDEC).

3.2 Site Characterization Field Sampling Activities

Following the Site reconnaissance task, the Engineering Consultant will mobilize the necessary equipment, manpower, and materials to the Site. Notification of NYSDEC and NYSDOH will be provided (10) ten days prior to mobilization to the Site. The drilling subcontractor will set-up a temporary decontamination pad and decontaminate all subsurface sampling and downhole equipment in accordance with the Generic FSP (see Appendix B).

3.2.1 Mobilization/Utility Markout

The Engineering Consultant will coordinate with the Underground Facilities Protective Organization (UFPO), and the property owner or company representative of the Site to schedule the meeting. The Engineering Consultant, through UFPO, will contact local utility companies (i.e., telephone, gas, electric, cable, water, sewer, etc.) at least 72 hours prior to mobilization. NM will request that the property owner/company representative locate all other known on-site utilities/subsurface structures prior to mobilization. (See Appendix B, Generic FSP for details).

Following completion of these activities, the Engineering Consultant will mobilize to the Site to review the utility markouts, in relation to the approved Site-Specific Work Plan sampling locations and initiate field activities.

Proposed soil boring, monitoring well, and test pit excavation locations will be evaluated with respect to nearby (i.e. within 20 ft) overhead obstructions. The locations will also be evaluated with respect to on-site and off-site utility markouts and available engineering drawings of the Site. After proposed sampling locations have been modified, if necessary, the sampling locations will be finalized by the placement of markings on the ground surface with paint or painted stakes.

A decontamination pad will be constructed in an area approved by NM and the property owner. An area will also be established for the storage of drummed cuttings and fluids generated during the Site Characterization and for equipment and materials.

3.2.2 Surface Soil Sampling

Surface soil samples will be collected on-site to assess the near surface conditions and to determine if shallow soils have been impacted by the chemical constituents. The sample locations have been selected based on a modified grid pattern. The sampling locations will be finalized during the Site reconnaissance task. Visual evidence of near surface MGP related impacts and/or stressed vegetation, related to former MGP structures, will assist in final determination of the sample location orientation. The surface soil sampling locations are presented in the appropriate Site-Specific Work Plan (Volume I).

Surface soil samples will be collected with a stainless steel spoon from the interval 0 to 2 inches below the surface ground cover (e.g. gravel), if present. Surface soils will be screened with a PID and through visual and olfactory observation prior to collection. If surface soil samples do not contain observable impacts then the VOC analysis will not be performed, if observable impacts are identified then the soil sample will be analyzed for volatile organic compounds (VOCs) on the Target Compound List (TCL). All Samples, at a minimum, will be analyzed for semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) metals, and total organic carbon (TOC). Additional details on the sampling procedure are provided in the Generic FSP (see Appendix B) and the Generic QAPP (see Appendix D).

3.2.3 Soil Boring Installation

Soil borings will be drilled for the purpose of obtaining subsurface soil samples for analytical testing, geological characterization, and for the installation of monitoring wells. Boring locations were established according to a modified grid, biased toward areas where former MGP structures were located. Soil boring locations at each Site are presented in the respective Site-Specific Work Plan. The top 5 feet at each soil boring location will be hand-dug if subsurface live utilities are suspected to be present. If subsurface live utilities are found near a boring location then the location will be reoriented and the live subsurface utility will be properly protected.

Soil borings will be advanced through the unconsolidated deposits to the top of the bedrock surface, to the first confining layer, or to a pre-determined depth (either 20 or 30 feet, as specified in the Site-Specific Work Plan) whichever is encountered first. If at this depth MGP impacts are encountered, the soil borings will be advanced deeper until there is reasonable assurance we are beyond the impact zone. Drilling methods are presented in the Generic FSP (see Appendix B).

Following the completion of the soil borings and sampling, the boreholes will be abandoned with a cement-bentonite grout or utilized for the installation monitoring wells. All soil cuttings generated during the drilling process will be stored in Department of Transportation (DOT) approved 55-gallon steel drums or roll-offs and moved to an on-site location approved by NM and the property owner. Disposal of these soils will be in accordance with applicable regulations and NYSDEC guidance.

3.2.4 Subsurface Soil Sampling

Split-spoon samples will be collected continuously from each soil boring. Split-spoon samples will be screened with field instruments and using odor and visual characteristics for residues or staining. The results will be noted in the field logbook. In addition, soil samples will be logged in accordance with ASTM D2487 (engineering purposes)/D2488 (desorption) or the Burmeister method and classified with respect to the United Soil Classification System (USCS). All soil classification data, instrument readings, and other observations will be documented in the field log-

book. Details are provided in the Generic FSP (see Appendix B) and the Generic QAPP (see Appendix D).

Soil samples will be collected at predetermined depth intervals (see Site-Specific Work Plan) from each boring and sent to the laboratory for chemical testing. Soil samples will be analyzed for benzene, toluene, ethylbenzene and xylene (BTEX); polycyclic aromatic hydrocarbons (PAHs); and total cyanide. In addition, one sample will be collected from each boring and submitted for TOC analysis and (10%) ten percent of all subsurface soils will be analyzed for TCL/TAL parameters. Certain soil samples will also be analyzed for polychlorinated biphenyls (PCBs) where historical electrical equipment was suspected to have been located. Additional details are provided in the Generic FSP (see Appendix B), and the Generic QAPP (see Appendix D).

3.2.5 Test Pit Excavations

Test pits will be excavated in former MGP structures or across subgrade holder walls with a backhoe or mini-excavator. Surface cover (e.g. gravel) will be stockpiled on plastic for use following completion of the excavation. Excavated soil will be placed on plastic on the ground surface. Test pits will be advanced to a maximum depth of 12-ft bgs, to the top of the bedrock surface, or to the water table, whichever is encountered first. Each location will be logged and the information recorded in the field logbook.

If prescribed in the Site-Specific Work Plan, soil samples may be collected from an impacted interval. The sampling interval will be selected based on field screening techniques. The soil samples will be analyzed for BTEX, PAHs, and Total Cyanide. Additional details regarding test pit excavation are presented in the Generic FSP (see Appendix B).

3.2.6 Monitoring Well Installation

Monitoring wells will be installed at each Site. Groundwater data collected from the wells will be evaluated with respect to up- and downgradient water quality at the Site, groundwater flow direction, and impact to groundwater, if any. Monitoring well locations at each Site are presented in the respective Site-Specific Work Plan.

The procedures for drilling and sampling at each monitoring well location are described in Sections 3.2.3 and 3.2.4. Details of these procedures are provided in the Generic FSP (see Appendix B). Following the advancement of the borehole to a target depth of 30-ft. bgs, a monitoring well will be installed straddling the water table. If the top of the bedrock surface is encountered prior to encountering the water table, a monitoring well will not be installed. The well construction will consist of 2-inch diameter Schedule 40, slot screen surrounded by an appropriate size sand pack with a bentonite pellet layer on top. The PVC riser will consist of flush joint connections surrounded by a cement-bentonite grout. The screen length and slot size will be selected in the field based on aquifer thickness and geology. The well will be completed with a flushmount roadbox or stickup protective pipe surrounded by a concrete collar at the surface. The well will also have a locking well cap. Monitoring wells will be developed no sooner than 24 hours after installation is complete. The wells will be developed by the surge and evacuate method in accordance with New York State TAGM-HWR-88-4008 (NYSDEC, 1988). Further details on well construction, installation and development are provided in the Generic FSP (see Appendix B) and the Generic QAPP (see Appendix D).

3.2.7 Groundwater Sampling

Two rounds of groundwater samples will be collected from monitoring wells installed during Site Investigation. Methodologies for monitoring well development and groundwater sampling are described in the Generic FSP (see Appendix B).

3.2.8 Groundwater Level Measurements

As a component of groundwater sampling, water level measurements will be collected from each well with an oil/water interface probe. The presence of light non-aqueous phase liquid (LNAPL) and/or a dense non-aqueous phase liquid (DNAPL), if any, will be noted in the field logbook along with a water level measurement. If LNAPL or DNAPL is encountered, a sample may be collected for analysis. Methodology for groundwater level monitoring is presented in the Generic FSP (see Appendix B).

3.2.9 Analytical Program

Laboratory analyses will be conducted in accordance with NYSDEC Analytical Service Protocol (ASP) protocols. Modification and/or use of other testing protocols will be considered, if ASP protocols are not available/applicable. Laboratory analyses will be performed by a NYSDOH approved laboratory.

The individual analyses for each medium to be sampled are discussed above and in the Generic FSP (see Appendix B). Details of the analytical program, including methodologies, containers, and holding times are discussed in the Generic QAPP (see Appendix D).

Data Quality Objectives

The results of the Site Characterization will undergo a detailed review by NYSDEC as well as NM. To support this review, laboratory analyses will be conducted in accordance with NYSDEC ASP protocols and Category B deliverables in accordance with the Data Quality Objectives (DQOs) outlined in the Generic QAPP (see Appendix D). As part of the ASP analyses, the laboratory will generate analytical packages for the Engineering Consultant.

Quality Assurance/Quality Control (QA/QC)

Quality assurance measures for maintaining the quality of laboratory samples collected during field sampling are described in the Generic FSP (Appendix B) and the Generic QAPP (Appendix D).

The analytical data generated from the field activities will be validated in accordance with NYSDEC and USEPA guidance. Data Usability Summary Report (DUSR) will be prepared following completion of the data validation task. Details regarding the data validation are provided in the Generic QAPP (Appendix D).

3.2.10 Waste Management

Investigation derived wastes (IDW) will be generated during implementation of the Site Characterization investigation. These will include soil cuttings, purge water, decontamination fluids, plastic, asphalt/concrete, and personal protective equipment (PPE). These wastes will be containerized and properly labeled in DOT approved 55-gallon steel drums, roll-off containers and/or polypropylene agricultural tanks. The drums will be properly stored at a designated on-site area identified by NM and the property owner. NM will properly dispose of these IDW. Further details are provided in the Generic FSP (Appendix B).

3.3 Baseline Ground Survey

Following the completion of the field activities, the Engineering Consultant will coordinate surveying activities with a surveying subcontractor. All Sampling locations will be surveyed and placed on a Site base map prepared by the surveying subcontractor. Survey data will be provided to the Engineering Consultant within three weeks of the completion of the Site Characterization field activities. Additional discussion of the survey is provided in the Generic FSP (see Appendix B).

3.4 IRM Evaluation

The Engineering Consultant will evaluate whether, based on the current conditions at the Site, an IRM is necessary. An evaluation of IRM alternatives will be performed if an imminent threat to human health and/or to the environment exists based on the data generated in the Site Characterization. An IRM may also be performed at the desecration of Niagara Mohawk if localized MGP-related LNAPL or DNAPL is encountered during field activities and if it appears that removal of such material may facilitate natural attenuation of residual soil and groundwater, reduce the overall project schedule, or reduce the extent of field activities ultimately necessary at the Site.

3.5 Draft Site Characterization/IRM Report

The results of the SC/IRM report will first be submitted to the NYSDEC in a data report format. If it is determined that no MGP-impacted media is present and further investigation and/or remediation is not, a draft Site Characterization/IRM Report (Report) will be prepared and submitted to the NYSDEC. If additional investigation is required, a RI work plan will be submitted to NYSDEC. As the onsite effort for the SC investigation is substantial, the primary focus of any additional investigation would be offsite. The RI work plan will consist of a scope of work and will incorporate the generic QAPP, FSP and EHS Plans.

If a SC/IRM report will be submitted, it will contain the following:

- Site Conditions;
- Site History;
- A detailed and comprehensive description of all tasks completed;
- Results of the Site Characterizationfield activities, analytical testing program and IRM evaluation;
- Conclusions;
- Recommendations for No Further Action at the Site, additional investigation (if necessary) or any recommneded Interim Remedial Measure IRM efforts; and
- Certification that the Site Characterization was performed in accordance with this NYSDEC-approved Site-Specific Work Plan.

Figure 3-1 presents a preliminary table of contents for the draft Report.

Figure 3-1

Draft Site Characterization/IRM Report
Example Table Of Contents

1.0 EXECUTIVE SUMMARY
- 1.1 Site Background
- 1.2 Site Assessment
  - 1.2.1 Project Objectives
  - 1.2.2 Soil Investigation Results
  - 1.2.3 Groundwater Investigation Results
  - 1.2.4 Sediment/Surface Water Investigation Results
- 1.3 Interim Remedial Measure Evaluation
- 1.4 Recommendations

2.0 INTRODUCTION
- 2.1 Purpose and Project Objectives of Site Investigation
- 2.2 Site Location and Description
- 2.3 Site History
  - 2.3.1 Records Identified and Located
- 2.4 Background
- 2.5 Regional Setting
  - 2.5.1 Regional Geology
  - 2.5.2 Regional Hydrogeology
  - 2.5.3 Groundwater Usage In Site Vicinity
  - 2.5.4 Soils
- 2.6 Site Characterization/IRM Report Organization

3.0 SCOPE OF WORK
- 3.1 Introduction
- 3.2 Field Investigation
  - 3.2.1 Field Mobilization
  - 3.2.2 Surface Soil Sampling/Analysis
  - 3.2.3 Soil Boring Drilling and Sampling/Analysis
  - 3.2.4 Monitoring Well Installation and Development
  - 3.2.5 Test Pit Excavations and Sampling/Analysis
  - 3.2.6 Surface Water/Sediment Sampling/Analysis
  - 3.2.7 Groundwater Sampling/Analysis
  - 3.2.8 Groundwater Level Measurements
  - 3.2.9 Visual Inspection of Structures
  - 3.2.10 Surveying
  - 3.2.11 Waste Management

Figure 3-1 (Cont'd)

Draft Site Investigation/IRM Report
Example Table Of Contents

4.0 SITE CHARACTERIZATIONRESULTS
- 4.1 Site Topography
- 4.2 Site Investigation
  - 4.2.1 Surface Water
  - 4.2.2 Geology
  - 4.2.3 Groundwater Hydrogeology
- 4.3 Site Conceptual Model

6.0 CONCLUSIONS AND RECOMMENDATIONS
- 6.1 Conclusions
- 6.2 Recommendations

APPENDICES
- A Soil Boring Logs
- B Monitoring Well Construction Details
- C Test Pit Excavation Logs
- D Surveying Data
- E Analytical Data

4.0 SCHEDULE

The schedule for implementation of each of the Site Characterization at the Non-owned Former MGP Sites is presented in the Site-Specific Work Plans. The field activities will commence following execution of any required property access agreements and procurement of an environmental/engineering consultant to implement the Site-Specific Work Plan.

5.0 REFERENCES

NYSDEC, 1988. Technical and Administrative Guidance Memorandum #4008 – Phase II Investigation Oversight Guidance New York State Department of Environmental Conservation, May 9, 1988.

APPENDIX K

RESPONSIBILITIES OF OWNER AND REMEDIAL PARTY

APPENDIX K

RESPONSIBILITIES OF SITE OWNER, REMEDIAL PARTY AND OFF-SITE-OWNER

Responsibilities

The responsibilities for implementing the Interim Site Management Plan ("ISMP") for the Patchogue Former MGP Site (the "Site"), Site #1-52-182, and the 234 West Main Street Property (the "Off-Site Property) are divided between the Site owner(s) and a Remedial Party (also known as the Respondent), as defined below. The owner(s) is/are currently listed as: (the "owner").

Site: KeySpan Gas East Corporation d/b/a National Grid (a predecessor company of National Grid), 175 East Old Country Road, Hicksville, New York 11801

Off-Site Property: 210 West Main Realty Corp., 50 Gilpin Avenue, Hauppauge, New York 11788

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out**,** the term Remedial Party ("RP"), also referenced herein as the Respondent, currently refers to National Grid. The RP (Respondent) is:

National Grid Contact:

Sarah Aldridge
175 East Old Country Road
Hicksville, New York 11801
(516) 545-2568

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the Site.

Site Owner's Responsibilities:

The Site owner is currently National Grid who is also the RP/Respondent. National Grid maintains the following responsibilities. In a future scenario in which National Grid sells the property and is no longer the Site owner, the future Site owner will be responsible for the following:

1) The owner shall follow the provisions of the ISMP as they relate to future construction and excavation at the Site.

2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that Institutional Controls set forth in an Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the Site's PRR certification to the NYSDEC.

3) In the event the Site is delisted, the owner remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.

4) The owner shall grant access to the Site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the ISMP and assuring compliance with the ISMP.

5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the Site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3 - Notifications.

6) In the event some action or inaction by the owner adversely impacts the Site, the owner must notify the Site's RP and the NYSDEC in accordance with the time frame indicated in 1.3 - Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7) The owner must notify the RP and the NYSDEC of any change in ownership of the Site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Site property. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 1.3 of the ISMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

Off-Site Property Owner's Responsibilities:

1) The owner of the Off-Site Property will responsible to notify the RP/Respondent (National Grid) within the established time frames documented in this ISMP of plans for the performance of invasive activities in areas of the Off-Site Property that may encounter known or potential contaminated soils and/or groundwater.

2) The owner of the Off-Site Property shall grant access to the Off-Site Property to the RP/Respondent (National Grid) and its agents for the purposes of performing activities required under the ISMP, including groundwater monitoring activities, and assuring compliance with the ISMP.

2) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify National Grid in accordance with the timeframes indicated in Section 1.3.1 - Notifications.

3) In the event some action or inaction by the owner adversely impacts the Off-Site Property, the owner must notify the RP/Respondent (National Grid) in accordance with the time frames indicated in Section 1.3.1 - Notifications and (ii) coordinate the performance of necessary corrective actions with National Grid.

4) The owner must notify National Grid of any change in ownership of the Off-Site Property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Off-Site Property.

Remedial Party Responsibilities

1) The RP must follow the ISMP provisions regarding any construction and/or excavation it undertakes at the Site.

2) The RP shall report to the NYSDEC activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated ISMPs.

3) Before accessing the Site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the ISMP, a copy of any data generated during the Site visit and/or any final report produced.

4) If the NYSDEC determines that an update of the ISMP is necessary, the RP shall update the ISMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved ISMP to the owner(s).

5) The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html .

6) The RP shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3- Notifications of the ISMP.

7) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the ISMP, the RP shall submit to the NYSDEC for approval an amended ISMP.

8) Any change in use, change in ownership, change in Site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the Site may result in a change in responsibilities and, therefore, necessitate an update to the ISMP and/or updated legal documents. The RP shall contact the NYSDEC to discuss the need to update such documents.

Change in RP ownership and/or control and/or Site ownership does not affect the RP's obligations with respect to the Site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future Site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

APPENDIX L

PERMITS AND/OR PERMIT EQUIVALENT

APPENDIX L

PERMITS AND/OR PERMIT EQUIVALENT

All permits required for the implementation of the remedy, post-remedial monitoring as well as compliance with this ISMP will be obtained by National Grid. The following summarizes the Federal, State and Local permits that relate to the implementation of the remedy at the Site/Off-Site Property .

Federal Permits

According to Part II, Chapter 210 (Flood Damage Prevention), Article V, section 210-14 C(2), on streams with a regulatory floodway, as shown on the Flood Boundary and Floodway Map or the Flood Insurance Rate Map adopted in § 210-6, no new construction, substantial improvements or other development in the floodway (including fill) shall be permitted unless a technical evaluation by a licensed professional engineer shows that such an encroachment shall not result in any increase in flood levels during occurrence of the base flood. The remedial activities will be designed such that no additional fill will be added to the Site and the excavation areas will be returned to pre-remedial grades thus there is no loss of flood plain area and an increase in flood levels during occurrence of the base flood would not be anticipated.

Other federal permits are not anticipated to be required for the pre-remedial design or remedy implementation. Should other permits be required, they will be obtained by National Grid, as necessary.

State Permits

Since the remedial activities at the Site and the Off-Site Property are being performed under Order on Consent D1-001-99-05 signed by KeySpan (d.b.a., National Grid) and the NYSDEC September 30, 1999, state permits will generally not be required unless dewatering activities are deemed necessary to complete the remedial activities. If

dewatering activities are required, then a State Pollutant Discharge Elimination System (SPDES) permit will be necessary for discharge of the water to the Patchogue River.

In accordance with 6 NYCRR 375-1, NYSDEC-issued permits are not required for any other activities associated with pre-remedial design 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.

Local Permits

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 to implement the remedy. However, consultation with local officials and other stakeholders will occur prior to completion of the final design.

Although permits may not be required to be obtained, the project will be discussed with the local regulators to ensure a seamless implementation. The Remedial Contractor will be responsible to conduct all remedial activities in accordance with the substantive requirements of the local regulations. Construction activities will have to be performed with applicable Patchogue codes and regulations including the development of trucking routes, consistency with noise ordinances and observation of potential road or street closures that may be necessary for work conducted adjacent to West Main Street.

Appendix P: Waste Management Plan

Waste Management Plan
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 153021

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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Appendices

Appendix A DER-4 Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants
Appendix B National Grid US Companies Environmentally Approved Waste Disposal and Recycling Facilities
Appendix C National Grid Environmental Procedure No. 1 Waste Management

List of Abbreviations

BC	Brown and Caldwell Associates
DNAPL	Dense non-aqueous phase liquid
ELAP	Environmental Laboratory Approval Program
MGP	Manufactured Gas Plant
NAPL	Non-aqueous phase liquid
NIOSH	National Institute of Occupational Safety and Health
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYDOL	New York State Department of Labor
NYSDOT	New York State Department of Transportation
OSHA	Occupational Safety and Health Administration
PAHs	Polycyclic aromatic hydrocarbons
PPE	Personal protective equipment
RDR	Remedial Design Report
ROD	Record of Decision
SPDES	State Pollution Discharge Elimination System
TAGM	Technical and Administrative Guidance Memorandum
TCLP	Toxic Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
WMP	Waste Management Plan

Section 1

Introduction

This Waste Management Plan (WMP) has been prepared by Brown and Caldwell Associates (BC), on behalf of National Grid, to support the implementation of the selected remedy for the Patchogue (W. Main Street) Former Manufactured Gas Plant (MGP) Site (referred to as The Site). The Site is located at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York. The selected remedy is detailed in documents entitled "Record of Decision, K-Patchogue MGP, Patchogue, Suffolk County, Site No. 152182" (ROD) and "Explanation of Significant Differences, K – Patchogue MGP Site, Village of Patchogue, Suffolk County, Site No. 152182" (ESD). This WMP describes the characterization, management, handling, treatment/disposal, and re-use requirements for the wastes anticipated to be generated during the remedial activities.

1.1 Site Background

Site background is presented in the Remedial Design Report "Remedial Design Report (90-95% Submission), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" prepared by Brown and Caldwell Associates and submitted to the NYSDEC October 2017 (RDR).

1.2 Summary of Remedial Activities

The remedial activities will include the following:

- Selective Demolition;
- Installation of Embankment Protection Measures;
- In Situ Solidification
- Excavation;
- Backfilling and Compaction;
- Construction of Soil Cover; and
- Site Restoration.

These activities are further described in the RDR.

1.3 Applicable Rules and Regulations

The handling, transport, and disposal of waste materials will be performed in accordance with the following:

- Occupational Safety and Health Administration (OSHA) rules and regulations, including Title 29 of the Code of Federal Regulations (CFR) Parts 1920 and 1926;
- United States Environmental Protection Agency (USEPA) rules and regulations, including 40 CFR;
- United States Department of Transportation (USDOT) rules and regulations, including 49 CFR Parts 171 and 172;
- National Institute of Occupational Safety and Health (NIOSH) recommendations;

- New York State Department of Environmental Conservation (NYSDEC) rules and regulations, including Title 6 of the Official Compilation of Codes, Rules, and Regulations (6 NYCRR) Parts 360, 364, 370, 374, and 376;
- "DER-4 Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants," (MGPs), DER-4; NYSDEC 2002a, included herein as Appendix A;
- "DER-10 Technical Guidance for Site Investigation and Remediation," DER-10; NYDEC 2010;
- New York State Department of Labor (NYDOL) rules and regulations, including 12 NYCRR Part 56;
- New York State Department of Transportation (NYSDOT) rules and regulations;
- New York State Department of Health (NYSDOH) rules and regulations;
- Applicable federal, state, and local government regulations;
- National Grid USA Waste Management and Recycling Procedures for conducting Work at Company Facilities;
- National Grid Supplementary Conditions;
- National Grid Contractor Environmental Requirements;
- National Grid Safety Procedures; and
- National Grid Contractor Safety Requirements.
- National Grid Environmental Procedure No. 1 Waste Management

Whenever there is a conflict or overlap of the above-referenced rules and regulations, the most stringent provision shall be applicable.

Section 2

Waste Management

It is anticipated that the following waste materials be generated during the implementation of the remedial activities:

- Soil
- Solidified soil [i.e., In Situ Solidification (ISS)-Related Swell];
- Wastewater;
- Non-aqueous phase liquid (NAPL);
- Demolition debris; and
- Miscellaneous construction debris.

All wastes designated for off-Site treatment and/or disposal will be transported to one or more National Grid-approved facilities, listed in Appendix B, unless otherwise noted. Facilities will be selected based on the type of waste material, characterization results, and local flow provisions.

Laboratory analysis of any samples collected to characterize waste materials will be performed by a laboratory certified by the New York State Department of Health (NYSDOH), Environmental Laboratory Approval Program (ELAP), and approved by National Grid. The handling/management and disposal requirements for each type of waste materials are discussed in the following subsections of this WMP.

Waste materials intended for off-Site transportation and disposal will be staged in designated areas of the Site that are not proximate to off-Site roadways in order to minimize the potential for off-Site impacts. All staging of excavated soil, solidified soil, and impacted debris will be performed on staging areas that are underlain by plastic sheeting with perimeter berms to contain run-on and run-off. Additionally, excavated soils, solidified soil, and impacted debris will be covered with plastic sheeting to minimize the potential for impacts from odors as well as the effects of weather. Covers will be properly anchored to prevent uplift due to wind conditions and will be installed to minimize ponding of precipitation. Odor suppressing foam will be applied to waste stockpiles, as necessary, to minimize the potential for impacts from odors generated by waste stockpiles.

2.1 Soil

Remedial activities include the excavation of soil. Excavated soil will be disposed off-Site at a National Grid-approved facility. Excavated soils resulting from the implementation of the remedial action are not expected to be classified as hazardous waste for disposal.

Excavated soils, destined for off-Site disposal, will be characterized either in-situ prior to excavation activities or using samples obtained from stockpiled excavated soils. The Remedial Contractor will be responsible for coordinating with off-Site National Grid-approved disposal facilities to profile soils according to the requirements of the individual facilities. The Remedial Contractor shall notify the National Grid and/or BC (the Design Engineer) as to any restrictions imposed by the disposal facility.

2.2 ISS-Related Swell

Periodically throughout ISS treatment, ISS-related swell will be removed from the ISS area and staged within a temporary waste staging area. Waste characterization will be performed by the Remedial Contractor prior to transportation and off-Site disposal at a National Grid-approved facility. ISS-related swell is not expected to be classified as hazardous waste for disposal. ISS-related swell will be broken, crushed, etc. to satisfy any sizing requirements of the off-Site disposal facility.

2.3 Wastewater

Wastewater is anticipated to be generated during remedial activities from decontamination activities and subsurface structure/pipe removal. These wastewaters may be potentially contaminated with chemical constituents from on-Site sources. Wastewater will be containerized, staged on-Site for waste characterization, and transported to an off-Site facility for treatment and/or disposal at a National Grid-approved facility.

2.4 NAPL

NAPL generation may occur as part of excavation activities. NAPL will remain commingled with the soil matrix and disposed off-Site with the impacted soil.

2.5 Former MGP Structures

Former MGP structures which may be encountered during the remedial activities are likely to consist of concrete and brick. The former MGP structure will be broken, crushed, or otherwise prepared into maximum size 2-foot pieces. The prepared pieces will be placed into and incorporated into the ISS mass. Former MGP utilities, such as the gas manifold and its corresponding piping, shall be washed, characterized, and disposed of in accordance with Section 31 700 00.

2.6 Debris

Debris which may be encountered during the remedial activities is likely to consist of wood, metal, or miscellaneous rubbish. The debris will be removed in its entirety, characterized, processed by the Remedial Contractor as necessary, and recycled or disposed as appropriate.

2.7 Miscellaneous Construction Waste

Other construction debris generated during the remedial activities may include the following:

- Construction access road materials (e.g., fill materials and geosynthetics);
- Waste staging and decontamination areas (e.g., fill materials and geosynthetics);
- Temporary erosion and sediment control measures (e.g., silt fencing, etc.);
- Disposable tools and equipment; and
- Personal protective equipment (PPE).

These materials will be placed in 55-gallon drums, roll-off or similar containers during the work and will be removed from the Site, as soon as practicable. The construction debris will be characterized and processed by the Remedial Contractor as required by the waste transportation and disposal/recycling facilities.

Section 3

Transportation and Disposition

During the implementation of remedial construction activities, the Remedial Contractor will coordinate and manage transportation and disposal of generated wastes to disposal facilities that have been approved by National Grid. Approved disposal facilities have been reviewed for permitting and licensing requirements, licenses and regulatory enforcement status by National Grid.

To avoid the potential for work delays, the Remedial Contractor will identify and coordinate with the appropriate treatment/disposal facilities prior to initiating remedial activities.

National Grid will be identified as the generator of all solid wastes transported from the Site.

3.1 Waste Profiles and Manifests

All waste profiles will be prepared by the Remedial Contractor and reviewed/signed by National Grid or an authorized representative. When preparing waste profiles, the Remedial Contractor will determine if the waste materials can be transported/disposed of under an existing National Grid waste profile (if one exists) or if a new waste profile is required. A Manifest and/or Bill of Lading corresponding to each shipment of waste will be prepared by the Remedial Contractor and reviewed/signed by National Grid or an authorized representative. The Remedial Contractor will provide copies of the completed waste profiles and countersigned manifests to National Grid and BC (the Design Engineer) for the project file. The Remedial Contractor shall prepare and submit weekly waste tracking reports summarizing daily disposal tonnages, waste types, manifests, and weight tickets.

3.2 Transportation

All wastes designated for off-Site disposal will be transported to solid, liquid, and hazardous waste treatment/disposal facilities that have been approved by National Grid, using New York State-licensed waste transportation companies. The trucks and/or roll-off containers will be fully lined and covered with solid covers. Safety latches will be used on the gates of transport trucks to prevent spills and/or releases to the environment. All transporters will be reviewed for up-to-date permitting requirements and licensing (pursuant to New York Codes, Rules and Regulations (NYCRR) Part 364). Those permits will be maintained on-Site of the duration of the project. The Remedial Contractor shall ensure that transportation vehicles do not exceed permitted weights. Prior to leaving the Site, the vehicles will be inspected by the Remedial Contractor and cleaned, within the decontamination area, of any visible soil or debris. The trucks will then follow the approved truck route and requirements detailed in the Maintenance and Protection of Traffic Plan.

Section 4

References

NYSDEC, 2002, DER-4 Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants (MGPs), January.

NYSDEC, 2010, DER-10 Technical Guidance for Site Investigation and Remediation, May.

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

NYSDEC, 2017. “Explanation of Significant Differences, K – Patchogue MGP Site, Village of Patchogue, Suffolk County, Site No. 152182”, October.

Appendix A: DER-4 Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants

Management Of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment (DER-4)

Issuance Date: January 11, 2002

Abstract:

This guidance outlines the criteria wherein coal tar waste and soils and sediment that have been contaminated with coal tar waste from former manufactured gas plants (MGPs) only exhibiting the toxicity characteristic for benzene (D018) may be conditionally excluded from the requirements of 6 NYCRR Parts 370 -374 and 376 when they are destined for permanent thermal treatment. This is an amended version of the document effective on September 13, 2001. The only modification is to the Responsibility Section. Additions are underlined and deletions are stricken.

I. Purpose

This guidance memorializes an exercise of enforcement discretion, effective immediately, with regard to the conditional exclusion of soils, sediments, and waste contaminated with coal tar from the site of former Manufactured Gas Plants ("MGPs") which exhibit the toxicity characteristic for benzene (D018) from New York State's hazardous waste management regulatory program. The intent of this exercise is to facilitate the permanent treatment of these materials in an environmentally sound manner.

This change will be proposed as part of the next rulemaking which includes 6 NYCRR Part 371. This Enforcement Directive supersedes Program Policy DER - 3 (TAGM 4060) entitled "Management of Soil and Sediment Contaminated with Coal Tar From Former Manufactured Gas Plants." Specifically, that guidance allows for the decharacterization of coal tar contaminated soil and sediment which exhibit the D018 hazardous characteristic, that were destined for thermal treatment. That guidance did not allow for the decharacterization of coal tar that failed the D018 hazardous characteristic, requiring that it be managed as a hazardous waste.

II. Background

Historically, MGP contaminated soils, sediments or waste were regulated as hazardous if they exhibited a hazardous waste characteristic. On April 21, 2000, a court decision (*Association of Battery Recyclers Inc. vs. United States Environmental Protection Agency* -

April 21, 2000) vacated the use of the Toxicity Characteristic Leaching Procedure (TCLP) test to determine if, under federal law, MGP waste and contaminated soils exhibited a characteristic of hazardous waste. The United States Environmental Protection Agency (USEPA) has not challenged the decision and has clarified its position in a letter to Vectren Corporation, dated October 19, 2000, and a memo to USEPA Senior Resource Conservation and Recovery Act (RCRA) personnel. These documents acknowledge that the TCLP test cannot be used to determine if MGP waste, contaminated soil, or contaminated sediment exhibits a characteristic of a hazardous waste and since these materials typically do not exhibit any other hazardous characteristic, they will unlikely be classified as a hazardous waste under the federally administered program.

USEPA also acknowledged that many states have regulations that are broader in scope than the federal regulations, and may regulate MGP wastes as hazardous under their own state requirements.

The *Battery Recyclers* case does not directly affect New York's hazardous waste management regulatory program since its program derives from state, not federal, law. However, USEPA has authorized the State program to be administered in lieu of the federal RCRA program. New York's hazardous waste management regulatory program currently uses TCLP to determine if MGP contaminated soil exhibits a characteristic of a hazardous waste.

The Department of Environmental Conservation (DEC) recognizes that mixing of soil or sediment occurs through the normal consolidation of contaminated soil or sediment from various portions of a site during the course of remedial activities or in the course of normal earthmoving and grading activities, and does not consider this to be a form of impermissible dilution. However, mixing cannot be allowed to merely dilute the hazardous constituents into a larger volume so as to lower the constituent concentration in order to avoid treatment.

III. Policy

Applicability

This guidance applies to former MGP sites being remediated under the oversight of the DEC, either through a Consent Order, Voluntary Cleanup Agreement or State funded project, in instances where soil or sediment contaminated with coal tar related residuals will be thermally treated (as in a combustion boiler unit or in a thermal desorber) at an off-site (including out-of -state) facility permitted to receive non-hazardous contaminated soil or at

an on-site facility. This guidance does not apply to coal tar contaminated materials which contain significant quantities of purifier wastes or any quantity of other hazardous wastes. A significant quantity of purifier waste is defined as any quantity that would cause the MGP site remediation waste mixture, sent for thermal treatment, to contain in excess of 3.5 % sulfur by weight. Other hazardous waste includes listed hazardous wastes and wastes exhibiting a characteristic of a hazardous waste except for MGP related remediation waste exhibiting the Toxicity Characteristic for benzene. MGP site remediation waste meeting the applicability requirements that are being sent out of state must comply with the rules and regulations of the receiving state.

Requirements

A. Management of Soil/Sediment: Management of MGP site remediation waste meeting the applicability requirements, that is under DEC oversight is not subject to the DEC's hazardous waste management regulatory program {6 NYCRR Parts 370 to 374 and 376} if that soil or sediment is thermally treated at a facility permitted to receive non-hazardous contaminated soil or sediment. The following activities are exempt from the hazardous waste management requirements, however they continue to be subject to the solid waste management requirements {6NYCRR Parts 360 and 364}:

   a. Excavation and storage at the point of generation;
   b. Transportation to the thermal treatment facility or unit;
   c. Handling and storage prior to thermal treatment at the facility;
   d. Thermal treatment; and
   e. Management of treated materials.

   Materials transported off-site, and are stored outside the shipping container at locations other than the site of generation or the treatment facility, must be placed on an impervious surface such as asphalt, concrete or other impervious material and covered with plastic or other impervious material. Storage at the treatment facility must be in compliance with the facility's permit.

   MGP site remediation waste meeting the applicability requirements can be mixed with coal fines, carbon, onsite soil, sediment or other materials deemed necessary to facilitate and ensure proper operation of the final treatment technology as approved by the DEC.

There must be a demonstration that MGP site remediation wastes do not contain a significant quantity of purifier wastes, do not contain any listed waste or do not exhibit a characteristic of a hazardous waste (except for TCLP benzene) and are not otherwise incompatible with proper and effective thermal treatment. Soil or sediment which contains discernible amounts of purifier material must be tested for hazardous characteristic of reactivity, total cyanides and sulfur.

B. Permit Requirements: No solid waste management permit is required for the thermal treatment of coal tar contaminated soil or sediment from a former MGP site by a corporate entity acting pursuant to a Consent Order or a Voluntary Cleanup Agreement, provided that the thermal treatment occurs either at that site or at another former MGP site owned by the same corporate entity and provided that the applicable substantive regulatory requirements are met. Coal tar contaminated soil or sediment may also be transported to a facility for thermal treatment which has received a permit to accept this type of contaminated material. Coal tar contaminated soil or sediment must be transported by a 6 NYCRR Part 364 permitted transporter.

C. Land Disposal Restrictions: Coal tar contaminated materials which meet the applicability requirements and the respective treatment residuals are not subject to the LDRs.

IV. Responsibility

The person(s) remediating the site is(are) responsible for complying with all applicable regulations. This includes the LDRs if the materials are not destined for permanent thermal treatment. The Project Manager assigned to oversee the remediation of the former MGP site, is responsible for reviewing and accepting any demonstration that the materials are being managed in accordance with this policy. The Project Manager's supervisor must concur with the Project Manager's determination.

Appendix B: National Grid US Companies Environmentally Approved Waste Disposal and Recycling Facilities

National Grid USA Companies
Environmentally Approved Hazardous Waste
Disposal and Recycling Facilities

Vendor	Facility Location			Phone	EPA ID Number
American Ref-Fuel Company of Niagara Facility	100 Energy Blvd at 56th St	Niagara Falls, NY	14304	(716) 284-0031	NYD986930543
AMREC	130 Route 20	Charlton, MA	01508	(508) 248-3777	MAD982201055
Aggregate Industries (formerly Bardon Trimount)	1101 Turnpike Street	Stoughton, MA	02072	(781) 344-1100	MAD981213531
Aggregate Industries (formerly Bardon Trimount)	651 Lake Street	Shrewsbury, MA	01545	(781) 344-1100	MAD985277862
Aggregate Industries (formerly Bardon Trimount)	30 Danvers Road	Salem, MA	01970	(781) 344-1100	MAD001014984
American Lamp Recycling, LLC.	26 Industrial Way	Wappingers Falls, NY	12590	(800) 315-6262	NYR000129015
Bridgeport United Recycling	50 Cross Street	Bridgeport, CT	06610	(203) 334-4812	
Brox Paving Materials Inc.	1471 Methuen St.	Dracut, MA	01826	(978) 454-9105	MAD985267798
Brox Paving Materials Inc.	181 Mill Street	Marlboro, MA	01752	(508) 485-7382	MAD985276559
Cable Recycling Inc. **(NY use Only)**	220 John Street	Barrie, Ont.	L4N 2L2	(705)728-1622)	ON1599101
CID Landfill, Inc.	10860 Olean Road	Chaffee, NY	14030	(716) 496-5514	NYD000517458
Capitol Environmental	8229 Boone Boulevard	Vienna, VA	22182	(703)-356-3135	
Carbon Service and Equipment Co.	1037 Route 519	Eighty Four, PA	15330		N/A
Chemical Waste Management	Highway 17	North Emelle, AL	35459	(205) 652-8086	ALD000622464
Chemical Waste Management	1550 Balmer Road	Model City,	14107	(716) 754-8231	NYD049836679
Ciment St-Laurent	1945 Graham Boulevard	Mount Royal, Quebec	H3R1H1		N/A
City of Albany Landfill	525 Rapp Road	Albany, 12202	12202	(518) 869-3651	N/A
Clean Harbors Inc.	1 Hill Avenue	Braintree, MA	02184	(781) 849-1807	MAD053452637
Clean Harbors Inc.	51 Broderick Road	Bristol , CT	06010	(860) 583-8917	CTD000604488
Clean Harbors Inc.	37 Rumery Road	S. Portland, ME	04106	(207) 799-8111	MED980672182
Clean Harbors (Baltimore)	1910 Russell Street	Baltimore, MD	21230		MDD980555189
Clean Harbors – Murphy's	252 Salem Street	Woburn, MA	01801	(781) 935-9066	MAD066588005
Clean Harbors – Cleveland	2900 Broadway	Cleveland, OH	44115	(216) 429-2401	OHD000724153
Clean Harbors Grassy Mountain, LLC	P.O. Box 22750	Salt Lake City, UT	84122	(801) 323-8900	UTD991301748
Clean Harbors – Kimball	HC54 Box 28	Kimball, NE	69145	(308)235-4012	NED981723513
Clean Harbors (formerly Rollins)	2027 Battleground Road	Deer Park, TX	77536	(281) 930-2300	TXD055141378
Clean Harbors - PPM-Ashtabula OH	1302 West 38th Street	Ashtabula, OH	44004	(440) 992-8665	OHD981093420
Clean Harbors - PPM-Philadelphia	4105 Whitaker Avenue	Philadelphia, PA	19124	(215) 425-5144	PAD981113749
Clean Harbors PCB Serv. USPCIOHT	1672 East Highland	Twinsburg, OH	44087	(330) 425-3825	OHD986975399
Clean Harbors Env. Services, Inc.	309 American Circle	El Dorado, AR	71730	(870) 863-7173	ARD069748192
Colonie Landfill	Memorial Town Hall	Newtonville, NY	12128	(518) 783-2827	
CRT (Consolidated Recycling Technologies)	1 Depot Street	Bridgewater, MA	02324	(508) 697-1860	MAD985290717
DANC (Rodman Landfill)	NYS Route 177	Rodman, NY	13682	(315) 785-2593	NONHAZ
EnerSys (formerly YUASA)	16 Celina Ave.	Nashua, NH	03060	(800) 343-5526	N/A
Environmental Soil Management, Inc.	304 Towpath Road	Fort Edward, NY	12828	(518) 747-5500	N/A
EnviroTech	798 Hartwell Avenue	East Syracuse, NY	13057	(315) 463-7178	N/A
ESMI	67 International Drive	Loudon, NH	03301	(603) 783-0228	NH5986485852
G&S Technologies	1800 Harrison Ave.	Kearny, NJ	07032	(201) 998-9244	NJD011370525
Green Environmental (Environmental & Industrial Contracting Services Inc.)	8335 Quarry Road	Niagara Falls, NY	14304	(716) 298-8876	NYR000013086

National Grid USA Companies
Environmentally Approved Hazardous Waste
Disposal and Recycling Facilities

Vendor	Facility Location			Phone	EPA ID Number
Hiacres Landfill	425 Perinton Parkway	Fairport, NY	14450	(716) 223-6132	NONHAZ
Industrial Oil Tank	120 Dry Road	Oriskany, NY	13424	(315) 736-6080	NYR000005298
Ingenco - CHP Plant	2369 Lanier Rd.	Rockville, VA	23146	(804) 749-4774	VAR000006759
INMETCO	245 Portersville Road	Ellwood City, PA	16117	724 758-5515	PAD087561015
Lakeview Landfill	851 Robinson Road East	Erie, PA	16509	(814) 825-8588	NONHAZ
Maxymillian RESOIL	E Street	North Adams, MA	01247	(413) 499-3050	MAV000018385
Mercury Waste Solutions	21211 Durand Avenue	Union Grove, WI	53182	(262) 878-2599	WIR000000356
Modern Disposal	4746 Model City Road	Model City, NY	14107	716-754-8226	NY0986921237
MV Medical Services Co. (BFI)	0 Farley Street	Lawrence, MA	01843	(978) 687-2775	MAD991302266
Norlite Corporation	628 South Saratoga Street	Cohoes, NY	12047	(518) 235-0401	NYD080469935
NovaPb, Inc.	1200 Garnier St.	St. Catherine, Quebec		(781) 849-1807	Ship thru CHI
Ondrick Construction	58 Industry Road	Chicopee Falls, MA	01021	(413) 592-2081	MV4135922081
Ontario County Sanitary Landfill	3555 Post Farm Road	Stanley, NY	14561		N/A
Veolia (formerly Chemical Waste Management)	P.O. Box 2563	Port Arthur, TX	77643	(409) 736-2821	TXD000838896
Veolia (CWM Sauget, IL)	7 Mobile Avenue	Sauget, IL	62201	(618) 271-2804	ILD098642424
Veolia (formerly Global Recycling)	218 Canton St.	Stoughton, MA	02072	(781) 341-6080	MA5000004713
Optech Waverly	370 Route 34	Waverly, NY	14892	(607) 565-8891	NYR000101220
Ovide Rouillard, Inc. Recuperation Materioux Secs	8750, bowl. Bourque	Deauville (Quebec)	J1N3G1		N/A
Piney Creek LTD Partnership	428 Power lane	Clarion, PA	16214	(410) 820-9836	PAR000012450
Rodman Landfill (Development Authority of North Country Solid Waste Management Facility)	23400 NYS Route 177	Rodman, NY	13682		N/A
Safety-Kleen Systems Inc.	17 Green Mountain Road	Cohoes, NY	12047	(518) 783-8080	NYD986872869
Seneca Meadows Landfill	1786 Saloman Road	Waterloo, NY	13165	(315) 539-5624	N/A
Stericycle Inc.	369 Park East Drive	Woonsocket, RI	07895	(401) 769-5801	RID600008763
TCI	39 Falls Road Industrial Park	Hudson, NY	12534	(518) 828-9997	NYD986899912
Trans-Cycle Industries (TCI)	101 Parkway East	Pell City, AL	35125	(205) 338-9997	ALD983167891
United Oil Recovery Inc. (UOR)	136 Gracey Avenue	Meriden, CT	06450	(203) 238-6745	CTD021816889
Waste Management – Turnkey	97 Rochester Neck Road	Rochester, NH	03867	(603) 332-2386	N/A

National Grid USA Companies Approved Hazardous Waste Disposal and Recycling Facilities by Waste Stream		
Waste Stream	Facility Location	Comments
ASBESTOS		
Waste Management-Turnkey	Rochester, NH	Asbestos/special wastes
Chemical Waste Management	Model City, NY	
Hiacres Landfill	Fairport, NY	
Lakeview Landfill	Erie, PA	
Seneca Meadows Landfill	Waterloo, NY	
CID Landfill, Inc.	Chaffee, NY	
BALLAST RECYCLING		
ONYX/Superior Special Services (formerly Global Recycling Technologies)	Stoughton, MA	
ONYX/Superior Special Services (formerly SalesCo)	Phoenix, AZ	
BATTERY RECYCLING		
EnerSys (formerly YUASA/EXIDE)	Nashua, NH	Lead Acid Batteries/Gel Cell
INMETCO	Ellwood City, PA	Nickel Cadmium and Lithium Batteries
NovaPb, Inc.	St. Catherine, Quebec	Non-intact Lead Acid Batteries
ONYX/Superior Special Services (formerly Global Recycling Technologies)	Stoughton, MA	Lead Acid/Universal Waste Batteries (Broker)
COAL TAR SOILS		
American Ref-Fuel Company of Niagara	Niagara Falls, NY	Non-Haz coal tar sludge
ESMI	Loudon, NH	Non-Haz Coal Tar Soils
ESMI –	Fort Edward, NY	
Maxymillian RESOIL	North Adams, MA	Non-Haz Coal Tar Soils
Clean Harbors	Kimball, Nebraska	Hazardous Coal Tar Soils and RCRA Wastes
American Ref-Fuel Company of Niagara Facility	100 Energy Blvd Niagara Falls, NY 14304	Non-Haz Coal Tar Soils
DANC (Rodman Landfill)	NYS Route 177, Rodman, NY 13682	Non-Haz Coal Tar Soils
Piney Creek Power Plant	428 Power lane Clarion, PA 16214	Up to 25% lends of non-haz. Tars and oils
FLUORESCENT LAMP RECYCLING		
ONYX/Superior Special Services (formerly Global Recycling Technologies)	Stoughton, MA	
American Lamp Recycling, Inc.	Wappingers Falls, NY	
ONYX/Superior Special Services (formerly SalesCo)	Phoenix, AZ	
INCINERATION		
Onyx Environmental Services, LLC (formerly Chemical Waste Management)	Port Arthur, TX	TSCA,RCRA
ENSCO	El Dorado, AR	RCRA
Norlite	Cohoes, NY	RCRA, Non-PCB Oil
Clean Harbors/Rollins	Deer Park, TX	TSCA, RCRA
Clean Harbors (Kimball)	Kimball, NE	RCRA

National Grid USA Companies Approved Hazardous Waste Disposal and Recycling Facilities by Waste Stream		
Waste Stream	Facility Location	Comments
LAB PACKS		
Clean Harbors Environmental Services Inc.	Braintree, MA	
LANDFILL		
BFI	Fall River, MA	"Urban Soils" only
Chemical Waste Management	Emelle, AL	TSCA, RCRA
Chemical Waste Management	Model City, NY	TSCA, RCRA, Special Wastes
Waste Management – Turnkey	Rochester, NH	Special Wastes, Asbestos
Colonie Landfill	Albany, NY	Petroleum Contaminated Wastes < 2 ppm PCB
Clean Harbors – Grassy Mountain	P.O. Box 22750 Salt Lake City, UT 84122	PCB Landfill
City of Albany Landfill	Albany, NY	Petroleum Contaminated Wastes < 2 ppm PCB
Hiacres Landfill	Fairport, NY	Asbestos
Lakeview Landfill	Erie, PA	Asbestos & Non-Haz. Soils < 2 ppm PCB
Seneca Meadows Landfill	Waterloo, NY	Asbestos & Non-Haz. Soils < 2 ppm PCB
Rodman Landfill	Rodman, NY	C & D, petroleum Contaminated soil
Ontario County Landfill	Stanley, New York	Solid Waste Landfill
CID Landfill, Inc.	Chaffee, NY	Asbestos & Non-Haz. Soils < 2 ppm PCB
MEDICAL WASTE INCINERATION		
Merrimack Valley Medical Services Co. (BFI)	Lawrence, MA	Medical Waste Only
Envirotech	East Syracuse, NY	Medical Waste Only
Stericycle Inc.	Woonsocket, RI	Medical Waste Only
MERCURY RECOVERY and DISPOSAL		
ONYX/Superior Special Services (formerly Global Recycling Technologies)	Stoughton, MA	
Mercury Waste Solutions	Union Grove ,WI	Mercury Regulator Recycling
MISCELLANEOUS RCRA WASTES		
OIL FILTER RECYCLING		
Consolidated Recycling Technologies (CRT)	Bridgewater, MA	
Murphy's Waste Oil (Clean Harbors Env. Services)	Woburn, MA	
OIL RECYCLING (NON-TRANSFORMER OIL)		
Clean Harbors Environmental Services Inc.	So. Portland, ME	
Murphy's Waste Oil (Clean Harbors Env. Svcs.)	Woburn, MA	
United Oil Recovery Inc. (UOR)	Meriden, CT	
OILY SOIL RECYCLING (BATCH/THERMAL TREAT.)		
AMREC	Charlton, MA	COLD MIX
Aggregate Industries (formerly Bardon Trimount)	Stoughton, MA	HOT & COLD MIX
Aggregate Industries (formerly Bardon Trimount)	Shrewsbury, MA	HOT & COLD MIX
Aggregate Industries (formerly Bardon Trimount)	Salem, MA	COLD MIX

National Grid USA Companies Approved Hazardous Waste Disposal and Recycling Facilities by Waste Stream		
Waste Stream	Facility Location	Comments
Brox Paving Materials Inc.	Marlboro, MA	HOT MIX
Brox Paving Materials Inc.	Dracut, MA	HOT MIX
ESMI	Loudon, NH	Thermal Treatment
Environmental Soil Management, Inc.	Fort Edward, NY	Thermal Treatment
Maxymillian Technologies RESOIL	North Adams, MA	Thermal Treatment
Ondrick Construction	Chicopee Falls, MA	COLD MIX
PARTS CLEANER		
Clean Harbors - Cohoes NY	Cohoes, NY	
TRANSFORMER RECYCLING		
Environmental Protection Services	Wheeling, WV	PCB Oils and Cont. Equip.
TCI	Hudson, NY	Non-PCB Transformers
Trans-Cycle Industries (TCI)	Pell City, AL	PCB Transformers
PPM-Philadelphia-Clean Harbors	Philadelphia, PA	Transformer Disposal
S Kleen PCB Serv. USPCIOHT	Twinsburg, OH	PCB Wastes
Clean Harbors - PPM-Ashtabula OH	Ashtabula, OH	Transformers >50
G & S Technologies	Kearny, NJ	Non-PCB & empty PCB-Contam. Transformers
USED OIL FUEL BURNERS		
Ingenco - CHP Plant	Rockville, VA	Non-PCB MODF only
Norlite	Cohoes, NY	Non-PCB MODF only (< 25 ppm PCB)
WASTE BROKERS		
Capitol Environmental	Vienna, VA	Waste only to listed disposal and recycling facilities.
Clean Harbors Environmental Services Inc.	Braintree, MA	same as above
Clean Harbors Environmental Services Inc.	Bristol, CT	same as above
TCI	Hudson, NY	same as above
WASTEWATER TREATMENT (WWT)		
Clean Harbors Environmental Services Inc.	Bristol, CT	
Clean Harbors Environmental Services Inc.	Cleveland, OH	
Chemical Waste Management	Model City, NY	
Clean Harbors Environmental Services Inc.	So. Portland, ME	Non-RCRA wastewaters
Environmental Prod. & Services	Syracuse, NY	
Industrial Oil Tank	Oriskany, NY	Non-Haz. Wastewaters
North Tonawanda WW Treatment Plant	Tonawanda NY	Non-Haz. Wastewaters
WOOD RECYCLING		
Ciment St-Laurent	Mount Royal, Quebec	Wood Waste
Ovide Rouillard, Inc. Recuperation Materioux Secs	Deauville, Quebec	Wood Waste

National Grid Approved Scrap Metal Facilities					
Vendor	Facility Location	Phone	Scrap Metal Approval		
			Lead Cable	Tanks	All Other Metal
D&D Welding & Salvage Corp.	146 Ashland Ave. Southbridge, MA 01550	(508) 765-5119	no	no	yes
James G. Grant Co.	28R Wolcott St. P.O. Box 54 Boston, MA 02137	(617) 361-2716	yes	yes	yes
Mid City Scrap Iron and Salvage Co., Inc.	P.O. Box 157 Westport, MA 02790	(508) 675-7831	no	yes	Yes
William Reisner Corp. Iron & Steel Scrap	33 Elm St. Clinton, MA 01510-2307	(978) 365-4585	no	no	Yes
Cable Recycling Inc. **(NY use Only)**	220 John Street Barrie, Ont. L4N 2L2	(705) 728-1622)	yes	yes	Yes
Arnold Scrap Processors	2216 Angling Road Batavia, NY 13503-0353	(585)762-9080	no	yes	Yes
Ange's Scrap Metal	2133 Maple Ave Niagara Falls, NY 14305-1714	(716)284-8729	no	yes	Yes
Roth Steel	PO Box 1354, Hiawatha Blvd Syracuse, NY 13201-1354	(315)475-8431	no	yes	Yes
Matlow Co. Inc	PO Box 297 Syracuse, NY 13209-0297	(315)488-3171	no	yes	Yes
Empire Recycling	PO Box 353 Utica,NY13503-0353	(315)724-7161	no	yes	Yes
Cap Scrap	RD#2 West River Road Frankfort,NY 13340	(315)735-4451	no	yes	Yes
Hudson River Recycling	2216 Angling Road Albany, NY 12202	(518)465-2288	no	yes	Yes
Kimco Steel	PO Box 300 Kingston, Ontario Canada K7L4W1	(800)267-0902	no	yes	Yes
Bristol Metals	PO Box Bristol, Rhode Island 02809	(401)253-4070	no	yes	Yes

Appendix C: National Grid Environmental Procedure No. 1 Waste Management

FOREWORD

National Grid is committed to conducting business in a manner that preserves the quality of the environment by continuously seeking ways to minimize the environmental impact of past, present and future operations. We believe that aggressively addressing environmental issues is good business and in the best interest of the communities we serve, our employees, our shareholders, and all our other stakeholders.

National Grid will promote continual improvement in our environmental management systems (EMS) and environmental performance and will develop internal standards to guide activities when no appropriate laws or regulations exist. This Environmental Procedure (EP) No. 1, Waste Management, provides information and direction on regulatory and company policy requirements for the management of waste material. This EP addresses Solid Waste, Hazardous Waste, Universal Waste and other wastes, such as asbestos, medical waste and remediation waste. The management of waste includes generation, storage, transportation and disposal.

This EP supports the Environmental Policy commitment to "minimize and properly manage the waste we generate, and reuse or recycle waste materials whenever economically feasible."

Questions or inquiries regarding information provided in this EP should be referred to your respective Environmental Director.

Approved by: Vice President, Environmental Services

Record of Change		
Date of Review/Revision:		
Revision	Date	Description
0	04/01/06	Complete revision of Waste Management.
1	03/27/07	Clarifications of Section 3.5 regarding Land Disposal for MGP wastes.
2	05/15/07	Chapter 3 was revised in 3.3.1 to include examples of hazardous waste labels and their associated National Grid Stockroom codes.
3	07/25/07	Revised 6.2.8 to allow for shipment to a scrap metal dealer. Revised Table 5.
4	10/29/08	Revised sections 6.1.7, 6.1.8, and 6.2.11 to include recycling requirements for NE States.
5	01/26/10	Revised fluorescent lighting waste in Chapter 5, Temp. EPA ID Numbers in Section 3.2, Figure 3.1 & 3.2, Table 5.2, 5.3 & 5.4, and SQG one-time exceedance in Chapter 3.
6	08/11/10	Revisions to Rhode Island Universal Waste.
7	01/04/12	Revised Section 11.10. Removed web links in lieu of included citations. Update link URL addresses in 7.3.1.
8	07/03/12	Updated to be consistent with the DEC policy for the management of contaminated rags and clothing (specifically Table 6.1, page 90).

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1.0 INTRODUCTION

This procedure provides guidance on how to manage the various waste streams generated by National Grid's activities in accordance with applicable federal, state and local laws. This EP addresses the various hazardous, solid and special wastes generated by National Grid.

2.0 APPLICABILITY

This procedure is applicable to the generation, transportation, or disposal of solid or hazardous waste from National Grid's facilities.

3.0 HAZARDOUS WASTE MANAGEMENT

3.1 Identification of Hazardous Waste

A material becomes a waste at the point at which it is no longer suitable for the purpose for which it was purchased, or when it is no longer intended to be used. Examples may include oil drained from transformers, soil contaminated with oil from a spill, and unused degreasers.

3.1.1 Identification Procedure

Waste Determination

A material is classified as a waste if it meets the definition provided in:

Federal	40 CFR 261.2
RI	RI Rule 3
MA	310 CMR 30.010
NH	Env-Wm 110.01(b)(130)
VT	Hazardous Waste Management Regulation 7-101 to 7-916
NY	6 NYCRR 371.1

Some states use the term "waste," whereas the EPA regulations use the term "solid waste."

The term "solid waste" is not limited to materials in a solid state, but includes solids, liquids and gases. Solid wastes include materials that are discarded by being abandoned (disposed of, burned, or incinerated), that are accumulated, stored or treated prior to being abandoned, or that are recycled.

The regulations exclude certain materials from the definition of a solid waste depending on the types of materials and how they are managed. Materials listed in Table 1 of 40 CFR 261.2, which are not marked with an asterisk, are not considered to be a solid waste when managed in the manner listed at the top of the column. Also, certain materials are not considered to be solid wastes when they are recycled as specified in 40 CFR 261.2(e).

3.1.2 Hazardous Waste Determination

Once a waste has been determined to meet the definition of a solid waste, the waste must be evaluated to determine if it meets the definition of a hazardous waste. The states incorporate EPA's *Hazardous Waste Identification Procedure*. The procedure outlined below must be followed to determine if a solid waste is an EPA or state regulated hazardous waste.

1. Determine if the waste is **excluded** (40 CFR 261.4; 310 CMR 30.104; Env-Wm 401.03: 7-203; 6 NYCRR 371.1(e)). If the waste is excluded, it is not hazardous. If it is not excluded, continue to the next step in the procedure.

2. Determine if the waste is **listed** in any of the lists in the hazardous wastes (40 CFR 261.31 - 261.33; 310 CMR 30.130 - 30.136; Env-Wm 402.04 - 402.07; 7-211; 6 NYCRR 371.4). This includes F, K, P, and U wastes. If the waste is listed, it is a hazardous waste. If it is not listed, continue to the next step in the procedure.

   Before the four lists are reviewed, it is important to gather as much information as is available concerning the waste being evaluated. In most cases, analyses are not required to determine if the waste is listed. However, detailed information concerning the type of process generating the waste and the raw materials utilized in the process, including chemical constituent names and percentages, is needed. This information is often available from materials safety data sheets (MSDSs) and manufacturer contacts.

   The search for the appropriate waste number can be narrowed down by determining if the waste is a spent material from a manufacturing process or is an unused chemical, which must be disposed of. The F and K lists apply only to spent or used materials. The U and P lists apply to only unused, off-specification and residues of chemicals.

   - **F-Listed Wastes:** The F list is found in 40 CFR 261.31; 310 CMR 31.131; Env-Wm 402.06 (a); 7-210; 6 NYCRR 371.4(b). It applies to wastes from non-specific sources. For the F listed solvents F001, F002, F004, and F005, a waste meets the listing only if the raw material contained at least ten percent of the listed solvent or combination of listed solvents. This is called the "ten percent rule." For F003 listed solvents, a waste meets the listing only if the raw material contained the technical grade (or essentially 100 percent) of the F003 listed solvent or solvents. Based on interpretations by EPA, the F003 listing also applies to mixtures containing ten percent or more of the solvents listed in F001, F002, F004 and F005 with any amount of F003. In addition, for a waste to meet any of the definitions under F001 through F005, it must have been a solvent used for its solvent properties (i.e., to dissolve or mobilize other materials).

   - **K-Listed Wastes:** The K list is found in 40 CFR 261.32; 310 CMR 30.132; Env-Wm 402.07 (a); 7-212; 6 NYCRR 371.4(c). It applies to wastes generated from specific industrial sources and are categorized as such.

   - **P-Listed Wastes:** The P list is found in 40 CFR 261.33(e); 310 CMR 30.136; Env-Wm 402.02 (b); 7-213; 6 NYCRR 371.4(d)(5). It applies to discarded commercial chemical products, off-specification products, container residues and spill residues resulting from spills of products. All of the wastes appearing on the P list are considered to be acutely hazardous wastes.

- **U-Listed Wastes:** The U list is found in 40 CFR 261.33(f), 310 CMR 30.133; Env-Wm 402.05 (b); 7-214; 6 NYCRR 371.4(d)(6). Like the P list, the U list applies to discarded commercial chemical products, off-specification products, container residues and spill residues resulting from spills of products. However, U listed wastes are not considered to be acutely hazardous.

3. Determine if the waste exhibits a **characteristic** defined in 40 CFR 261.21 - 261.24; 310 CMR 30.122 - 30.125B; Env-Wm 403.03 - 403.06; 7-205 to 7-208; 6 NYCRR 371.3. Characteristics include ignitability, corrosivity, reactivity, and toxicity. If the waste is characteristic, it is a hazardous waste. These are identified as **I** (ignitability), **C** (corrosivity), **R** (reactivity) and **T** (toxicity). If it is not, continue to the next step in the procedure.

   - **Ignitability:** Wastes which meet the ignitable hazardous waste characteristic definition (40 CFR 261.21; 310 CMR 30.122; Env-Wm 403.03; 7-205; 6 NYCRR 371.3(b)) are identified with the EPA waste number D001. Ignitable wastes include wastes which exhibit any of the following properties:

     - Liquids, other than aqueous solutions containing less than 24 percent alcohol by volume, with flash points less than 60 C (140 F).

     - Non-liquid materials that are capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burn so vigorously and persistently that they create a hazard.

     - Ignitable compressed gases as defined in 49 CFR 173.300.

     - Oxidizers as defined in 49 CFR 173.151.

     Refer to the regulations for details and test methods.

   - **Corrosivity:** Wastes which meet the definition of a corrosive hazardous waste (40 CFR 261.22; 310 CMR 30.123; Env-Wm 403.04; 7-206; 6 NYCRR 371.3(c)) are identified with the EPA waste number D002. Corrosive wastes include wastes which exhibit any of the following properties:

     - Aqueous solutions with a pH $\leq$ 2 or $\geq$ 12.5.

     - Liquids that corrode SAE 1020 steel at a rate greater than 0.25 inches (6.35 mm) per year at a temperature of 55 C (130 F).

     Refer to the regulations for more details and test methods.

- **Reactivity:** Wastes that meet the definition of a reactive waste (40 CFR 261.23; 310 CMR 30.124; Env-Wm 403.05; 7-207; 6 NYCRR 371.3(d)) are identified with the EPA waste number D003. Reactive wastes include those which exhibit any of the following properties:

  - Wastes which are normally unstable and readily undergo violent changes without detonating.

  - Wastes which react violently with water.

  - Wastes which form potentially explosive mixtures with water.

  - Wastes which, when mixed with water, generate toxic gases, vapors or fumes in quantities sufficient to present a danger to human health or the environment.

  - Cyanide or sulfide bearing wastes which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in quantities sufficient to present a danger to human health or the environment.

  - Wastes which are capable of detonation or explosive reaction if subjected to a strong igniting source or if heated under confinement.

  - Wastes which are readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

  - Wastes which are forbidden explosives as defined in 49 CFR 173.51, or Class A explosives as defined in 49 CFR 173.53 or Class B explosives as defined in 49 CFR 173.88.

- **Toxicity Characteristic:** A waste is considered to be toxic under the toxicity characteristic (40 CFR 261.24; 310 CMR 30.125B; Env-Wm 403.06; 7-208; 6 NYCRR 371.3[e]) if a representative sample contains any of the regulated contaminants in a concentration equal to or in excess of the regulatory level established for that contaminant based on the *Toxicity Characteristic Leaching Procedure* (TCLP) test. The TCLP test has been designed to determine the mobility of contaminants in solid, liquid, or multi-phase waste, and is intended to simulate the conditions in a sanitary landfill.

4. Determine if the waste is a **state-regulated hazardous waste** (RI Rule 3; 310 CMR 30.130 - 30.131; Env-Wm 402.06 (b), 402.04 (c), 403.04 (b)(3), 404; 7-211; 6 NYCRR 371.4). If the waste is a state-regulated hazardous waste, it is a hazardous waste. These wastes may include oily wastes and PCB wastes. It should be noted that PCBs are regulated by EPA under the Toxic Substances Control Act

(TSCA) as a toxic substance. Listed below are examples of state waste codes for oils and PCBs for states in which National Grid is located.

State	Oil and Oily Wastes	PCBs (50 ppm)
MA	MA01, MA97, MA98	MA02
NH	NH01	NA
RI	R010, R014	R007
VT	VT02	VT01
NY	N006[1]	B001-B007

1 - Non-hazardous waste.

Aside from these, several other state-regulated wastes that may be generated at National Grid include the following:

- Ethylene glycol in Vermont (VT08);
- Liquid wastes with a flash point less than 200 F or solid wastes with a flash point less than 100 F in Rhode Island (R003);
- Wastes containing "U" or "P" constituents at concentrations above 5 ppm for acutely hazardous or specifically identified carcinogens, or 100 ppm for all other constituents in New Hampshire (NH11).

5. If none of the above applies, the material is not hazardous. **Please note that when a waste has been determined to be non-hazardous based on the procedure presented in this section, it does not necessarily mean it can be managed or disposed of by any means. Other regulations are likely to apply for different management methods such as sewer discharge, surface water discharge, solid waste, medical waste, asbestos, recycling, and universal waste regulations, etc. Please refer to the appropriate sections within this manual for guidance on these topics.**

3.1.3 Special Hazardous Waste Identification "Rules" and "Policies"

Questions often arise regarding identification of wastes, hazardous waste spill residues, etc. The EPA has established several "rules" and "policies" within the definition of hazardous wastes to address these questions. These include the "mixture" rule, "derived from" rule, and the "contained in" policies. Each is described below.

"Mixture" Rule

Mixtures of hazardous wastes are addressed in 40 CFR 261.3(a); 310 CMR 30.102 and 30.140; Env-Wm 404.01; 6 NYCRR 371(d)(1)(ii)(c+d). In

general, the regulations state that mixtures of "toxic" and "acutely hazardous" wastes (mostly EPA listed hazard wastes) with other wastes are considered hazardous and are identified with the waste number corresponding to the listed hazardous waste. Mixtures of characteristic hazardous wastes (non-toxic wastes, i.e., wastes which are not "toxic" or "acutely hazardous") with other wastes are only hazardous if the mixture exhibits a characteristic. Any mixing process, which is conducted for the purpose of rendering a waste nonhazardous, is considered treatment.

"Derived From" Rule

40 CFR 261.3 (c)(2); 310 CMR 30.140 (2); Env-Wm 404.02; 6 NYCRR 371.1(d)(3) states that any waste generated ("derived") from treatment, storage, disposal, or use of a hazardous waste is a hazardous waste. For listed wastes, this remains true until it has been determined that the waste is not hazardous under the procedures for petitions. For characteristic hazardous wastes, this remains true unless the waste no longer exhibits a characteristic. Wastes meeting the "derived from" rule may include sludges, spill residues, ash, emission control dust, or leachate, etc.

"Contained In" Policy

Contaminated environmental media (soil, ground water, surface water and sediments), of itself, is not hazardous waste and, generally, is not subject to regulation under RCRA. Contaminated environmental media can be subject to regulation under RCRA if they "contain" hazardous waste. EPA considers contaminated environmental media to contain hazardous waste: (1) when they exhibit a characteristic of a hazardous waste; or, (2) when they are contaminated with concentrations of hazardous constituents from listed hazardous waste that are above health-based levels. It should be noted that this policy has not been codified. In general, site-specific evaluations should be made (considering the EPA and state requirements and policies) on a case-by-case basis with regard to this policy.

Empty Containers

Containers which previously held hazardous wastes are not considered to be hazardous if they meet the regulatory definition of "empty" (all product is removed that can be, and there is less than one inch of product remaining) in 40 CFR 261.7; 310 CMR 30.010; Env-Wm 401.03 (b)(12) 7-203; 6 NYCRR 371.1(h) and DEM Rule 5.8.

In Vermont, the following alternative performance standard exists for determining if a container is considered empty when all material is removed that can be:

- Less than 3 % by weight if the container is less than 110 gallons
- Less than 0.3 % by weight if the container is greater than 110 gallons

Containers or inner liners which held acutely hazardous wastes are considered empty if the container or inner liner has been triple-rinsed using a solvent capable of removing the chemical product.

Containers which held compressed gases are considered to be empty when the pressure in the container approaches atmospheric.

3.1.4 Sampling and Analysis Requirements

40 CFR 262.11; 310 CMR 30.302; Env-Wm 502.01; 7-202; 6 NYCRR 372.2(a)(2) requires generators to properly identify their wastes based on the procedures described above. Analysis is not specifically required; however, it is often necessary to have some analyses conducted in order to properly classify certain waste materials.

As can be determined from the procedures described above, listed hazardous wastes can generally be identified without conducting analyses because these determinations are usually made on the type of manufacturing processes and constituents of raw materials used in the process. However, when determining whether or not a waste meets one of the four hazardous waste characteristics, it is necessary to know specific information about the waste itself. 40 CFR 262.11; 310 CMR 30.302; Env-Wm 502.01; 7-202; 6 NYCRR 372.2(a)(2) indicate that generators must determine if wastes exhibit any of the hazardous waste characteristics by either (1) testing the waste, or (2) applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.

Therefore, identification of waste can be based on knowledge of the waste and the processes and the raw materials involved in the waste generation. MSDSs are a good source of information for potential waste characteristics if the waste material generated is essentially the same as the product used. However, it is important to note that chemical manufacturers are not required to report constituents on MSDSs unless they are present in amounts exceeding 1% (0.1% for carcinogens). Therefore, since the toxicity characteristic contaminants are regulated as hazardous at concentrations well below 1%, it is possible they may be present in a product, but not reported on the MSDS. Other sources of information on potential waste characteristics are chemical dictionaries, reference books, etc.

3.1.5 Record Keeping

40 CFR 262.40; RI Rule 5.6; 310 CMR 30.331 (3); Env-Wm 512.01; 7-710 require that generators maintain documentation of waste determinations on file for at least three years. This documentation must include copies of waste analysis and copies of any tests or other determinations made regarding the waste's content. Since laboratory analyses are not always required for identification purposes, hazardous waste identification documentation may include notes concerning the generating process, raw materials, constituent information, etc.

3.1.6 Typical Company Hazardous Wastes

Refer to the Waste Profile List on the Infonet for information on hazardous wastes typically generated by Company facilities.

3.1.7 Discovery of Unclassified Wastes

The discovery of unknown waste on a Company right-of-way or easement may constitute a threat of a release. Notifications to regulatory agencies may be required.

3.2 Hazardous Waste Generator Requirements

3.2.1 Waste Generator Classifications

Classification is determined based on the quantity of hazardous waste routinely generated during a given month and the amount accumulated on site at one time. The volume of wastes manifested per month should not be used to determine generator classification. Table 3.1, Generator Classification Criteria, lists the quantities of wastes that define generator status in Massachusetts, New Hampshire, New York, Vermont and Rhode Island. In addition, the following criteria apply specifically to the following states:

National Grid facility EPA Identification Numbers are listed on the Infonet.

In this procedure, the terms Very Small Quantity Generator (VSQG), Small Quantity Generator (SQG) and Large Quantity Generator (LQG) are used. Please note that:

i. In New Hampshire, a large quantity generator is called a full quantity generator
ii. In Vermont, a large quantity generator is called a Generator and a VSQG is called a Conditionally Exempt Generator
iii. In Rhode Island, all generators are regulated as LQGs.
iv. In New York, a VSQG is called a Conditionally Exempt Small Quantity Generator (CESQG).

3.2.2 EPA Generator ID Number

Company facilities which generate hazardous waste on a continuing basis, regardless of status, e.g., LQG, SQG, VSQG, must be assigned an EPA Identification (ID) Number. If waste is generated for more than one year at a location, this constitutes a "continuing basis."

The Environmental Department is responsible for securing EPA ID Numbers when required and for notifying the appropriate environmental agency when the EPA ID Number is no longer needed

When waste is generated in field locations that do not have an EPA ID Number (e.g., Substation, spill site, or manhole), the following guidance should be followed:

RI A temporary ID Number must be obtained from RIDEM.

NH A temporary ID Number must be obtained from NHDES.

MA Each of the Operating Companies in MA has been assigned an EPA ID Number to be specifically used for spills and off site locations in the specific companies' territories. Temporary numbers should not be needed.

VT National Grid operations in VT are limited to substations. All substations in VT have EPA ID Numbers.

NY Most all substations and Facilities have EPA ID Numbers. A new EPA ID Number will be obtained for a new generation point if required.

3.2.3 Temporary ID Numbers

A temporary ID Number may be obtained for Company locations that have applied for, but not yet been issued a permanent EPA ID Number, or to transport and dispose of hazardous waste from a single non-recurring waste generating event at a non-EPA ID numbered site. The temporary ID Number is valid for up to 30 days from issue in Massachusetts, New Hampshire, New York and Vermont, and for up to 90 days in Rhode Island.

Massachusetts: Each Operating Company in Massachusetts has been assigned an EPA ID Number by the MA DEP for waste generated in the field and from spills.

New Hampshire: For shipment of spill cleanup debris during regular working hours (8 a.m.-4 p.m.) a temporary EPA ID Number must be obtained from NH DES RIMS (603.271.2921). For shipments of oil spill cleanup debris during off hours, an EPA Number of NHD999999998 may be used. The EPA ID Numbers for the Salem and Lebanon offices will not be used for material that is generated from offsite locations.

New York: A temporary identification number may be obtained by contacting the EPA at (212) 637-4106.

Rhode Island: A temporary identification number may be obtained in Rhode Island by contacting the Rhode Island Department of Environmental Management at (401) 222-6822.

Vermont: A temporary identification number may be obtained in Vermont by contacting the Secretary of Natural Resources at (802) 241-3866.

3.2.4 Emergency Preparedness and Prevention

All hazardous waste generator facilities shall be maintained and operated to minimize the possibility of a fire, explosion or any unplanned, sudden release of hazardous wastes to the environment. The facility must be equipped with the proper emergency equipment as required by the applicable State hazardous waste regulations. Please refer to your State's regulation to meet this requirement. Below is a list of common alarms and equipment etc. that might be required by some of the State's in National Grid's territory:

- Internal communication or alarm system capable of providing immediate emergency instruction (voice or signal) to facility personnel.

- Communication devices available at all main accumulation areas, capable of summoning outside assistance. The device shall be located within a reasonable distance of the waste management area so waste management operators will be able to summon outside assistance in a timely manner.

- Fire control equipment, spill control equipment, and decontamination equipment.

- Water at adequate pressure and volume to supply hoses and other fire suppression equipment.

- Emergency coordinators at the facility or on call must be able to reach the facility quickly (one hour in Massachusetts).

- Marking of all emergency exits.

- A list posted at the nearest communication device (telephone) which provides:

  - Name, and work and home phone numbers, of primary and alternate emergency coordinators;
  - Phone numbers of the fire department, police department, hospital, and emergency response teams;
  - Location of fire extinguishers, spill control equipment, and fire alarm (if present);
  - Evacuation routes (MA only); and,
  - In NH, each LQG shall also post a list of the steps to be taken if an emergency occurs.

3.2.5 Inspection and Testing of Equipment

All hazardous waste generator communications and alarm systems, fire protection equipment, spill control equipment, and decontamination equipment shall be tested in accordance with applicable State Regulations and maintained as necessary to ensure they are functional.

3.2.6 Contingency and Emergency Response Planning Requirements

All Company hazardous waste "generators" must comply with applicable regulations associated with the development and maintenance of a contingency plan containing emergency notification and response procedures designed for mitigation of emergencies resulting from fire, explosion, spills, and other releases of hazardous materials to the environment. The contingency plan may be incorporated into an existing SPCC plan or incorporated into an "Integrated Contingency Plan."

The plan shall be updated when changes affecting a facility's ability to respond to emergencies occur. This includes changes in facility design or operation that substantially increase the potential for emergencies; when the list of emergency coordinators or specific information about current emergency coordinators changes; or the list of emergency equipment changes. Immediately following any updates, LQGs must send copies to all companies/agencies who initially received a copy of the plan.

The plan shall address the requirements of the applicable State Regulation which might include some of the following requirements:

- How the design of the facility minimizes the threat to public health, safety, and welfare or the environment from fire, explosion, spills and other release to the environment.
- A clear outline of lines of communication and procedures for hazardous waste generator personnel to follow in the event of an emergency.
- Documentation of arrangements made with local agencies (police, fire, ambulance, local officials, etc.) for support services in the event of an emergency.
- Identify a Primary Emergency Coordinator responsible for directing all emergency response actions at the hazardous waste generator. The Primary Emergency Coordinator or an alternate shall be available on site within one hour of the discovery of an emergency. The plan shall contain a list of all persons qualified to act as Alternate Emergency Coordinators. The list shall identify the emergency coordinators, their work and home telephone numbers and home addresses.
- A description of procedures, structures and equipment used at the hazardous waste generator for prevention of releases of hazardous wastes and response to releases should they occur.
- An evacuation plan including signals to begin evacuation, evacuation route, and alternate routes.

As required by applicable state regulations, SQGs need not develop the plan but must attempt to make arrangements to familiarize police, fire, local boards of health, and emergency response teams with the layout of the site, properties and hazards of hazardous waste handled at the site, and other site specifics such as entrances and evacuation routes.

3.2.7 Release Response

Requirements for response actions required to address releases of oil and/or hazardous materials are found in the National Grid Environmental Procedure No. 5 Release Response. However, it should be noted that Vermont's (7-105) and New York's (373.3)

hazardous waste regulations require notification, the conduct of emergency action and submittal of reports in the event of a release of a hazardous waste.

3.2.8 Training Program Requirements

Hazardous waste management training must be provided to employees who handle hazardous waste as part of their job responsibilities. This training must be described in a Personnel Training Plan as is discussed in the environmental procedure on training.

3.2.9 Recordkeeping Requirements

All hazardous waste generators shall maintain records related to the management of hazardous waste, substances and PCBs. Refer to the EP No. 15 for document/record maintenance.

3.3 Hazardous Waste Accumulation

Hazardous waste generators must ensure that wastes are accumulated and stored in compliance with applicable regulations while on-site. These regulations can be found primarily in 40 CFR 262.34. In addition, state-specific hazardous waste regulations must be complied with:

Massachusetts	310 CMR 30.340 LQGs 310 CMR 30.350 SQGs and VSQGs
New Hampshire	Env-Wm 507 - 509
New York	6 NYCRR 372, 373-1 and 373-3
Rhode Island	Rules 5.2 and 5.4
Vermont	7-310

Storage regulations include requirements such as labeling, storage time limitations, inspection requirements, container management, etc. The applicable requirements vary depending on whether the waste is collected in containers or tanks. In general, a container is considered to be a portable device and a tank is considered to be a stationary device designed to contain hazardous waste.

The following sections describe the hazardous waste accumulation regulations applicable to generators.

Attachment A, located at the end of this chapter, provides a summary of National Grid Policy and state-specific hazardous waste generator requirements, including a list of state hazardous waste codes.

3.3.1 General Accumulation Requirements

Accumulation Time

Allowable accumulation time varies depending on where the waste is stored and the category of generator. The accumulation time clock starts when waste is first added to a container or tank. The only exception to this is for satellite accumulation containers, where the clock starts when the container is full (up to 55 gallons). Generators who accumulate wastes in satellite accumulation areas may accumulate these wastes for an indefinite period of time until the container is full, provided that all of the requirements applicable to satellite accumulation areas are complied with.

Please note: PCBs have a 30 day accumulation time limit for main and satellite accumulation areas unless stored in a TSCA 761.65(b) storage facility. Also, the clock starts when the waste is first added to a container or tank, regardless of whether it is stored in main accumulation storage or satellite storage.

General Accumulation Time Limits		
Generator Category	**Type of On-Site Storage Area**	**On-Site Storage Time Limit**
LQG	Main Accumulation Storage	90 Days
SQG	Main Accumulation Storage	180 days
VSQG	Main Accumulation Storage	No Limit

New Hampshire Accumulation Time Limits
Full quantity generators may accumulate hazardous waste on-site for 90 days or less without being subject to the requirements applicable to TSDFs.
Small quantity generators that never accumulate more than 100 kilograms of hazardous waste (or 1 kilogram of acutely hazardous waste) may accumulate hazardous wastes on-site for an unlimited amount of time without being subject to the requirements applicable to TSDFs provided they comply with the requirements of Env-Wm 508.02.

New Hampshire Accumulation Time Limits
Small quantity generators that accumulate between 100 and 1,000 kilograms of hazardous waste may accumulate hazardous wastes on-site for up to one year without being subject to the requirements applicable to TSDFs provided they comply with the requirements of Env-Wm 508.03. This includes a provision for never accumulating more than one 55-gallon drum of each unique non-acutely hazardous waste stream on-site. In addition, when such a container is filled, it must be marked with an

accumulation start date and shipped off-site within 90 days. **Please note: the one year limit is from the original start of accumulation**.

New York Accumulation Time Limits		
Generator Category	Type of On-Site Storage Area	On-Site Storage Time Limit
LQG	Main Accumulation Storage	90 Days
SQG	Main Accumulation Storage	180 days
CESQG	Main Accumulation Storage	No Limit

Rhode Island Accumulation Time Limits
Generators may accumulate hazardous waste on-site for 90 days or less without being subject to the requirement applicable to TSDFs.

Vermont Accumulation Time Limits
Large Quantity Generators may accumulate hazardous waste on-site in the main accumulation area for 90 days or less without being subject to the requirement applicable to TSDFs.
Small Quantity Generators may accumulate hazardous waste on-site in the main accumulation area for 180 days without being subject to the requirements applicable to TSDFs.
Conditionally Exempt Generators do not have a limit on the amount of time which they can accumulate hazardous waste on site in the main accumulation area without being subject to the requirements applicable to TSDFs.

Ignitable, Reactive or Incompatible Waste Accumulation

Ignitable, reactive or incompatible wastes are required to be separated and protected from sources of ignition or reaction, such as open flames, smoking, cutting, welding, hot surfaces, frictional heat, sparks, spontaneous ignition and radiant heat. The intent is to prevent accidental ignition or reaction of ignitable or reactive wastes.

Smoking and open flames must be confined to designated areas while ignitable or reactive wastes are being handled. "No Smoking" signs must be posted wherever there is a potential hazard from ignitable or reactive wastes.

Signs and Markings

All main accumulation areas where hazardous wastes are accumulated must have signs indicating the presence of hazardous waste storage. State-specific sign requirements are described in the table below. Signs shall be in a format to meet individual state regulations.

Massachusetts	HAZARDOUS WASTE
New Hampshire	HAZARDOUS WASTE DANGER – UNAUTHORIZED PERSONNEL KEEP OUT
New York	HAZARDOUS WASTE
Rhode Island	HAZARDOUS WASTE
Vermont	DANGER – HAZARDOUS WASTE STORAGE AREA – AUTHORIZED PERSONNEL ONLY

Satellite accumulation areas in Massachusetts and Conditionally Exempt generators in Vermont are not required to have a sign as described above.

ALL storage and accumulation areas containing PCB wastes ≥ 50 ppm must have a PCB mark posted in the accumulation area.

In **Massachusetts**, main accumulation areas must also be clearly marked (i.e., by a line or a piece of tape on the floor, a gate, fence or sign at the boundary of a clearly distinguishable area) so that they are distinguished from any satellite accumulation areas and other areas at the facility.

Security

Main storage areas shall be secured by a fence or other means of restricting access to prevent unknowing and unauthorized entry. General facility security fencing can serve as a means of preventing unknowing and unauthorized entry.

Outdoor main accumulation areas shall be adequately secured. Installation of a fence is not mandatory, but recommended with a locked gate unless the entire facility is fenced and secured (24 hours per day).

Satellite Accumulation Definition

The primary purpose of satellite accumulation is to allow generators to accumulate a waste near the process which generates the waste, without being subject to a time limitation, until up to 55 gallons of non-acutely hazardous waste are generated. This prevents generators from having to ship very small quantities of waste off-site to meet the central storage area time limitations because the waste is generated at a slow rate. Satellite accumulation areas must be maintained in compliance with the requirements described below:

Satellite Accumulation Area Requirements	MA	NH	RI	VT	NY
Satellite accumulation containers must be maintained in good condition and handled in a manner which will not cause them to rupture or leak. **NH also requires the use of DOT authorized containers**.	X	X	X	X	X
Containers used for satellite accumulation must be compatible with the hazardous wastes placed in them.	X	X	X	X	X
Satellite accumulation containers must be maintained closed at all times except when adding or removing wastes.	X	X	X	X	X
Satellite containers must be stored on an impervious surface**.**	X	X			

Satellite Accumulation Area Requirements	MA	NH	RI	VT	NY
Satellite accumulation containers must be stored away from functional floor drains unless secondary containment is provided as described in Section 4.2.3. In addition, containers stored outdoors should be under cover and stored at least 50 feet from any surface waters.[1]	X[1]	X	X[1]	X[1]	
Satellite accumulation area containers must be marked with:					
• The words "Hazardous Waste" and other words that describe the contents of the container[2]	X	X	X	X	X
• Associated hazards of the waste	X				
• Initial accumulation start date[3]		X			X
• EPA or state waste number		X			
Satellite accumulation containers must be inspected weekly.	X	X			
Aisle space must be provided to allow for inspections and to comply with any applicable National Fire Protection Codes.	X				
When a satellite accumulation container becomes full, the date must be marked on the container. The generator must comply with all other requirements applicable to the central storage containers within three days.	X	X	X		X

Notes:

1. Some States require secondary containment for all containers of liquid hazardous waste, even when indoors if there is potential for a spill to reach the outside environment (see Section 4.2.3).
2. If materials with a PCB content of 50 ppm or greater are stored in the container, the container shall also be labeled with a PCB mark.

3. The initial accumulation start date must be indicated on all containers of PCB-containing wastes (≥ 50 ppm).

New Hampshire

- NH SQGs may not accumulate hazardous wastes at satellite locations for greater than one year from the original start date of accumulation.
- NH DES also recognizes another type of accumulation area under Env-Wm 507.01(f) which allows generators to accumulate wastes at the point of generation and to transport that waste to a designated hazardous waste storage area at the end of every work shift. The type of container used is required to satisfy the following requirements:
  - The container must be labeled with the words "Hazardous Waste" and the contents of the container;
  - The container must be under control of a trained employee;
  - The container must be emptied at the end of every work shift, which does not exceed 12 hours; and,
  - The container must be no greater than 10 gallons in capacity, and no more than one container of each non-acutely hazardous waste may actively collect the waste at each point of generation.

Hazardous Waste Container Storage Requirements - Main Storage Areas

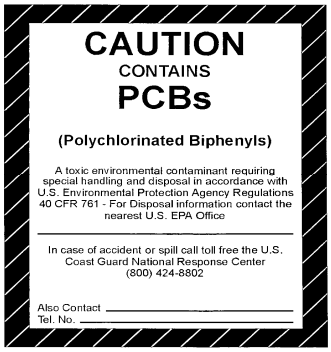
This section provides a description of the requirements applicable to generators that store hazardous wastes in containers. Container is defined as any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled.

Container Labeling

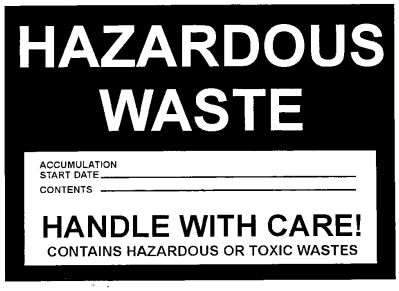
Containers must be clearly labeled on-site. All labels on containers shall be affixed on the upper third of the container when possible. If more than one label is required, they shall be placed in close proximity to one another. Labels must not be hidden by walls or other containers and must be clearly visible for inspection. **Note that prior to off-site shipment, all containers must meet DOT pre-transport requirements which include additional labeling information.** Containers that store materials with a PCB content of ≥ 50 ppm shall also be marked with a PCB mark.

Common examples of labels include:

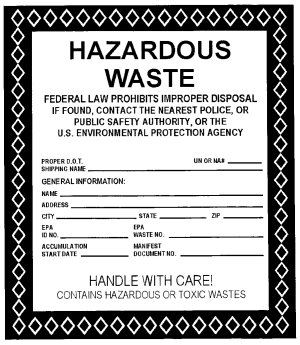
PCB Mark
STORES CODE 467242



Hazardous Waste Sticker
Stores Code 467238



Hazardous Waste Mark
Stores Code 467239
(Includes D.O.T. Pre-transport Information)



State-Specific Hazardous Waste Container Labeling Requirements					
Labeling Requirement	**MA**	**NH**	**RI**	**VT**	**NY**
The words "Hazardous Waste" and other words which identify the contents of the container.	X	X	X	X	X
Type of hazard associated with the waste	X				
Accumulation start date	X	X	X	X[1]	X
EPA or state waste code		X	X	X[1]	
Generator's name and address			X	X[1]	
Uniform Hazardous Waste Manifest Document Number (prior to off-site shipment)			X		
Proper DOT label			X		
The wording "Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency."			X	X[1]	
Information required by DOT marking regulations (including the shipping name, UN or NA ID number, RQ information if applicable, technical names if applicable and hazardous waste wording).			X		

Note: 1 – Not required for Conditionally Exempt Generators.

Container Management

Containers used to hold waste may include drums, roll-offs, boxes and other types. The type of container that can be used depends on the material to be kept in it. Non-bulk containers, such as drums, shall be used only once for hazardous waste disposal.

Hazardous material containers are generally single trip containers. Some manufacturers offer refunds on returned containers. Drums which previously held a hazardous material (e.g., unused oil) may be reused for on-site storage of similar materials and for the off-site shipment of similar materials provided the container is approved for transport by the DOT regulations. Containers may not be used for other purposes (e.g., trash containers) without permission from the Environmental Department.

Empty packaging may be reused for shipping hazardous wastes from a generator to a TSDF without complying with reuse and reconditioning requirements in 49 CFR 173.28 and Part 178 as long as the following requirements are complied with:

a. Before reuse, each packaging must be inspected and may not be reused unless free from incompatible residue, rupture, or other damage which reduces its structural integrity.

b. The waste is packaged in accordance with all other applicable DOT requirements.

c. Packaging may be used only once under these provisions.

Container Secondary Containment Requirements

In Massachusetts and New Hampshire, containers of liquid hazardous waste must have secondary containment when stored outdoors. Containers of liquid hazardous waste when stored indoors near functional floor drains, manholes, or when near doorways where a release could enter the environment must also have secondary containment. In Rhode Island, **all** containers of liquid hazardous waste in the main hazardous waste accumulation area must have containment.

Containers containing no fluids do not require a containment system. Secondary containment requirements for containers of fluid are summarized in the table below.

In New York, containers of liquid hazardous waste exceeding 185 gallons in total require secondary containment in the counties of Kings, Nassau, Queens, and Suffolk, or over the Schenectady/Niskayuna Aquifer System in Schenectady, Saratoga and Albany Counties, or the Clinton Street Ball Park Valley Aquifer System in Broome and Tioga Counties.

Container Inspections

Inspections of main storage areas and satellite accumulation areas of the facility must be conducted and documented. Very Small Quantity Generators in Vermont and New York are exempt from inspection requirements. Containers and their accumulation areas are to be inspected at a minimum for:

- Container condition;
- Condition of storage area;
- Adequate aisle space;
- Compliance with labeling and marking requirements; and,
- Storage Times.

When conducting inspections, the following guidance should be considered:

- Inspections must be conducted in accordance with the frequency established in the applicable regulations and documented.

- Inspection reports/forms should be completed **during** the inspection with all deficiencies noted and corrective actions documented.
- The inspector should complete the inspection report/form during the inspection. The completed inspection report/form must contain the **date, time**[(1)] **and identity** of the inspector. Initials are acceptable as long as the initials adequately identify the inspector.
- Completed inspection reports/forms should not be copied and utilized for future inspections. A **blank** form/report should be utilized for each inspection period.
- The inspection report/form should not be filled out, initialed or dated by anyone other than the person who personally conducted the inspection.
- Inspection reports/forms may not be backdated to cover inspections conducted but not documented in the past.

Note: [(1)] – Not required in New York.

Subpart CC Container Air Emission Standards

40 CFR Part 265, Subpart CC applies generally to wastes which contain an average volatile organic (VO) concentration ≥ 500 ppm. Section 265.1083 establishes general applicability of the standard, and includes exemptions for certain waste treatment processes. To determine if a waste contains 500 ppm, §265.1084(a) establishes a waste determination procedure. Wastes should always be evaluated at the point of origin. Generators may use either knowledge of a waste, or direct measurement to determine the VO concentration. §265.1084 provides detailed information concerning how to collect samples, the number of samples required, frequency of evaluation, etc. The specified analytical method for determining VO concentrations is Method 25D in 40 CFR Part 60, Appendix A.

The organic air emissions standards apply to containers (excluding satellite accumulation containers) which are larger than 26 gallons and which hold hazardous wastes with an average VO concentration ≥ 500 ppm. The container standards can be found in 40 CFR 265.1087.

Hazardous Waste Tank Storage Requirements

This section provides a description of the requirements applicable to generators who store wastes in tanks. These requirements apply in addition to the general requirements described above. A tank is defined as a stationary device designed to contain an accumulation of hazardous waste which is constructed primarily of non-earthen materials (i.e., wood, concrete, steel, plastic, etc.) and which provides structural support.

Tank Labeling

Regarding the accumulation start date:

- For PCB waste (≥ 50 ppm), the date waste was first put into the tank must be recorded on the tank. A record that includes, for each batch of PCBs, the quantity of the batch and the date the batch was added to the tank, as well as the date, quantity and disposition of any batch of PCBs removed from the tank must also be maintained. It is recommended that a log be maintained for this purpose.
- For wastes containing no PCBs, record the date when the tank first receives waste.

Containers that store materials with a PCB content of ≥ 50 ppm shall also be marked with a PCB mark.

Tank Management
Tanks holding hazardous wastes are subject to the requirements outlined below.

- In general, hazardous wastes may not be placed in a tank system if they would cause the tank system to rupture, leak, corrode or otherwise fail.
- Appropriate controls and practices must be used to prevent spills and overfills (i.e., check valves, high level alarms, automatic feed cutoffs, etc.) and to provide sufficient freeboard in uncovered tanks.
- Tanks must be in good condition and compatible with the waste stored in them.
- Tanks holding ignitable wastes are subject to applicable fire codes regarding location. Also see 373-3.10(i) for New York requirements.
- Tanks storing liquid hazardous wastes must have secondary containment.
- Tanks must be inspected daily.

Tank Secondary Containment Requirements (See Regulations for Full Requirements)
Secondary containment systems must be:

- Designed, installed, and operated so that no waste is released to the surrounding soil, groundwater, or surface water.
- Construction material or liner must be compatible with the waste to be stored and must be capable of containing accumulated material until it is promptly removed.
- Accumulations should be removed within 24 hours, or when such removal cannot be accomplished in a 24-hour period, within another time frame specified by the EPA Regional Administrator.
- Must have sufficient structural strength to prevent failure, and the foundation must be designed to resist failure due to normal movement of the surrounding soils.

- Must be equipped with a leak detection system capable of detecting failure in either the primary or secondary containment structures. Daily visual inspections provide acceptable leak detection, except for double wall tanks.
- Include daily visual inspections where tanks and tank components are physically accessible.

Tank Inspections
Daily inspections of hazardous waste tanks shall include:

- Overfill and spill control equipment to ensure that it is in good working order;
- Aboveground portions of the tank system to detect corrosion or releases of waste;
- Data gathered from any monitoring and leak detection equipment to ensure that the tank system is being operated according to its design; and,
- Construction materials and area surrounding the externally accessible portion of the tank system; including secondary containment structures to detect erosion or signs of releases of hazardous wastes.
- Cathodic protection systems must be inspected, if present, according to the following schedule:
- Proper operation of the cathodic protection system must be confirmed within six months after the initial installation and annually thereafter.
- All sources of impressed current must be inspected and/or tested as appropriate, but at least bimonthly.

All inspections must be documented in an inspection log. For PCB waste ($\geq$ 50 ppm), a record that includes for each batch of PCBs the quantity of the batch and the date the batch was added to the tank, as well as the date, quantity and disposition of any batch of PCBs removed from the tank must also be maintained. It is recommended that a log be maintained for this purpose.

3.4 Hazardous Waste Shipping

This section provides guidance for shipping hazardous waste. This includes preparing the shipment; offering the shipment to others for transport; and actual transport over the road.

When a regulated hazardous waste is offered for transportation, the material may also be regulated as hazardous by the DOT if the material being offered for shipment exhibits a DOT Hazard Class characteristic (i.e., Flammable Liquid, Corrosive Material, etc.). Hazardous waste is also regulated by the DOT if the material is regulated as hazardous by the federal EPA

even if the material does not exhibit a DOT Hazard Class characteristic. This is due to an interagency agreement between the DOT and the EPA. It should be noted that many state regulated hazardous wastes are not regulated as hazardous by the DOT. However, all state and federal wastes regulated as hazardous are managed under a shipping paper called a hazardous waste manifest when being offered for transportation. The process for shipping a hazardous waste includes the following steps:

- **Step 1:** Determine the proper DOT Hazard Class,
- **Step 2:** Select the best shipping description,
- **Step 3:** Select the proper shipping package,
- **Step 4:** Apply the proper marking & labeling to the container,
- **Step 5:** Prepare the shipping paper (Hazardous Waste Manifest),
- **Step 6:** If applicable, affix Placards to the vehicle.

When shipping hazardous wastes from a National Grid facility, a fax may be sent to the hazardous waste vendor providing details regarding the pickup. Please refer to the Environmental Department's Infonet web page to obtain a copy of a hazardous waste pick-up form which can be used to fax this information to the vendor.

3.4.1 DOT Hazard Class

According to the DOT, a hazardous waste is one which meets the federal EPA definition of a hazardous waste, which includes materials carrying EPA waste codes "D", "F", "K", "U", or "P". If a state regulated hazardous waste does not carry an EPA waste code or meet one of the 9 DOT Hazard Classes, it is not regulated as hazardous by the DOT and should not be assigned a Hazard Class.

To determine if a hazardous waste meets a DOT Hazard Class characteristic, refer to 49 CFR Part 173. Tables 3.2 and 3.3 provide descriptions of the DOT Hazard Classes and Placards, with applicable regulatory references. Figures 3.1 and 3.2 provide pictures of the DOT Hazard Class Labels and Placards.

3.4.2 DOT Shipping Description

For Hazardous Wastes which exhibit a DOT Hazard Class or are DOT regulated via interagency agreement with the EPA, a proper DOT shipping description must be used. Proper DOT shipping descriptions are selected from the DOT Hazardous Materials Table (49 CFR 172.101). If the material exhibits a DOT Hazard Class, a shipping description must be selected which matches the Hazard Class and best describes the material. However, if the material is an EPA regulated hazardous waste without a DOT Hazard Class, DOT makes it a Class 9 material with the generic description of "Hazardous Waste Liquid NOS" or "Hazardous Waste Solid NOS." The shipping name is then followed by: the DOT Class Number; the DOT Identification Number; and the Packing Group (PG) Number as found on the Hazardous Materials Tables. Lastly, if a constituent makes the material hazardous, that constituent should be identified in brackets following the basic DOT description.

3.4.3 DOT Shipping Packages

Shipping packages are defined by DOT as either bulk or non-bulk. Bulk packages have a capacity ≥ 119 gallons, such as tank trailers. Non-bulk packages have a capacity under 119 gallons such as a metal 55 gallon drum. DOT package requirements are found in 49 CFR Parts 173, 178, and 179. DOT requires that all packages used to contain a hazardous material be a United Nations (UN) performance package. The most common package used by National Grid to contain hazardous waste are steel 55 gallon drums. These drums must be marked on the bottom as either UN 1A1 or UN 1A2 for closed head and open head drums, respectively. In addition, drums used by National Grid shall at a minimum be marked with a "Y" rating for PG II and III performance standards. However, if a PG I hazardous waste is being shipped, a UN 1A1 or 1A2 drum with an "X" rating must be used. Shippers must check Column 8 of the proper DOT description in DOT's Hazardous Material Table (49 CFR 172.101) to select a proper shipping package. For further guidance on DOT package requirements, refer to the DOT packaging regulations at 49 CFR 173. Containers that provide environmentally equivalent protection and meet DOT requirements can also be used.

For shipping state regulated hazardous wastes which are not DOT regulated hazardous materials, National Grid generators shall at a minimum use UN 1A1 or 1A2 steel drums with a "Y" rating.

3.4.4 DOT Marking Requirements

Non-bulk packagings must be marked in accordance with 49 CFR 172.301 and associated regulations. These regulations require that non-bulk packagings holding either waste or virgin hazardous materials be marked with the following information prior to being shipped:

1. Shipper's name and address;

2. Proper DOT shipping name, including technical names and hazardous substance information, if required; and,

3. DOT ID number (including the letters "UN" or "NA" as appropriate).

The information for Items 2 and 3 above can be found in 49 CFR 172.101 (Hazardous Material Tables) on Columns (2), (4) and (6).

In addition, if the material being shipped is a hazardous waste, it must be marked with all of the following additional information prior to transport:

1. The words "HAZARDOUS WASTE" - Federal law prohibits improper disposal. If found, contact the nearest police or public safety authority or contact the U.S. EPA;

2. Generator's name and address; and,

3. Manifest Tracking Number.

Labels such as those shown in Figure 3.1 may be used to comply with the marking requirements for hazardous waste.

Bulk packagings must be marked with the proper DOT ID Number (UN/NA). The DOT ID Number can be found on Column (4) in 49 CFR 172.101 (Hazardous Material Table). The identification number must be marked on the bulk packaging as follows:

1. On each side and each end, if the packaging has a capacity of ≥ 3,785 L (1,000 gallons);

2. On two opposing sides if the packaging has a capacity of less than 3,785 L (1,000 gallons).

A bulk packaging must remain marked when emptied unless it is sufficiently cleaned of residue and purged of vapors to remove any potential hazard or it has been refilled. Once refilled, it must be marked in accordance with the above requirements.

3.4.5 DOT Labeling Requirements

DOT regulations require that hazardous materials be labeled with small square-on-point (diamond-shaped) labels which warn of the hazard of the material being shipped. Labeling requirements can be found in 49 CFR 172 Subpart E. Labels are required to be provided on the following:

1. Non-bulk packagings;

2. Bulk packagings other than cargo tanks, or tank cars with volumetric capacities of less than 18 cubic meters (640 cubic feet), unless placarded in accordance with 49 CFR 172 Subpart F;

3. Portable tanks of less than 3,785 L (1,000 gallons) capacity, DOT Specification 106 or 110 multi-unit tank cars, and overpacks, freight containers or unit load devices of less than 18 cubic meters (640 cubic feet) unless placarded in accordance with 49 CFR 172 Subpart F.

Labels can only be placed on packages that contain a hazardous material exhibiting the hazard identified on the label.

To choose the correct label for a material being shipped, you must determine the correct shipping name and hazard class in accordance with the Hazardous Materials Tables. The proper label is listed in Column 6 of the Hazardous Materials Table. If more than

one label is listed, the first is called the primary label and the second is called the subsidiary label. Primary hazard labels must have the hazard class number indicated in the bottom point of the label. Subsidiary hazard labels **cannot** have the hazard class number indicated on the label.

Figure 3.1 shows examples of labels commonly used for materials carried or transported by National Grid.

3.4.6 DOT Placarding Requirements

Placards are similar to DOT labels. They are used to warn of the hazards of materials being transported. Shippers of hazardous materials are responsible for either placarding vehicles or offering the initial carrier the appropriate placards. In general, placards must be provided on each end and each side of a transport vehicle.

To determine which placard to use for a material, the appropriate DOT hazard class or division of your material must be known. It is the Shipper/Generator's responsibility to determine the proper hazard class. A Placard Table is provided in Table 3.3. Pictures of DOT Placards are provided in Figure 3.2.

Find the hazard class in the left column of Table 3.3. The appropriate placard is listed in the right column.

Placarding requirements do not apply to the following situations:

1. Non-bulk packages containing less than 1,000 pounds aggregate gross weight of hazardous materials covered by Part B of Table 3.3;

(**NOTE:** Any quantity of hazardous material identified in Part A of Table 3.3 must be placarded.)

2. Any Hazard Class 9 material being shipped domestically;

3. Combustible liquids in non-bulk packagings;

4. Infectious substances;

5. Consumer Commodities;

6. Materials authorized to be offered as limited quantities in accordance with 49 CFR 172.203;

7. Hazardous materials packaged as small quantities under 49 CFR 173.4;

8. Empty non-bulk packages containing only the residues of hazardous materials in Table 3.2;

9. Subsidiary hazards.

Placards are required when a vehicle is transporting 55-gallon drums totaling more than 1,000 pounds of hazardous materials other than exclusively Class 9 materials. In Massachusetts, flammable and combustible placards are required for all flammable and combustible materials when ≥ 21 gallons are transported. This is a requirement of the Massachusetts Fire Marshall.

DANGEROUS placards may be used for shipments containing more than one hazard class. If the shipment contains non-bulk packages of hazard classes listed in Table 5.2 and there are no more than 2205 pounds of any of the hazard classes, a DANGEROUS placard may be used instead of individual placards. If any of the above qualifications is not true, individual placards must be used.

Figure 3.2 provides sample placards for hazardous materials commonly shipped by the Company.

3.4.7 Transporting PCB Contaminated MODF and PCB Transformers

In addition to DOT requirements, PCB regulations state that each vehicle transporting PCB containers that contain more than 45 kg (approximately 13 gallons) of liquid PCBs at concentrations of 50 ppm and greater or with one or more PCB transformers (500 ppm+), must be marked with the yellow and black M_L mark. Note that the total weight of PCB contaminated liquid must be calculated (not the PCB weight only) when determining if the mark is needed.

3.4.8 Hazardous Waste Manifest

The uniform hazardous waste manifest is a document which is used to track hazardous waste shipments from the generator to the treatment, storage or disposal facility (TSDF). Small and large quantity generators are required to comply with the manifest regulations. The manifest is also the shipping paper used for hazardous waste shipments, so in addition to the hazardous waste regulations governing manifests, DOT regulations governing shipping papers also apply. These can be found in 49 CFR 172 Subpart C.

A hazardous waste manifest is required for the transport of any Company-generated hazardous wastes from a Company generator facility to a non-Company treatment, storage or disposal facility (TSDF). This requirement includes state-regulated hazardous wastes as well as EPA hazardous wastes. A manifest is also required if the waste generated is not a hazardous waste in the generator state, but is a state-regulated hazardous waste in the destination state. Generally, hazardous waste manifests are not used when shipping wastes that are not regulated as hazardous.

The following rules apply to transporting and manifesting company hazardous wastes:

1. Transportation of hazardous wastes from one company generator facility to another Company generator facility is prohibited.

2. Equipment, debris, and other materials being transported from release locations or from VSQGs may be transported without a manifest to the nearest company generator for classification as a waste or for reuse.

3. Large volumes of wastes generated from non-generator facilities as a result of planned maintenance activities shall be manifested directly to a TSDF. A temporary EPA ID Number must be obtained in Rhode Island, New York, and New Hampshire and may be obtained in Massachusetts and Vermont. In Massachusetts and Vermont, the ID Number of the nearest company facility may also be used.

4. When hazardous spill cleanup-generated wastes are transported by a spill response vendor to a TSDF from a spill response in the territory, a hazardous waste manifest is required. A temporary EPA ID Number must be obtained in Rhode Island, New York and New Hampshire and may be obtained in Vermont. In Vermont, the ID Number of the nearest company facility may also be used. In Massachusetts, the field operating company EPA ID Numbers obtained for this reason from MADEP must be used.

5. Small volumes of spill cleanup debris and soil generated by National Grid cleanup activities may be transported in National Grid vehicles without a manifest to the nearest National Grid facility possessing an EPA ID Number. In Rhode Island up to 55 gallons of PCB contaminated waste may be transported.

3.4.9 Transporting PCB Wastes

In addition to TSCA PCB requirements, PCB wastes are subject to the DOT regulations if PCBs are in high enough concentrations and quantities to be considered hazardous substances. In order to be a DOT hazardous substance, there must be at least one pound of PCBs in each container. A hazardous waste manifest must be used to track the shipment of the waste, with the appropriate DOT shipping information included on the manifest.

The formula below may be used to determine the pounds of PCBs in a waste container:

PCB conc. (ppm) x S.G. of oil x 8.34 lb/gal x volume (gal) in container/ 1,000,000 = pounds of PCBs

The PCB concentration can be determined from lab analysis or from Clor-N-Oil test kits. If a test kit is used to determine the concentration, use the upper bound of the test kit as the concentration. In other words, if the test kit shows that the concentration of PCBs is between 50 and 500 ppm, use 500 ppm in the calculation. The S.G. of oil means the specific gravity of the oil, which can be found on a material safety data sheet for the oil. The specific gravity of MODF is typically approximately 0.9.

When shipping PCB wastes utilizing an independent transporter (40 CFR 761.208(a)(3)(ii)), the generator must confirm that the waste was received by the commercial storing or disposal facility. Confirmation of waste receipt must be completed within 1 day of receiving copy 3 of the hazardous waste manifest. Documentation of this confirmation should be maintained with the copies of the hazardous waste manifest.

3.4.10 Vendor Generated Hazardous Waste

Wastes generated by vendors at company locations are subject to regulatory requirements for transporting waste.

Projects Generating Large Quantities of Waste

For large projects which will generate significant quantities of waste, contractual language should be developed which specifically addresses the responsibility for management of hazardous wastes generated during the project.

Projects Generating Small Quantities of Waste

If a National Grid facility has an EPA ID Number, the vendor must either:

- Leave the waste on-site for management by National Grid personnel, or
- Ship the waste off-site under a hazardous waste manifest. National Grid must be named as the generator, the waste must be shipped to a National Grid-approved disposal facility, and National Grid personnel must sign the manifest (1).

Note: (1) - In Massachusetts and New York, National Grid may provide written authorization to vendor personnel to sign hazardous waste manifests on behalf of National Grid. The authorized vendor must have hazardous waste training.

3.4.11 Manifest Completion Responsibility

The generator is responsible for completing the hazardous waste manifest. Because the Company is the generator of the hazardous waste covered in this manual, the manifest shall be initiated by a Designated Supervisor or authorized company agent. The Designated Supervisor or authorized company agent shall sign the manifest as generator. Personnel authorized to sign manifests must have received adequate training. National Grid Service Company personnel may sign hazardous waste manifests for the various operating companies except as noted below regarding RI.

Usually, the transport vendor will provide the manifest form and assist in its completion. At present, several company approved waste brokers provide pre-printed manifests for shipment of company wastes.

It is the responsibility of the company to ensure that the manifest is properly, completely and legibly filled out and signed by all parties including the Designated Supervisor or authorized company agent. Wastes shall not be released to the transport vendor until all signatures are completed.

In Rhode Island, a list of company employees authorized to sign hazardous waste manifests as generators must be submitted annually to the Rhode Island Department of Environmental Management. Only these people may sign manifests in Rhode Island.

In New Hampshire, the generator must initial any changes made to a hazardous waste manifest.

3.4.12 Hazardous Waste Manifest Forms

The Hazardous Waste Manifest System is a set of forms, reports, and procedures designed to seamlessly track hazardous waste from the time it leaves the generator facility where it was produced, until it reaches the off-site waste management facility that will store, treat, or dispose of the hazardous waste. The system allows the waste generator to verify that its waste has been properly delivered, and that no waste has been lost or unaccounted for in the process.

The key component of this system is the Uniform Hazardous Waste Manifest which is a form prepared by all generators who transport, or offer for transport, hazardous waste for off-site treatment, recycling, storage, or disposal. Currently, the manifest is a paper document containing multiple copies of a single form. When completed, it contains information on the type and quantity of the waste being transported, instructions for handling the waste, and signature lines for all parties involved in the disposal process. The manifest is required by both Department of Transportation and EPA. Each party that handles the waste signs the manifest and retains a copy for themselves. This ensures critical accountability in the transportation and disposal processes. Once the waste reaches its destination, the receiving facility returns a signed copy of the manifest to the generator, confirming that the waste has been received by the designated facility.

3.4.13 Hazardous Waste Manifest Preparation

An example of a uniform Hazardous Waste Manifest is presented in Figure 3.3. Additional information on the federal hazardous waste manifest system as well as instructions for completion of the manifest are located at http://www.epa.gov/epaoswer/hazwaste/gener/manifest/.

3.4.14 DOT Emergency Response Information

Generators are also subject to some additional DOT regulations that must be complied with and completed by the generator prior to shipment. Specifically, the generator must provide the following emergency response information for each waste being shipped:

1. **A 24-hour emergency response telephone number for use in an emergency involving the hazardous waste**. The telephone number must be monitored at all times when the hazardous material is being shipped, and must be entered on the shipping paper either immediately following the shipping description or on a hazardous waste manifest in Item 3. It may only be entered in a separate location if the same telephone number applies to all of the materials represented by the shipping paper and if it is indicated that the number is for emergency response. In New England, Clean Harbors and Onyx both provide 24-hour emergency response information for the hazardous wastes and universal wastes being shipped by National Grid. The number for Clean Harbors is: 1-800-645-8265. In New York, the emergency contact number is provided by CHEMTREC at 1-800-424-9300.

2. **DOT Emergency Response Guide Number.** The guide number may be included in Item 9b of the hazardous waste manifest, after the DOT shipping description, or may be included in Item 14 of the manifest.

3.4.15 Distribution of the Hazardous Waste Manifest

As the manifest is forwarded along with the waste shipment, each party (generator, transporter, and TSDF) completes its applicable section. Please refer to EG-102 for details hazardous waste manifest distribution and management.

3.4.16 Incomplete Hazardous Waste Shipments

It is the responsibility of the generator to verify that the transported wastes actually arrive at the TSDF. If the generator does not receive a manifest copy from the TSDF within 35 days of the date of shipment, the generator representative responsible for hazardous waste manifest management shall contact the Environmental Engineer who will trace the shipment. In the event that the original copy cannot be located, a faxed copy of the signed manifest from the TSDF may be utilized to confirm receipt of the waste. The Environmental Engineer will submit an exception report to the hazardous waste authority of the state in which the shipment originated if the copy (or fax) is not received from the TSDF within 45 days of the date of shipment. Exception reports shall be written in conjunction with the appropriate Environmental engineer/staff. See EP 15.

If notified of a discrepancy in a waste shipment by the transporter or TSDF, contact the Environmental Engineer. The Environmental Engineer shall consult with the appropriate Environmental engineer/staff and attempt to rectify the situation or arrange for disposal at an alternate location.

3.4.17 Hazardous Waste Shipping from a Very Small Quantity Generator (VSQG) Facility (Massachusetts)

A VSQG may transport hazardous waste in a vehicle without a hazardous waste transporters license and without a manifest under the conditions listed below:

- The waste is generated by the VSQG or collected from another company VSQG;
- The waste is transported to another company SQG or LQG. New York must ship wastes generated by a CESQG to a TSDF;
- The weight of the waste does not exceed, in aggregate, more than 200 kg;
- The containers are tightly sealed and secured to the vehicle and properly labeled;
- The generator's DEP registration is located in the vehicle and easily accessible;
- Spills from the vehicle are reported to the local fire and police departments, the DEP, and NRC; and,
- A receipt for the waste is provided from facility accepting the waste with copy retained by the person delivering the waste and the person receiving the waste. The receipts must be maintained for three years.

3.4.18 National Grid Hazardous Waste Profiles

Most waste profiles for hazardous wastes shipped by National Grid are listed on the Environmental Department's web page on the company's Infonet. Please refer to this web site for an up-to-date listing of waste profiles.

3.5 Land Disposal Restrictions

40 CFR Part 268 identifies hazardous wastes that are restricted from land disposal and the treatment standards that will allow land disposal. It is important to note that the Land Disposal Restrictions (LDR) regulations apply to hazardous wastes being incinerated or otherwise treated, not just to hazardous wastes initially being land disposed. This is because the ash or sludge generated by the destruction or treatment of restricted wastes may ultimately be land disposed and still carries the restricted hazardous waste code designation.

The D.C. Court of Appeals in the case Association of Battery Recyclers, Inc. et. al. v. U.S. Environmental Protection Agency (decided August 21, 2000) vacated the use of the Toxicity Characteristic Leaching Procedure (TCLP) for evaluating whether manufactured gas plant (MGP) wastes (MGP-contaminated soil) are a hazardous waste. However, individual states may regulate MGP wastes that fail TCLP.

In New York, DEC allows a conditional exemption for MGP coal tar waste, soils and sediments exceeding TCLP for benzene (D018) destined for permanent thermal treatment.

Purifier waste containing greater than 3.5 percent sulfur by weight is excluded. The DEC Policy is stated in TAGM-4061.

In Massachusetts, the DEP Bureau of Waste Prevention has reviewed the court decision and concluded that the decision does not impact the regulation of MGP waste in Massachusetts under the Massachusetts Hazardous Waste Regulations, 310 CMR 30.000. Therefore, MGP remediation wastes generated at 21E sites that exhibit the toxicity characteristic when transported from a disposal site must be managed in Massachusetts as a hazardous waste, including the use of a hazardous waste transporter, hazardous waste manifest, and the applicable hazardous waste code. However, such wastes may be shipped to a non-hazardous waste facility in another state, provided that the receiving facility is legally authorized to accept MGP remediation wastes and complies with the requirements of the receiving state. In addition, the remediation wastes must comply with the management requirements for remediation waste under the MCP, including the transport of the waste to the receiving state on a hazardous waste manifest.

In Rhode Island, the DEM has indicated that the EPA decision does not impact the regulation of MGP waste in Rhode Island under DEM's "Rules and Regulation for Hazardous Waste Management" (Hazardous Waste Regulations), Regulation #DEM OWM-HW01-07. As such, MGP remediation wastes generated at a site which fail TCLP testing must be managed when transported from a disposal site as a Rhode Island hazardous waste, including the use of a hazardous waste transporter, hazardous waste manifest, and the applicable Rhode Island hazardous waste code. Additionally, MGP wastes which fail TCLP testing cannot be disposed of at an instate facility as the receiving requirements of such facilities are governed by DEM Hazardous Waste Regulations. However, similar to Massachusetts, such wastes may be shipped to a non-hazardous waste facility in another state, provided that the receiving facility is legally authorized to accept MGP remediation wastes and complies with the requirements of the receiving state.

As of this date, only a one-time notification is required. The one-time notification would apply to shipments of all restricted hazardous waste, and so would include lab packs. No new notification would be required unless there was a change in the waste, process, or receiving facility.

This chapter will provide general guidance on complying with these regulations. Contact the Environmental department for details or with questions.

3.5.1 Applicability of LDR

State regulated (non-RCRA) wastes are not subject to the LDR regulations nor are wastes generated by RCRA very small quantity generators. Newly identified wastes for which EPA has not promulgated land disposal restriction or treatment standards are also not subject to LDR. Lastly, de minimus losses of characteristic wastes to wastewaters are not prohibited wastes. See §268.41 for additional details on the applicability of the LDR.

New York State: PCB wastes are subject to LDR. [Ref. 6 NYCRR Part 376]

3.5.2 Generator Requirements

Generators of hazardous waste are required to determine if their wastes are subject to the land disposal restrictions. Restricted wastes cannot be land disposed unless all concentration limits are met or the specified treatment has been conducted.

Step 1: Determine all the applicable waste codes for a specific waste stream. This determination can be made in either of two ways: testing the waste or using knowledge of the waste. If the waste displays a hazardous characteristic of ignitability, corrosivity, reactivity or toxicity, comply with the special requirements of 40 CFR §268.9, in addition to any other applicable requirements.

Step 2: Determine whether the waste is a wastewater or non-wastewater. This is called the treatability group. Wastewaters are wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS), with some exceptions. All other wastes are non-wastewaters. Most hazardous wastes will be non-wastewaters.

Step 3: Determine if the hazardous waste meets the treatment standards listed in 40 CFR §268.40 (treatment standards for hazardous waste or hazardous soil), §268.45 (alternative treatment standards for hazardous debris), and §268.48 (universal treatment standards). Standards are listed as total concentration, concentration of hazardous constituents in an extract of the waste, or waste treatment technologies. Technology treatment standards found in §268.40 are described in detail in Table 1 of §268.42. All hazardous constituents in the waste or in the waste residue must be at or below the values found in the tables for that waste.

3.5.3 Notification Requirements

The requirements for notices vary and are found at 40 CFR §268.7. The Company's licensed hazardous waste transporter/disposal vendors provide fill-in-the-blank notifications for use when shipping restricted wastes. Other facilities may also provide notifications which can be used if the notifications provide all the required information.

There are no specific or standard forms identified in the regulations. It is the generator's responsibility to prepare the forms and to ensure that the forms comply with the regulations.

There are four types of notices as described below:

- Notices for restricted wastes not meeting the treatment standards (these cannot be land disposed prior to treatment);

- Notices for restricted wastes meeting the treatment standards at the original point of generation (these can be land disposed without further treatment);

- Notices for wastes subject to exemptions from the requirement that hazardous wastes meet treatment standards before they can be land disposed, such as MGP wastes under certain circumstances. This also includes, but is not limited to, case-by-case extensions under §268.5, disposal in a no migration unit under §268.6, or a national capacity variance or case-by-case capacity variance under Subpart C of §268; and,

- Notices if a generator is managing a lab pack containing hazardous wastes and wishes to use the alternative treatment standard for lab packs found at §268.42(c).

The majority of National Grid RCRA wastes do not meet the land disposal restriction treatment standards and, therefore, cannot be land disposed without prior treatment. The notification requirements for several types of wastes are summarized below. Refer to §268.7 for notification requirements for other types of wastes and for specific details. It is important to remember that for characteristic wastes, the notification must include all underlying hazardous constituents that exceed their respective Universal Treatment Standards.

3.5.4 Waste Not Meeting Treatment Standards

If the waste or contaminated soil does not meet the treatment standard, the generator must send a one-time written notice, with the initial shipment of waste, to each treatment or storage facility receiving the waste, and place a copy in the file. The notice must include the information in column §268.7(a)(2) of the Generator Paperwork Requirements Table, provided as Table 3.4. No further notification is necessary until such time that the waste or facility changes, in which case a new notification must be sent and a copy placed in the generator's file.

3.5.5 Waste Meeting Treatment Standards

If the waste or contaminated soil does meet the treatment standard, the generator must send a one-time written notice, with the initial shipment of waste, to each treatment or storage facility receiving the waste, and place a copy in the file. The notice must include the information in column §268.7(a)(3) of the Generator Paperwork Requirements Table, provided as Table 3.4, and the following certification statement, signed by an authorized representative:

> *I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Subpart D. I believe that the information I submit is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.*

If the waste changes, the generator must send a new notice and certification to the receiving facility, and place a copy in their file.

3.5.6 Waste Exempt from Treatment Standards

The notice for waste that is exempt from LDR must include the information in column §268.7(a)(4) of the Generator Paperwork Requirements Table, provided as Table 3.4. If the waste changes, the generator must send a new notice and certification to the receiving facility, and place a copy in their file.

3.5.7 Lab Packs

The notice required when a generator is managing a lab pack containing hazardous wastes and wishes to use the alternative treatment standard for lab packs found at §268.42(c), must include the information in column §268.7(a)(9) of the Generator Paperwork Requirements Table, provided as Table 3.4, and the following certification statement, signed by an authorized representative:

> *I certify under penalty of law that I personally have examined and am familiar with the waste and that the lab pack contains only wastes that have not been excluded under appendix IV to 40 CFR 268 and that this lab pack will be sent to a combustion facility in compliance with the alternative treatment standards for lab packs at 40 CFR 268.42(c). I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.*

If the lab pack contains characteristic hazardous wastes, the underlying hazardous constituents need not be identified.

This option is available to generators when the small containers of hazardous wastes in over packed drums (lab pack) are packaged as specified in 40 CFR §264.316 and §265.316, or if the lab pack does not contain any of the wastes listed in Appendix IV of §268 (includes D009, mercury), or if the lab packs are incinerated in accordance with the requirements for hazardous waste incinerators and certain incinerator residues are treated in compliance with the treatment standards specified for such wastes. Refer to §268.42(c) for the specific details.

3.5.8 On-site Treatment of Restricted Wastes in Tanks, Containers, or Containment Buildings

These activities are not normally conducted by National Grid generators. All activities which may involve treatment of hazardous waste must be reviewed with the Environmental department prior to initiating these activities.

3.5.9 Restricted Waste Exempt from Subtitle C

There are additional record keeping requirements for hazardous waste generators that treat waste on-site in systems that are excluded from subtitle C regulations, such as wastewater treatment systems subject to the Clean Water Act (CWA). These activities are not normally conducted by National Grid generators. All activities which may involve treatment of hazardous waste must be reviewed with the Environmental department prior to initiating these activities.

3.5.10 Special Requirements for Characteristic Wastes

Special rules regarding waste that exhibit a characteristic are found at 40 CFR §268.9. There are special requirements for listed hazardous wastes that also exhibit a hazardous characteristic. In most cases, the treatment standard for the listed waste operates in lieu of the treatment standard for the characteristic waste, provided the treatment standard for the listed waste includes a treatment standard for the constituent that causes the waste to exhibit the characteristic. Otherwise, the waste must meet the treatment standards for all applicable listed and characteristic waste codes.

For wastes that have been decharacterized, the generator must complete a one-time notice and certification which must be placed in the generator's or treater's file and sent to the EPA Region.

3.5.11 Records Requirements

Generators must retain a copy of all notices, certifications, waste analysis data, and other documentation produced pursuant to 40 CFR §268 for at least three years from the date the waste that is the subject of such documentation was last sent to the on-site or off-site treatment, storage or disposal facility.

3.6 Hazardous Waste Disposal

3.6.1 Importance of Ensuring Proper Disposal of Wastes

It is extremely important that hazardous wastes are disposed of in full compliance with federal and state laws and regulations. Failure to comply with these laws and regulations can result in improper disposal of hazardous wastes.

3.6.2 Treatment of Hazardous Waste

Generators are only allowed to treat hazardous waste on-site under specific conditions such as the case for VSQG's in Massachusetts. All treatment not performed in accordance with regulations is considered to be improper disposal of a hazardous waste. An example of allowable treatment is treatment of wastewater in a wastewater treatment unit provided the activity complies with all applicable permits and requirements.

Under federal regulations, characteristic wastes may be treated in 90-day tanks, containers, or containment buildings covered by 40 CFR Section 262.34(a), without a permit. If the waste thereafter no longer exhibits a hazardous characteristic, any further management of the waste is no longer subject to Subtitle C of RCRA. However, unless

the waste was decharacterized within an agency-approved Area of Contamination, LDRs will still apply.

The following activities are generally not considered "treatment":

- Neutralization of caustic or corrosive wastes that are hazardous due to characteristic only;
- Gravity separation of oil from water, that is not a hazardous waste, including the addition of acid or base to bring about a better separation of an oil/water emulsion;
- Filtering of solids from an oily sludge or other non-hazardous component of an oil mixture; and,
- Addition of an absorbent (e.g., sawdust, speedi-dry, $CaCO_3$) in which a chemical reaction does not occur and the use of a gelation process or similar technique in which a chemical reaction does not occur, if such processes are done at the site of generation and are done solely for the purpose of making the waste more amenable to disposal at a hazardous waste facility.

A generator may think they are minimizing hazardous waste, but may actually be treating the waste. For example, although evaporation may minimize the amount of hazardous waste a generator is shipping off-site, it is actually considered to be treatment of a hazardous waste and would be improper disposal.

3.6.3 Approved Hazardous Waste Disposal Facilities

Hazardous wastes generated by the National Grid shall be disposed of at disposal facilities which have been approved by the National Grid Waste Disposal Vendor Advisory Group. A list of Company-approved disposal facilities is shown on the Environmental Department's Web site on the Company's Infonet.

3.6.4 Disposal of PCB Wastes

PCB wastes are regulated for disposal by the EPA through the TSCA Regulations. The TSCA regulations require PCBs to be disposed of only at chemical waste landfills (solids) and incinerators (solids and liquids) permitted by EPA for the disposal of PCBs.

3.6.5 Disposal of On-Site Vendor Generated Wastes

Vendor-generated wastes may be managed in various manners depending upon the classification of the facility and the quantity of wastes being generated. In all cases, the following conditions apply:

- The vendor shall provide to the Environmental Engineer a list of the anticipated chemicals to be used during the project. The vendor is responsible for providing MSDSs for each chemical product to be used on site.

- All wastes generated by a vendor at a company site shall be owned, managed and disposed by the vendor.

- All unused chemicals (non-waste) and/or products originally brought to the company location by the outside vendor will remain the responsibility of the vendor and be removed by the vendor from the company location at the conclusion of the vendor's on-site activities.

- All wastes must be disposed of at a National Grid approved hazardous waste disposal facility. Refer to the Environmental Department's web site on the company's Infonet for a listing of approved disposal facilities.

3.6.6 Recycling of Scrap Metal

Because of the potential for National Grid scrap metal to contain oils, PCBs or lead, the company has developed a list of vendors approved to recycle National Grid scrap metal. Refer to the Environmental Department's web site on the company's Infonet for a listing of approved scrap metal facilities.

All junk oil-filled electrical equipment shall be disposed or recycled at a National Grid approved hazardous waste disposal facility. Oil-filled equipment shall not be sent to scrap metal recyclers, even if the equipment has been drained.

In an effort to limit potential liability associated with the unrestricted shipment and ultimate processing of lead-sheathed copper cable, only those facilities indicated as approved for lead cable may receive National Grid non-PCB lead cable.

Table 3.1: Generator Classification Criteria

Large Quantity Generator[1]					
Criteria	**MA[1]**	**NH[2]**	**VT[3]**	**RI[4]**	**NY[5]**
Generate Hazardous Waste Per Month	>1000 kg	≥100 kg	≥1000 kg	>1000 kg	>1000 kg
Generate Acute Hazardous Waste Per Month	>1 kg	≥1 kg	≥1 kg	>1 kg	>1 kg
Generate Residue from Cleanup of Acutely Hazardous Waste Spill	>100 kg	≥100 kg	≥100 kg	>100 kg	N/A
Accumulate Hazardous Waste	>2000 kg in containers >6000 kg in tanks >6000 kg total	≥1000 kg	≥6000 kg	>6000 kg	>6000 kg
Accumulate Acute Hazardous Waste	>1 kg	≥1 kg	≥1 kg	>1 kg	>1 kg
Accumulate Residue from Cleanup of Acutely Hazardous Waste Spill	N/A	≥100 kg	≥100 kg	N/A	N/A

Small Quantity Generator				
Criteria	**MA[1]**	**NH[2]**	**VT[3]**	**NY[5]**
Generate Hazardous Waste Per Month	<1000 kg	<100 kg	100 - 999 kg	>100 - <1000 kg
Generate Acute Hazardous Waste Per Month	<1 kg	<1 kg	<1 kg	<1 kg
Generate Residue from Cleanup of Acutely Hazardous Waste Spill	<100 kg	<100 kg	<100 kg	N/A
Accumulate Hazardous Waste	<2000 kg in containers <6000 kg in tanks <6000 kg total	<100 kg (if >1000 kg)	< 6000 kg	< 6000 kg
Accumulate Acute Hazardous Waste	<1 kg	<1 kg	<1 kg	<1 kg
Accumulate Residue from Cleanup of Acutely Hazardous Waste Spill	<100 kg	<100 kg	<100 kg	N/A

Table 3.1 (continued): Generator Classification Criteria

Very Small Quantity Generator			
Criteria	**MA[1]**	**VT[3]**	**NY[5]**
Generate Hazardous Waste Per Month	<100 kg	<100 kg	<100 kg
Generate Acute Hazardous Waste Per Month	0 kg	<1 kg	<1 kg
Generate Residue from Cleanup of Acutely Hazardous Waste Spill	0 kg	<100 kg	<100 kg
Accumulate Hazardous Waste	<600 kg	<1000 kg	<1000 kg
Accumulate Acute Hazardous Waste	0 kg	<1 kg	<1 kg
Accumulate Residue from Cleanup of Acutely Hazardous Waste Spill	NA	<100 kg	<100 kg

1. Massachusetts
   - Generators in Massachusetts may maintain dual status: one for waste oil and PCBs and another for RCRA hazardous waste. The advantage of maintaining dual status is that waste oil generators are subject to fewer regulations than RCRA hazardous waste generators. When determining a facility's MA generator status, the total amount of the following waste must be calculated: Waste Oil and Debris (MA01), PCB Waste Oil and Debris (MA02), Paint-Related Waste (MA04), Specification Used Oil Fuel (MA97), and Off Specification Used Oil Fuel (MA98) Waste.
   - MA VSQGs may self-transport limited quantities of waste without a license to a Company LQG/SQG.
   - MA VSQGs may treat hazardous waste or recycle regulated recyclable materials without a permit provided:
     - Only its own wastes are treated;
     - Treatment occurs at the site of generation;
     - Waste is treated only to render it less hazardous or nonhazardous;
     - Compliance with VSQG limits is always maintained.
   - MA SQGs that generate ≥ 1,000 kg of hazardous waste in a month are required to notify MADEP immediately after the one-time exceedance occurs. If possible, notify MADEP prior to generation of waste, such as for a planned clean-out. The facility is then required to have the large volume of waste removed as soon as possible, and no later than 90 days from the date of generation. Additionally, a biennial report must be prepared for the year that exceedance occurred.
2. New Hampshire
   - Used oil which is to be recycled by being burned for energy recovery or re-refinement does not need to be included when adding up the amount of waste generated on site.
   - NH SQGs may self-transport no greater than 20 gallons of nonacutely hazardous waste to an authorized facility. See Env-Wm 508.02 for additional details.
   - In New Hampshire, a large quantity generator is called a full quantity generator

- NH SQGs that generate ≥ 100 kg of hazardous waste in a month are required to notify NHDES immediately after the one-time exceedance occurs. If possible, notify NHDES prior to generation of waste, such as for a planned clean-out. The facility is then required to have the large volume of waste removed as soon as possible, and no later than 90 days from the date of generation. Additionally, a biennial report must be prepared for the year that exceedance occurred.

3. Vermont
   - In Vermont, a large quantity generator is called a Generator and a VSQG is called a Conditionally Exempt Generator.
   - Used oil recycled for energy recovery or re-refining does not need to be included when totaling the amount of waste generated or accumulated on site.
4. Rhode Island
   - All generators are regulated as LQGs with regard to the applicability of most parts of the state hazardous waste regulations (such as the need for a contingency plan and storage time limits). However, other requirements of the regulations (such as the need for a biennial report), as well as the potential for regulatory inspections, are based on actual generator status. RI SQGs that generate ≥ 1,000 kg of hazardous waste in a month are required to notify RI DEM immediately after the one-time exceedance occurs. If possible, notify RI DEM prior to generation of waste, such as for a planned clean-out. Additionally, a biennial report must be prepared for the year that exceedance occurred.
5. New York
   - In New York, a VSQG is called a Conditionally Exempt Small Quantity Generator.

Table 3.2: DOT Hazard Classes

Class No.	Division No. (If Any)	Name of Class or Division	49 CFR Reference for Definitions
None		Forbidden Materials	173.21
None		Forbidden Explosives	173.54
1	1.1	Explosives (with a mass explosion hazard)	173.50
1	1.2	Explosives (with a projection hazard)	173.50
1	1.3	Explosives (with predominately a fire hazard)	173.50
1	1.4	Explosives (with no significant blast hazard)	173.50
1	1.5	Very insensitive explosives; blasting agents	173.50
1	1.6	Extremely insensitive detonating substances	173.50
2	2.1	Flammable gas	173.115
2	2.2	Non-flammable compressed gas	173.115
2	2.3	Poisonous gas	173.115
3		Flammable and combustible liquid	173.120
4	4.1	Flammable solid	173.124
4	4.2	Spontaneously combustible material	173.124
4	4.3	Dangerous when wet material	173.124
5	5.1	Oxidizer	173.127
5	5.2	Organic peroxide	173.128
6	6.1	Poisonous materials	173.132
6	6.2	Infectious substance (etiologic agent)	173.134
7		Radioactive material	173.403
8		Corrosive material	173.136
9		Miscellaneous hazardous material	173.140
None		Other regulated materials: ORM-D	173.144

Table 3.3: DOT Placard Tables

Vehicles carrying hazardous materials must display warning placards identifying the hazard class of the contents. Vehicles carrying any amount of hazard-class material shown in Part A must always display the specific placard. Vehicles carrying more than 1,000 lbs. of hazard-class materials shown in Part B must display appropriate placards.

Part A		
Category of Material (Hazard Class or Division Number and Additional Description, as Appropriate)	**Placard Name**	**49 CFR Placard Design Section Reference**
1.1	Explosives 1.1	172.522
1.2	Explosives 1.2	172.522
1.3	Explosives 1.3	172.522
2.3	Poison Gas	172.540
4.3	Dangerous when wet	172.548
6.1 (PG I, inhalation hazard)	Poison	172.554
7 (Radioactive Yellow III label only)	Radioactive 1	172.556
Part B		
Category of Material (Hazard Class or Division Number and Additional Description, as Appropriate)	**Placard Name**	**49 CFR Placard Design Section Reference**
1.4	Explosives 1.4	172.523
1.5	Explosives 1.5	172.524
1.6	Explosives 1.6	172.525
2.1	Flammable Gas	172.532
2.2	Nonflammable Gas	172.528
3	Flammable	172.542
Combustible liquid	Combustible	172.544
4.1	Flammable Solid	172.546
4.2	Spontaneously Combustible	172.547
5.1	Oxidizer	172.550
5.2	Organic Peroxide	172.552
6.1 (PG I or II, other than PG I inhalation hazard)	Poison	172.554
6.1 (PG III)	Keep Away From Food	172.553
6.2	(None)	
8	Corrosive	172.558
9	Class 9	172.560
ORM-D	(None)	

Table 3.4: Generator Paperwork Requirements Table

Required Information	§268.7 (a)(2)	§268.7 (a)(3)	§268.7 (a)(4)	§268.7 (a)(9)
1. EPA Hazardous Waste and Manifest numbers	✓	✓	✓	✓
2. Statement that this waste is not prohibited from land disposal.			✓	
3. The waste is subject to the LDRs. The constituents of concern for F001-F005, and F039, and underlying hazardous constituents (for wastes that are not managed in a Clean Water Act (CWA) or CWA-equivalent facility), unless the waste will be treated and monitored for all constituents. If all constituents will be treated and monitored, there is no need to put them all on the LDR notice.	✓	✓		
4. The notice must include the applicable wastewater/ non-wastewater category (see §268.2(d) and (f)) and subdivisions made within a waste code based on waste-specific criteria (such as D003 *reactive* cyanide).	✓	✓		
5. Waste analysis data (when available).	✓	✓	✓	
6. Date the waste is subject to the prohibition.			✓	
7. For hazardous debris, when treating with the alternative treatment technologies provided by §268.45: the contaminants subject to treatment, as described in §268.45(b); and an indication that these contaminants are being treated to comply with §268.45.	✓		✓	
8. For contaminated soil subject to LDRs as provided in §268.49(a), the constituents subject to treatment as described in §268.49(d), and the following statement: This contaminated soil [does/does not] contain listed hazardous waste and [does/does not] exhibit a characteristics of hazardous waste and [is subject to/complies with] the soil treatment standards as provided by §268.49(c) or the universal treatment standards.	✓	✓		
9. A certification is needed (see applicable section for exact wording).		✓		✓

Figure 3.1: DOT Labels

By means of their color, shape and design, DOT Hazard Class labels communicate the hazards of the material contained in the package. The label needed for each hazardous material is described in Column 6 of the DOT Table. A separate label exists for each of nine classes of hazardous material (some with subdivisions).

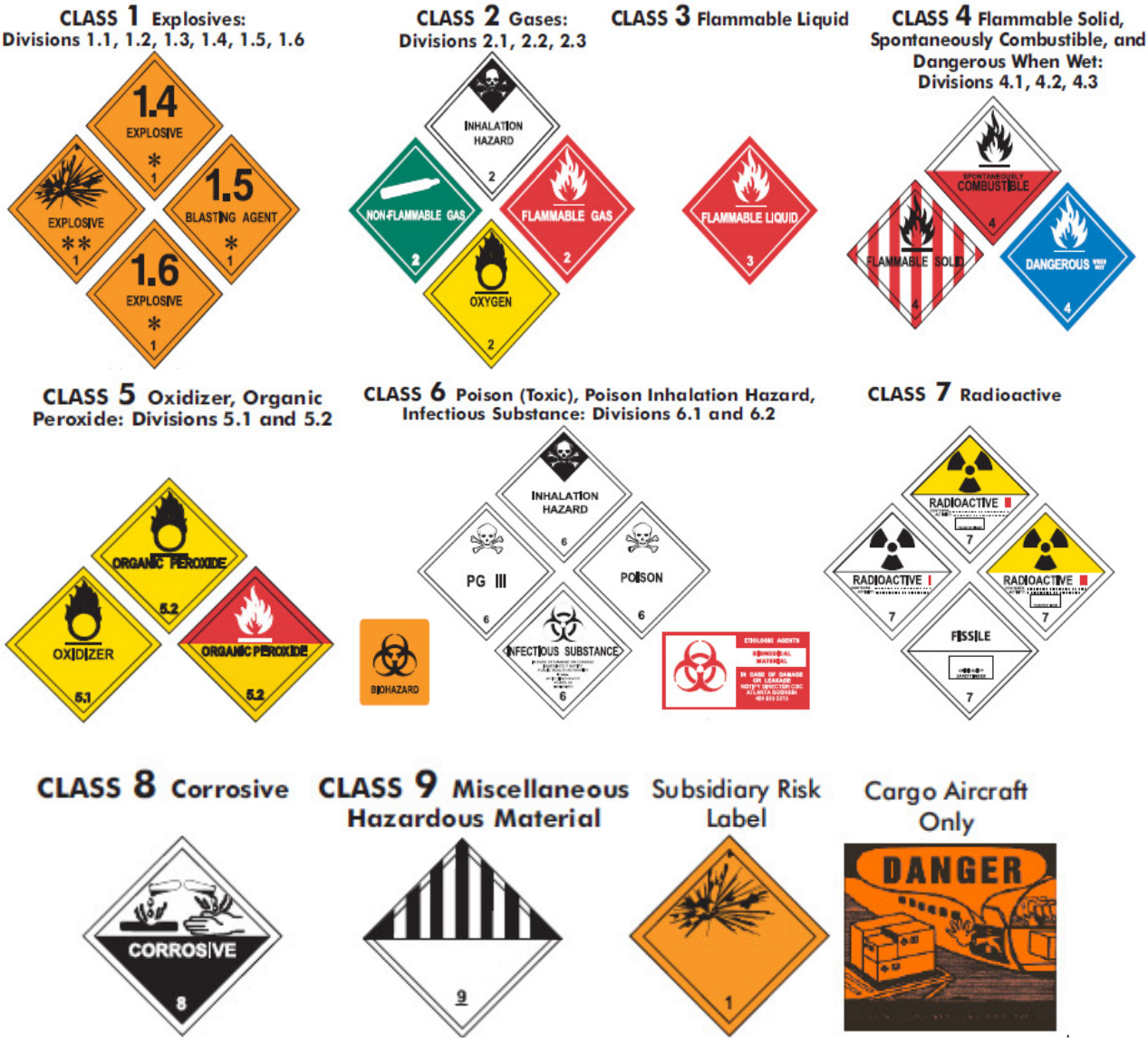


Figure 3.2: DOT Placards

Placards are designed for display on the outside of vehicles and are intended to provide emergency responders with warnings of the risks associated with vehicle contents. Placards may not be required for small quantities of hazardous materials.

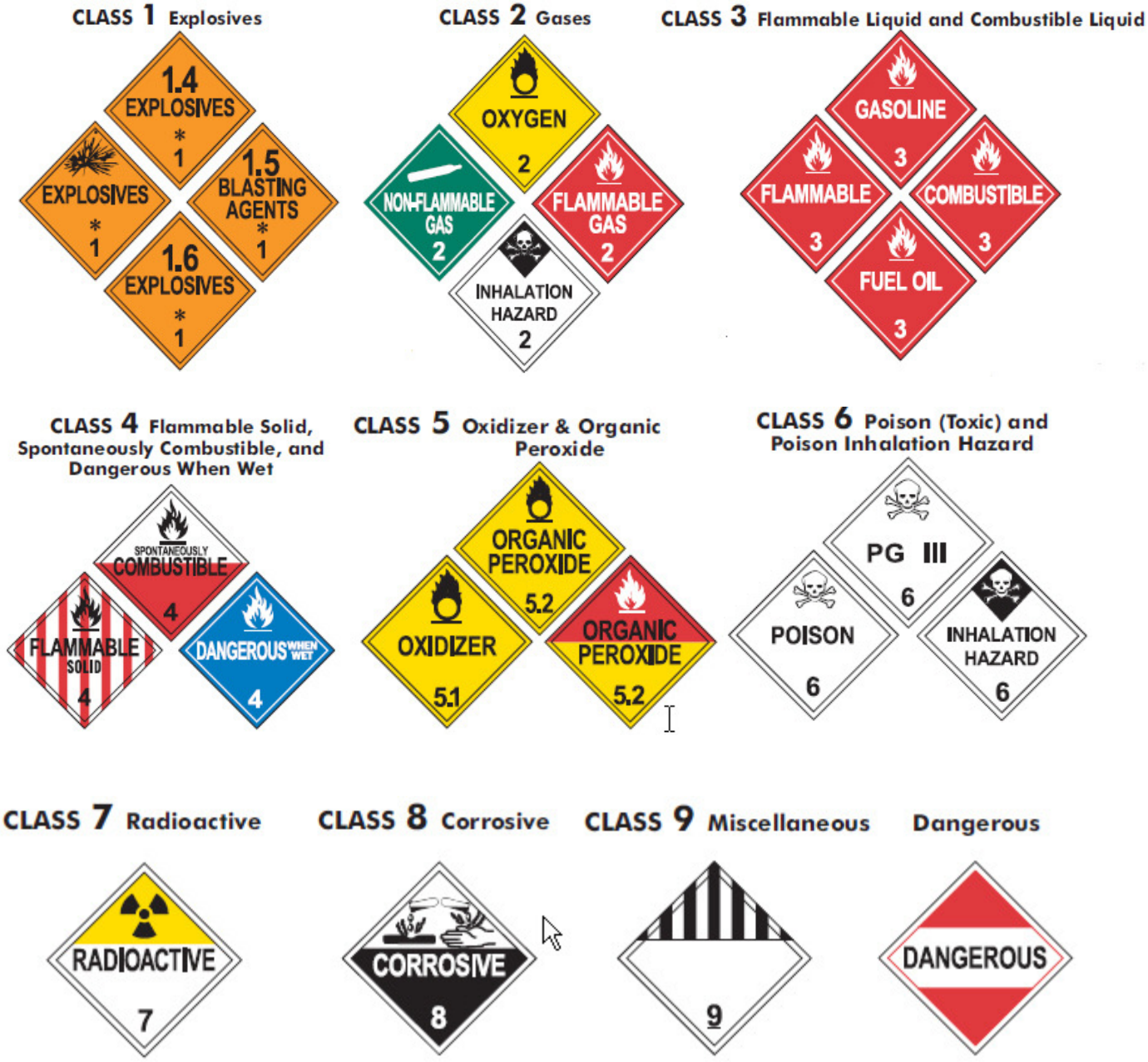
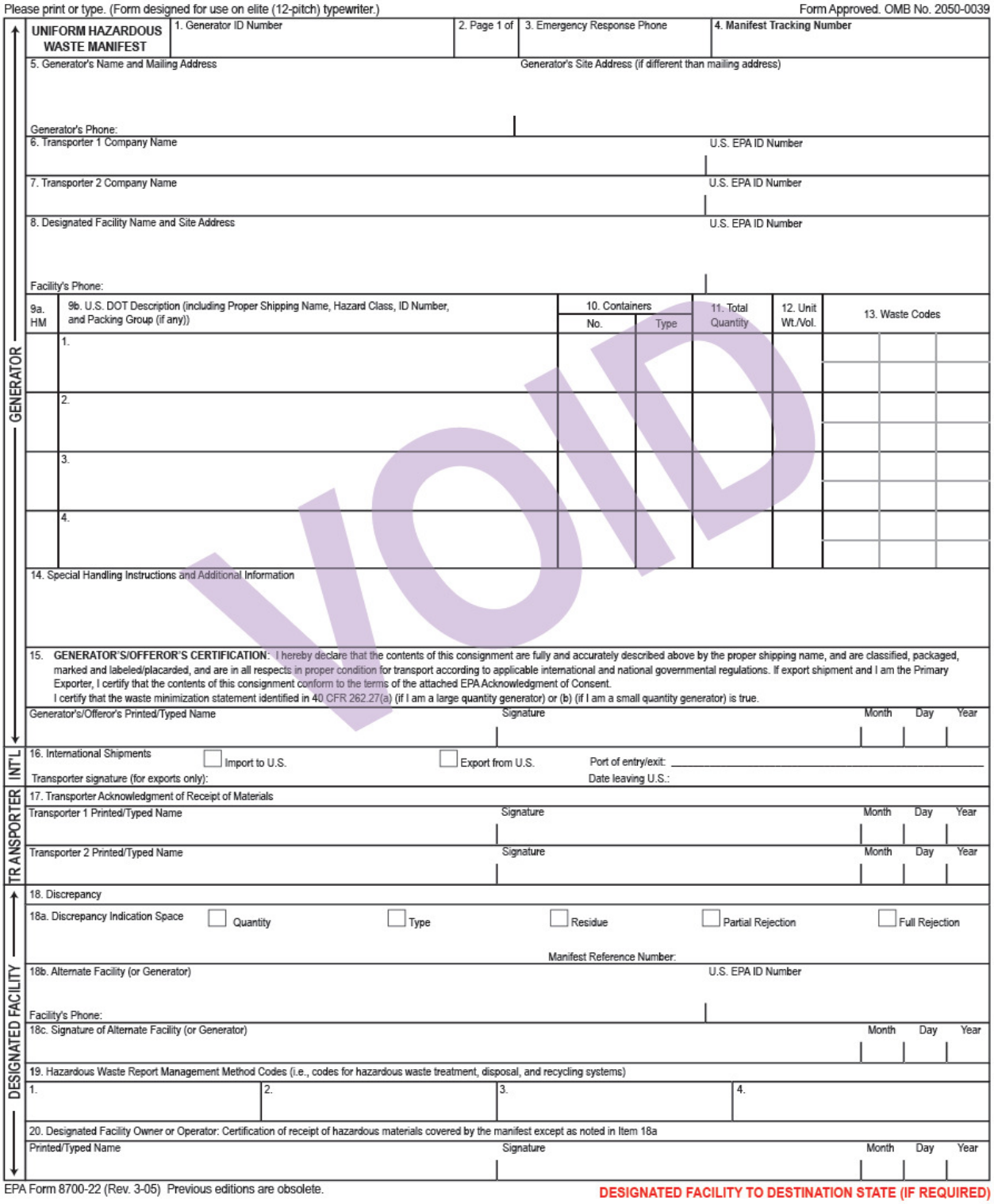


Figure 3.3: Uniform Hazardous Waste Manifest Example



Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number | 2. Page 1 of | 3. Emergency Response Phone | 4. Manifest Tracking Number

GENERATOR

5. Generator's Name and Mailing Address — Generator's Site Address (if different than mailing address)

Generator's Phone:

6. Transporter 1 Company Name — U.S. EPA ID Number

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number

Facility's Phone:

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1.					
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name — Signature — Month Day Year

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit: _____

Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name — Signature — Month Day Year

Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1. | 2. | 3. | 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name — Signature — Month Day Year

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

VOID

Figure 3.4: TSCA Manifest Continuation Form Example

Figure 5.4: TSCA Manifest Continuation Form Example

TSCA MANIFEST CONTINUATION FORM EXAMPLE

MANIFEST NUMBER: _____ GENERATOR NAME: _____

ADDRESS: _____

_____

EPA ID NUMBER: _____

ITEM	NUMBER	Type/ Description	Serial No. or Other ID No.	Date of Removal From Service For Disposal	Volume (gallons) or Weight (kilograms)

Information Purposes

NOTES

1. **Type/Description:** Brief description of the unit such as:
   (i) **Transformer** (> 500 ppm or < 500 ppm) **(ii) Capacitor** **(iii) Bulk Liquid/Solid** (tanker or roll-off)
   (iv) **PCB Container** - A container in direct contact w/ PCBs, such as a drum containing PCB spill debris
   (v) **PCB Article Container** - A container not in direct contact w/ PCBs, such as a drum containing one or more non-leaking motors, light ballasts, etc.
2. **Serial No. or Other ID No.:** Serial Number must be reported if one is present; if not, assign a unique number.
3. **Date Removed From Service For Disposal:** The date when the item was taken out of service for disposal. If more than one item (batch) is present in the container (tank), the reported date for the entire container (tank) must be the first (i.e., the earliest) date.

4.0 PCB WASTE MANAGEMENT

The following chapter outlines requirements for the management of waste PCB electrical equipment, MODF, and PCB waste. Please refer to EP No. 14 for information on the management of oil-filled equipment and waste oil.

The use, storage and disposal of PCB items is regulated by 40 CFR 761 -- Polychlorinated Biphenyls (PCBs), Manufacturing, Processing, Distribution in Commerce and Use Prohibitions which is administered by the Federal Environmental Protection Agency (EPA). In New York, Rhode Island, Massachusetts and Vermont, PCBs are also regulated as hazardous waste by state regulations.

EPA regulations allow for assumptions to be made regarding the PCB concentration in unlabeled oil-filled electrical equipment which is in use. However, testing for PCBs through laboratory analysis must be performed when classifying equipment or other materials for disposal. If the equipment does not have a manufacturer's label stating that the equipment is non-PCB, laboratory analysis must be performed prior to placing the equipment into storage for re-use. The analysis must be conducted by a certified laboratory using an EPA-approved method (gas chromatography). Screening kits may not be used for the determination of PCB content for disposal purposes.

Generally, wastes must be managed as a PCB hazardous waste if the PCB concentration $\geq$ 50 ppm. However, if utilizing the PCB Spill Cleanup Policy, it is important to note that spill cleanup wastes must be shipped as a PCB waste regardless of their actual PCB concentrations.

PCB-Contaminated fluid-filled electrical equipment, MODF and other wastes designated for disposal may only be accumulated as hazardous waste at a generator site in a main hazardous waste accumulation area for up to 30 days from the date the equipment was declared a waste. If drained, equipment may be accumulated without restriction. However, PCB-contaminated fluid-filled electrical equipment may be stored up to 90 days if stored in an area that complies with 40 CFR 761.65. Only Dewey Ave., Seventh North and North Albany Service Centers have such facilities.

> *Please note that the date the equipment was removed from service for disposal is the date the equipment was declared to be waste. This date may be different than the date the equipment was removed from use in the field.*

PCB fluid-filled electrical equipment designated for disposal may be accumulated as PCB hazardous waste at a generator site for up to 30 days from the date the equipment was removed from service for disposal. If drained, the empty carcass **and** MODF must be accumulated as a PCB hazardous waste at the generator site for up to 30 days of the date the equipment was declared a waste.

In order to demonstrate compliance with 40 CFR 761.215(d)(2) and 761.218, a Certificate of Disposal must be obtained for each PCB article shipped for disposal. Waste tracking reports are not an acceptable substitute. "Certificates of Disposal must be received from the disposal facility within 1 year of the date of shipment for disposal." Wastes not disposed of within 1 year of their "Out-of-Service" date must be included on an Exception Report.

5.0 UNIVERSAL WASTE & LIGHTING WASTE

This chapter details the National Grid management of universal wastes, including lighting waste. Section 5.1 of the chapter discusses the management of the various types of lighting wastes. Some types of lighting wastes may be managed as universal wastes if the generator so chooses and other types must be managed as hazardous waste, depending on the waste type and the generator state. Section 5.2 details the management of waste batteries. Section 5.3 details the management of mercury. Section 5.4 details the federal universal waste rule. Sections 5.5, 5.6, 5.7, 5.9 and 5.10 detail general universal waste rules applicable to all National Grid facilities, Massachusetts universal waste standards, New Hampshire universal waste program, and New York universal waste rule, respectively. As detailed in Section 5.8, Vermont has adopted the universal waste program for certain batteries, pesticides, thermostats, fluorescent light ballasts and mercury-containing lamps which would otherwise have to be managed as hazardous waste.

5.1 Management of Lighting Wastes

National Grid lighting wastes include a variety of items associated with indoor and outdoor lighting such as streetlights, floodlights, incandescent, vehicle and fluorescent lights. Streetlights and floodlights contain mercury vapor or sodium vapor High Intensity Discharge (HID) lamps, both of which contain quantities of mercury. Depending on the type and wattage of the light, it may contain ballasts and/or capacitors. In Massachusetts, New York, Rhode Island and New Hampshire, waste lamps are covered under the state Universal Waste programs. Refer to Table 5.1, 'Lighting Types and Wastes Generated from Each Lighting Type', for a summary of the various components of lights utilized by National Grid. Refer to Table 5.2, National Grid Management of Spent Lighting Materials, for state-specific information regarding the accumulation, storage, labeling, and shipping of lighting wastes. Refer to Chapter 1 for procedures to arrange for pickup of waste.

5.1.1 HID/Fluorescent Lamps: In order to minimize the quantities of hazardous waste lamps sent to non-hazardous waste landfills, EPA added hazardous waste lamps to the federal Universal Waste program, which is further discussed in Sections 5.4 and 5.5. The final rule was promulgated on July 6, 1999. This addition streamlines the management requirements for hazardous waste lamps, and supports energy and conservation efforts. Many states, including Massachusetts, Rhode Island and New Hampshire, had previously regulated hazardous waste lamps as universal wastes under their state-authorized hazardous waste programs.

5.1.2 Streetlight Capacitors: Intact PCB and non-PCB streetlight capacitors are removed from streetlight heads prior to sending the heads to a repair or scrap metal vendor. As defined in 40 CFR 761.3, small capacitor means a capacitor which contains less than 1.36 kg (3 lbs.) of dielectric fluid, while large capacitor (high/low voltage) means a capacitor which contains 1.36 kg (3 lbs) or more of

dielectric fluid. All streetlight capacitors collected by the company from lighting can be defined as small capacitors. PCB capacitors are managed as state-regulated hazardous waste in Massachusetts, New Hampshire, New York, Vermont and Rhode Island, and must be accumulated in a main or satellite hazardous waste accumulation area. Since 40 CFR 761.60(b)(7) provides exception to the storage requirements of 40 CFR 761.65 for PCB small capacitors, the company has no TSCA storage limits for intact PCB small capacitors. PCB and non-PCB capacitors may be accumulated in the same container, and disposed as PCB waste. Intact, small PCB capacitors are exempt from the federal Toxic Substances Control Act (TSCA) regulations; thus the PCB accumulation limits and PCB marking do not apply. PCB large capacitors and leaking PCB and non-PCB capacitors are TSCA regulated waste and must be managed and disposed in accordance with TSCA requirements (i.e., the waste must be marked with the PCB mark and transported within 30 days from when the first leaking capacitor was placed in the container.) (Note: Small, non-leaking capacitors [< 1.36 lb. PCB] are not hazardous waste in New York).

5.1.3 Fluorescent Light Ballasts: Intact PCB fluorescent light ballasts are devices that electrically control fluorescent light fixtures and that include a capacitor containing 0.1 kg or less of dielectric fluid. Such items are TSCA regulated wastes that fall under the definition of PCB Bulk Product Waste in the TSCA regulations. According to EPA, most fluorescent lamp ballasts manufactured before 1979 contain PCBs, but were not labeled as such. Only ballasts manufactured after 1979 are labeled to indicate that they do not contain PCBs.

Intact waste fluorescent light ballasts generated at National Grid facilities may be managed as either hazardous waste or non-hazardous wastes in New York and New Hampshire. In Vermont they may be managed as Universal Waste. Intact fluorescent light ballasts containing PCBs only in intact and non-leaking PCB small capacitors may be managed as non-hazardous waste in New York. If managed as non-hazardous, PCB and non-PCB lamp ballasts may be accumulated in the same container in an area outside the facility hazardous waste area. They should be labeled as Non-Hazardous Waste with the accumulation start date. They must also have the PCB mark as they are still TSCA regulated (not required in NY). Because ballasts are defined as a bulk product waste, they may be stored for 180 days in a storage area that meets the criteria found in 40 CFR 761.65(c)(9). Since the composition of the liner is not specified in the regulation, other than it prevents migration and is strong enough and designed to prevent failure, a floor of a building may be adequate to meet the definition. Therefore, if the storage for these ballasts is located indoors, away from floor drains or other areas where an uncontrolled release would allow for migration to the subsurface, and the surface of the storage area is in good condition, without cracks or other apertures that may lead to migration of waste to the subsurface, then ballasts could be stored for 180 days. Otherwise, ballasts may only be stored for 30 days. When PCB ballasts are transported from a

National Grid facility, they must be shipped on a TSCA manifest if required by applicable State regulations. The National Grid contact who schedules a pickup of PCB ballasts should remind the transporter that a TSCA manifest is required. If the generator chooses to manage the ballasts as hazardous waste, the ballasts must be accumulated in a Hazardous Waste Accumulation Area and must be shipped off-site within 90 days (providing the storage areas meets the 'liner' requirements discussed above; otherwise the time limit is 30 days) on a state hazardous waste manifest. PCBs can only be stored for 30 days in New York, unless in a TSCA-qualified containment.

In Rhode Island, Massachusetts, Vermont and New York (for large capacitors only), intact PCB ballasts are classified as hazardous waste (Waste Codes R007, MA02, VT01 and B004/B005, respectively), and must be managed accordingly. They must be accumulated in a Hazardous Waste Accumulation Area with a Hazardous Waste label and PCB mark, and have an accumulation time limit of 90 days (30 days for New York unless in a TSCA-qualified containment area). A federal hazardous waste manifest is not required for shipments of PCB ballasts in Rhode Island.

5.1.4 Streetlight Ballasts: Older mercury vapor streetlight systems utilized large cylindrical tank-style ballasts that contained the capacitor and electrical workings for the streetlight, while the streetlight head housed only the lamp. These old ballasts contain a PCB capacitor. Although they are quite different in appearance, these tank-style streetlight ballasts may be accumulated with fluorescent light ballasts. In Massachusetts, Vermont and New Hampshire, these streetlight ballasts should be accumulated and managed as TSCA regulated non-hazardous waste, and in Rhode Island the ballasts must be managed as TSCA regulated hazardous waste.

5.2 Management of Batteries

In an effort to facilitate the recycling of certain types of batteries, specifically nickel-cadmium and small-sealed lead acid batteries, Congress passed the "Mercury Containing and Rechargeable Battery Management Act" (Battery Act) on May 13, 1996. This act made the Universal Waste Rule effective immediately in all 50 states for the collection, storage, and transportation of batteries covered by the Act, providing national uniformity in the management of these batteries. National Grid manages intact, non-leaking batteries as Universal Waste. Non-intact or leaking batteries must still be managed as hazardous waste.

The National Grid battery recycling program incorporates elements of both the Universal Waste Rule and Battery Act for all non-leaking and non-cracked batteries. The battery recycling program has been established with National Grid approved vendors listed on the Environmental Department's web site on the company's Infonet. Table 5.4, National Grid Battery Recycling Program, summarizes the labeling, storage,

and shipping requirements for the various types of batteries. Details about the various types of batteries are provided below.

5.2.1 Substation/Recloser, Vehicle and Other Large Lead Acid Batteries

Spent large substation, vehicle and other large lead acid batteries are not required to be managed as hazardous or universal waste as long as they are intact and not leaking. 40 CFR 266.80 specifically exempts spent lead acid batteries that are to be reclaimed from regulation under the hazardous waste and universal waste regulations.

Because these batteries are exempt from regulation as a hazardous or universal waste, there is no accumulation, storage, or labeling requirements. However, for ease of storage and shipping, spent substation batteries and other large lead acid batteries such as those from vehicles or reclosers should be accumulated on pallets with short-circuit protection and strapping and/or shrink wrap. Recycling vendors should be informed as to what materials they will need to transport the pallets safely when the pickup is arranged.

A complete Bill of Lading (BOL) is required for each shipment of batteries. The BOL must contain: the name and address of the National Grid facility shipping the batteries; the destination facility; the quantity of each type of battery; the proper DOT shipping description; and the date the shipment left the facility. If a Recycling Certificate is provided by the vendor, it should be attached to the BOL and retained for 3 years.

Cracked or leaking batteries must be shipped on a hazardous waste manifest by an approved hazardous waste disposal vendor.

5.2.2 Small Sealed Lead Acid/Gel Cell Batteries

Spent small sealed lead-acid (SSLA) and gel cell batteries are covered by the Battery Act and are considered Universal Wastes in all states. These batteries may be returned to vendors when purchasing new batteries and the return of spent batteries may be a condition of the battery purchase contract. When the exchange of batteries is not possible, spent lead-acid batteries should be returned to a National Grid-approved facility for recycling or recovery.

Intact SSLA and gel cell batteries may be recycled at ENERSYS (formerly YUASA, Inc.) in Nashua, New Hampshire or Onyx Special Services (formerly Superior Special Services or Global Recycling Technologies) in Stoughton, Massachusetts. ENERSYS and Onyx accept intact SSLA and gel cell batteries of all types provided the conditions in Table 5.4 are met. ENERSYS does not accept nickel-cadmium or alkaline batteries.

Do not place leaking lead acid batteries into metal drums for disposal due to the possibility of the battery shorting out against the metal drum and causing the battery to explode.

Spent intact lead acid and gel cell batteries should be managed as Universal Waste when they are in storage prior to shipment from a National Grid facility. Universal Waste Batteries must be labeled or marked with the following:

- "Universal Waste-Battery(ies)"; or
- "Waste Battery(ies)"; or
- "Used Battery(ies)".

You may accumulate the batteries at the facility for up to one year. The accumulation start date must be known.

Refer to Table 5.4 for the labeling, storage, and shipping requirements for the lead batteries. Refer to the Environmental Department's web site on the company's Infonet for the names, addresses, and telephone numbers of the battery recycling vendors.

Because of potential environmental cleanup liability, spent lead batteries may not be disposed via scrap yards or junk dealers.

5.2.3 Nickel Cadmium and Lithium Batteries

Used, non-cracked, nickel-cadmium (Ni-Cd) and lithium batteries are considered universal wastes in all states under the Battery Act. Spent Ni-Cd or lithium batteries should be managed as universal waste when they are in storage prior to shipment from a National Grid facility. Universal waste batteries must be labeled or marked with the following:

- "Universal Waste-Battery(ies)"; or
- "Waste Battery(ies)"; or
- "Used Battery(ies)".

You may accumulate the batteries at the facility for up to one year. The accumulation start date must be known.

Refer to Table 5.4 for the labeling, storage, and shipping requirements for Ni-Cd batteries. Refer to the Environmental Department's web site on the company's Infonet for the names, addresses, and telephone numbers of the battery recycling vendors.

5.2.4 Alkaline Batteries

Alkaline batteries can be disposed as non-hazardous waste in the regular trash or recycled.

5.2.5 Nickel Metal Hydride (NiMH) Batteries

NiMH batteries are often used instead of NiCd batteries due to their lower price and better performance. NiMH batteries are not regulated as a Universal Waste or a Hazardous Waste. However, due to their Ni content, NiMH batteries should be recycled.

5.3 Mercury Management

Mercury and its compounds are severe cumulative poisons; mercury is also corrosive. Only National Grid personnel who have received training in the handling of mercury should conduct any activities related to the physical management of mercury waste streams. Material Safety Data Sheets may be referenced for specific health and spill response information.

Mercury may be contained in various instruments used in pressure and flow instrumentation such as gas pressure regulators, manometers, thermometers, barometers, electrical switches, pumps, batteries, fluorescent light bulbs, and mercury and sodium vapor high intensity discharge (HID) lamps. Mercury should be left in any mercury-containing device to be disposed. Attempting to remove the mercury may increase the chance of an accidental release.

Notes: Refer to Chapter 3 for disposal of mercury debris.

5.3.1 Mercury Disposal

Most mercury-containing lamps, thermometers, and devices are covered under the Universal Waste programs in Massachusetts, Vermont, New York, Rhode Island and New Hampshire. Hazardous waste mercury which fails the TCLP test is subject to Land Disposal Restrictions (LDRs). Refer to Chapter 3 for information regarding LDRs.

Refer to the Environmental Department's web site on the company's Infonet for a description of recycling/disposal shipping information for mercury-containing wastes at National Grid-approved vendors.

Refer to Sections 5.5, 5.6, 5.7, 5.8, 5.9 and 5.10 for a complete description of universal waste mercury management requirements applicable to all National Grid facilities and to those in individual states.

5.4 Federal Universal Waste Rule

On February 11, 1993, EPA proposed streamlining hazardous waste management requirements for collecting and managing certain widely generated hazardous wastes. On May 11, 1995, EPA finalized the Universal Waste Rule (the Rule), as an

amendment to the Resource Conservation and Recovery Act (RCRA). The intent of the Rule is to:

- Reduce the amount of hazardous wastes entering the municipal solid waste stream;
- Encourage the recycling and proper disposal of certain common hazardous wastes; and,
- Reduce the regulatory burden on businesses that generate these wastes and make the applicable regulations easier to comply with.

Specifically, the Rule streamlines the requirements related to notification, labeling, marking, prohibitions, accumulation time limits, employee training, response to releases, off-site shipments, tracking, exports, and transportation.

The federal Universal Waste Rule does not automatically apply in each state. In states authorized to implement the federal hazardous waste requirements (RCRA-authorized states), the Rule is not applicable until those states adopt the Rule in a separate state and receive authorization from EPA.

5.5 Universal Waste – All National Grid Facilities

5.5.1 Universal Waste Handler Categories

There are two categories of Universal Waste handlers:

- A small quantity handler of Universal Waste (SQHUW) is defined as a Universal Waste handler who accumulates less than 5,000 kilograms (11,000 pounds) total of universal waste at any time; and,
- A large quantity handler of Universal Waste (LQHUW) is defined as Universal Waste handler who accumulates 5,000 kilograms (11,000 pounds) or more total of universal waste at any time. A LQHUW must send written notification to the applicable state environmental regulatory agency and obtain an EPA Identification Number before meeting or exceeding the 5,000 kilogram accumulation limit. A facility that already has an EPA ID Number does not need to obtain another EPA ID Number, but does need to notify DEP of its universal waste activity, excluding batteries. Facilities that already have an EPA ID Number are not required to notify DEP of universal waste battery activity.

The National Grid facilities that accumulate universal waste do not accumulate 5,000 kilograms or more of universal waste at any time. As such, these facilities are covered under the standards for small quantity handlers of universal waste.

5.5.2 Standards for Small Quantity Handlers of Universal Waste-Universal Waste Management and Labeling

Universal wastes are subject to less stringent requirements than fully regulated hazardous wastes. National Grid facilities should have designated areas for the collection and storage of universal wastes.

5.5.3 Universal Waste Lamps

Universal Waste – Mercury-Containing Lamps

As stated in Section 5.1, Management of Lighting Wastes, mercury-containing lamps are a commonly generated waste at National Grid facilities. Examples of mercury-containing lamps include fluorescent, mercury vapor and sodium vapor high intensity discharge (HID), incandescent, and neon lamps. National Grid facilities use fluorescent lamps in offices, indoor substations, and other company buildings. HID lamps are found in streetlights.

a. Lamp Management: The types of fluorescent tubes at National Grid facilities include U-tubes, 4-foot linear, and 8-foot linear tubes. Spent fluorescent tubes from National Grid buildings should be accumulated in a designated area, preferably in cardboard boxes in which new fluorescent tubes are shipped. Boxes may also be obtained from the lighting waste vendor.

Spent mercury vapor and sodium vapor HID lamps should be accumulated in a designated area in a common container. HID lamps may be accumulated in drums or fiber containers that may be obtained from the lighting waste vendor.

Handlers are prohibited from dismantling, crushing, or treating mercury-containing lamps under the policy.

b. Lamp Labeling: Each mercury-containing lamp, or the container in which the mercury-containing lamps are contained, should be labeled or clearly marked with one of the following:

- "Universal Waste- Lamp(s)"; or
- "Waste Lamp(s)"; or
- "Used Lamp(s)".

5.5.4 Universal Waste Batteries

The company battery management program is discussed in Section 5.2 of this chapter. A battery must qualify as a hazardous waste before it can be classified as a universal waste. Batteries that do not qualify as hazardous waste such as alkaline batteries may instead continue to be managed as non-hazardous solid

wastes. Universal waste batteries that may be generated by National Grid include lead acid, lead gel cell, nickel cadmium, and lithium batteries.

a. **Battery Management:** Under the Universal Waste standards, batteries may be mixed together in a container. However, because reclamation processes often differ depending on the battery type, the various types should be accumulated separately.

b. **Battery Labeling:** Each battery or the container in which the batteries are contained should be labeled or clearly marked with one of the following:

- "Universal Waste-Battery(ies)" or
- "Waste Battery(ies)" or
- "Used Battery(ies)"

You may accumulate the batteries at the facility for up to one year. The accumulation start date must be known.

5.5.5 Universal Waste Mercury-Containing Equipment (MCE)

Universal waste mercury-containing equipment is defined as a device or part of a device that contains elemental mercury. Examples of some mercury-containing equipment are thermometers, thermostats, manometers, barometers, electrical switches and relays, gas pressure regulators and certain flow regulators. The universal waste standards allow for the joint collection, management, labeling, and recycling of mercury thermostats and mercury-containing equipment.

a. **Mercury-Containing Equipment Management:** Different types of mercury-containing equipment should be accumulated in the same container. Any broken mercury-containing device should be placed in a closed vapor-tight container, and any mercury residue must be cleaned up by a trained individual using a mercury spill kit (referenced in EP No. 5).

b. **Mercury-Containing Device Labeling:** Each mercury-containing piece of equipment or the container in which the mercury-containing equipment is contained should be labeled or clearly marked with the following:

- "Universal Waste- Mercury-Containing Equipment"; or
- "Waste Mercury-Containing Equipment"; or
- "Used Mercury-Containing Equipment".

You may accumulate mercury-containing equipment at the facility for up to one year. The accumulation start date must be known.

5.5.6 Universal Waste Accumulation Standards

A SQHUW may accumulate universal waste for no longer than one year from the date the universal waste is generated. A SQHUW must be able to demonstrate the length of time the universal waste has been accumulated from the date it becomes a waste. This may be accomplished in one of the following ways:

1. Placing the universal waste in a container and marking or labeling the container with the earliest date that any universal waste in the container became a waste; or

2. Marking or labeling each individual item of universal waste which is not in a container with the date it became a waste; or

3. Maintaining an inventory system on-site that identifies the date each universal waste became a waste; or

4. Maintaining an inventory system on-site that identifies the earliest date that any universal waste in a group of universal waste items or a group of containers of universal waste became a waste; or

5. Placing the universal waste in a specific accumulation area and identifying the earliest date any universal waste in the area became a waste; or

6. Any other method that clearly demonstrates the length of time that the universal waste has been accumulated from the date it became a waste.

5.5.7 Employee Training

Handlers of universal waste must receive training in proper handling and emergency procedures for the universal waste(s) handled. Universal Waste training is incorporated into the National Grid employees annual Environmental and Chemical Safety training program.

5.5.8 Response to Releases

All releases of universal waste and other residues from universal wastes must be immediately contained. Any mercury residue must be cleaned up by a trained individual using a mercury spill kit. Only personnel who have received appropriate training for mercury spills may participate in mercury cleanup.

5.5.9 Off-Site Shipments

A SQHUW is prohibited from sending or taking universal waste to a place other than another universal waste handler, destination facility, or foreign destination. If the SQHUW self-transports, they then become a universal waste transporter and must comply with the transporter requirements.

A National Grid SQHUW may self-transport universal waste to another National Grid SQHUW, without triggering Department of Transportation requirements, providing the following conditions are met:

- The SQHUW shipping the waste must ensure that the receiving SQHUW agrees to accept the waste;
- The transporter must not dispose, recycle, dilute or treat the waste except if responding to a release;
- Properly respond to releases;
- Do not hold the waste for more than 10 days during transport;
- If more than 1 pound of mercury is transported DOT requirements would apply. Since each fluorescent bulb contains ~ 30 mg of mercury, 1,000 bulbs would result in 30 grams of mercury which is well below 1 pound (454 grams); and,
- The receiving facility shall maintain documentation for at least three years for each shipment received of Universal waste. The documentation shall include:
  - The name and address of the waste shipper
  - The quantity of waste received
  - The date of receipt of the shipment

Any National Grid facility that is a LQHUW may not self-transport wastes.

The Environmental Department's web site on the company's Infonet contains a listing of the approved hazardous waste disposal and recycling facilities for company waste. This listing includes outlets for universal waste, specifically for batteries, fluorescent lamps, and mercury-containing items. Any of these vendors may be used for the specific type of universal waste.

Table 5.3 is an example of a spent lighting materials inventory sheet for shipments to a recycler in New England. The sheet should be completed for each company facility shipment of lighting materials. Depending on the lighting material, it may be classified as universal waste, hazardous waste, or non hazardous waste. After the inventory is completed, it should be faxed to the recycler and they will arrange for pick-up. Although universal waste batteries are not listed on the inventory sheet, the recycler may arrange for pickup of these items as well.

5.5.10 Tracking

A SQHUW is not required to keep records of shipments of universal waste.

5.6 Universal Waste in Massachusetts

The DEP adopted the federal Universal Waste Rule on October 17, 1997. The Standards for Universal Waste Management in Massachusetts are incorporated into the

state Hazardous Waste Regulations (310 CMR 30.00) at 310 CMR 30.1000. The Standards for Universal Waste Management provide an alternative set of management standards in lieu of regulation under the more stringent Hazardous Waste regulations. Table 5.5, "Summary of Massachusetts Universal Waste Regulations," provides a summary of the Massachusetts Universal Waste Regulations, including the regulatory citations.

5.6.1 Applicability

The provisions of the Massachusetts Standards for Universal Waste Management apply to the following wastes:

- Batteries
- Mercury-Containing Equipment
- Mercury-Containing Lamps
- Pesticides (Not a National Grid-generated waste so not discussed further.)

5.6.2 Universal Waste Thermostats/Mercury-Containing Devices

The standards for the management of universal waste thermostats and mercury-containing devices are found in separate sections of 310 CMR 30.1000.

5.6.3 Universal Waste – Mercury-Containing Lamps

Mercury-Containing Lamp Labeling: Each mercury-containing lamp, or the container in which the mercury-containing lamps are contained, should be labeled or clearly marked with one of the following:

- "Universal Waste-Mercury-Containing Lamp(s)"; or
- "Waste Mercury-Containing Lamp(s)"; or
- "Used Mercury-Containing Lamp(s)".

5.7 Universal Waste in New Hampshire

The NHDES adopted the federal Universal Waste Rule effective on October 14, 1998. Although New Hampshire has not as yet adopted the rule into codified regulations, New Hampshire has adopted a federal enforcement discretion policy that allows the state to manage certain hazardous wastes under Universal Waste standards.

5.7.1 Applicability

The provisions for the New Hampshire policy for Universal Waste Management apply to the following wastes:

- Antifreeze
- Batteries
- Mercury Lamps
- Mercury-Containing Devices

- Cathode Ray Tubes
- Pesticides (Not a National Grid-generated waste, so not discussed further.)

5.7.2 Universal Waste Antifreeze

The management requirements for waste antifreeze are found in NHDES Technical Bulletin HW-4. Antifreeze, which commonly consists of ethylene glycol or polypropylene glycol, may become contaminated with benzene, lead, and other hazardous constituents which may cause used antifreeze to be characterized as hazardous waste. HW-4 allows the management of waste antifreeze as a universal waste as an alternative to managing antifreeze as hazardous waste.

a. Antifreeze Management: Generators may recycle their own antifreeze on site through distillation or filtration; hire a contractor to come in with a mobile antifreeze recycling unit; or ship the antifreeze to a recycling facility.

b. Antifreeze Labeling: Each container or tank of waste antifreeze should be labeled or clearly marked with one of the following:

- "Universal Waste-Antifreeze", or
- "Waste Antifreeze", or
- "Used Antifreeze".

5.7.3 Universal Waste Mercury-Containing Lamps

The management requirements for waste mercury-containing lamps are found in NHDES Technical Bulletin HW-7. As stated in Section 5.1, Management of Lighting Wastes, mercury-containing lamps are a commonly generated waste at National Grid facilities. Examples of mercury-containing lamps include fluorescent, mercury vapor and sodium vapor high intensity discharge (HID), incandescent, and neon lamps. National Grid facilities use fluorescent lamps in offices, indoor substations, and other company buildings. HID lamps are found in streetlights.

Mercury-Containing Lamp Labeling: Each mercury-containing lamp, or the container in which the mercury-containing lamps are contained, should be labeled or clearly marked with one of the following:

- "Universal Waste - Lamp(s)"; or
- "Waste Lamp(s)"; or
- "Used Lamp(s)".

5.7.3 Universal Waste Cathode Ray Tube

The management requirements for waste cathode ray tubes are found in NHDES Technical Bulletin HW-25. As stated in Section 5.1, Management of Lighting Wastes, mercury-containing lamps are a commonly generated waste at National

Grid facilities. Examples of mercury-containing lamps include fluorescent, mercury vapor and sodium vapor high intensity discharge (HID), incandescent, and neon lamps. National Grid facilities use fluorescent lamps in offices, indoor substations, and other company buildings. HID lamps are found in streetlights.

Cathode Ray Tube Labeling: Each cathode ray tube, or the container in which the cathode ray tube are contained, should be labeled or clearly marked with one of the following:

- "Universal Waste – Cathode Ray Tube(s)"; or
- "Waste Cathode Ray Tube(s)"; or
- "Used Cathode Ray Tube(s)".

5.7.4 Accumulation Quantity Limits

Universal waste antifreeze and batteries do not have limits to the quantity of the wastes that may be accumulated on-site at any time. However the following quantity limits apply to mercury-containing lamps and mercury-containing devices:

- **Mercury-Containing Lamps:** No more than a combined total of 20,000 kilograms (44,000 pounds) of waste-mercury-containing lamps and other universal wastes.

- **Mercury-Containing Devices:** No more than a combined total of 5,000 kilograms (11,000 pounds) of waste-mercury-containing devices and other universal wastes.

5.8 Universal Waste in Vermont

Subchapter 9 of the Vermont Hazardous Waste Management Regulations details the universal waste program in Vermont.

5.8.1 Applicability

Universal waste management standards have been established in Vermont for the following wastes:

- Certain Batteries
- Thermostats
- Fluorescent Light Ballasts
- Mercury-Containing Lamps
- Pesticides (Not a National Grid-generated waste, so not discussed further.)

5.8.2 Universal Waste Batteries

The company battery management program is discussed in Section 5.2 of this chapter. The management requirements for universal waste batteries in Vermont are found in sections 7-902 and 7-204(f) of the Vermont Hazardous Waste Management Regulations.

5.8.3 Universal Waste Mercury-Containing Lamps

The management requirements for waste mercury-containing lamps are found in the Vermont Hazardous Waste management Regulations 7-912(5).

Mercury-Containing Lamp Labeling: Each mercury-containing lamp, or the container in which the mercury-containing lamps are contained, should be labeled or clearly marked with one of the following:

- "Universal Waste-Mercury-Containing Lamp(s)"; or
- "Waste Mercury-Containing Lamp(s)"; or
- "Used Mercury-Containing Lamp(s)".

In addition, a sign must be placed in the area of accumulation. The sign must be visible for at least 25 feet and include the following words; "Waste Mercury-Containing Lamps."

5.8.4 Universal Waste Thermostats

The management requirements for thermostats are found in 7-912(3) of the Vermont Hazardous Waste Management Regulations.

5.8.5 Universal Waste Fluorescent Light Ballasts

The management requirements for fluorescent light ballasts are found in 7-912(4) of the Vermont Hazardous Waste Management Regulations.

Each container into which ballasts have been placed must be labeled or clearly marked with one of the following:

- "Universal Waste- PCB Ballasts"; or
- "Waste PCB Ballasts"; or
- "Used PCB Ballasts"

5.9 Universal Waste in New York

6 NYCRR 374-3 of the New York Hazardous Waste Management Regulations details the universal waste program in New York.

5.9.1 Applicability

Universal waste management standards have been established in New York for the following wastes:

- Certain Batteries
- Mercury-containing equipment, including thermostats
- Lamps
- Pesticides

5.9.2 Off-Site Shipments

(1) (i) A small quantity handler of universal waste is prohibited from sending or taking universal waste to a place other than another universal waste handler, a destination facility, or a foreign destination; and,

(ii) When universal waste is being transported off-site, the requirements of Part 364 of this Title must be met.

(2) If a small quantity handler of universal waste self-transports universal waste off-site, the handler becomes a universal waste transporter for those self-transportation activities and must comply with the transporter requirements of Section 374-3.4 of this Subpart and Part 364 of this Title while transporting the universal waste.

(3) If a universal waste being offered for off-site transportation meets the definition of hazardous materials under CFR 49 Parts 171 - 180, incorporated by reference in subdivision 370.1(e) of this Title, a small quantity handler of universal waste must package, label, mark and placard the shipment, and prepare the proper shipping papers in accordance with the applicable Department of Transportation regulations under 49 CFR Parts 172 - 180 as incorporated by reference in subdivision 370.1(e) of this Title.

(4) Prior to sending a shipment of universal waste to another universal waste handler, the originating handler must ensure that the receiving handler agrees to receive the shipment.

(5) If a small quantity handler of universal waste sends a shipment of universal waste to another handler or to a destination facility and the shipment is rejected by the receiving handler or destination facility, the originating handler must either:

(i) Receive the waste back when notified that the shipment has been rejected, or

(ii) Agree with the receiving handler on a destination facility to which the shipment will be sent.

(6) A small quantity handler of universal waste may reject a shipment containing universal waste, or a portion of a shipment containing universal

waste that the small quantity handler has received from another handler. If a handler rejects a shipment or a portion of a shipment, the handler must contact the originating handler to notify them of the rejection and to discuss reshipment of the load. The handler must:

(i) Send the shipment back to the originating handler, or

(ii) If agreed to by both the originating and receiving handler, send the shipment to a destination facility.

(7) If a small quantity handler of universal waste receives a shipment containing hazardous waste that is not a universal waste, the handler must immediately notify the appropriate Department Regional Director of the illegal shipment, and provide the name, address, and phone number of the originating shipper. The Department Regional Director will provide instructions for managing the hazardous waste.

(8) If a small quantity handler of universal waste receives a shipment of non-hazardous, non-universal waste, the handler may manage the waste in any way that is in compliance with applicable federal, state or local solid waste regulations, including Part 360 of this Title.

5.10 Universal Waste in Rhode Island

The RI DEM adopted the federal Universal Waste Rule on November 13, 2001. The Standards for Universal Waste Management in Rhode Island are incorporated into the state Hazardous Waste Regulations (Regulation #DEM OWM-HW09-01). The Standards for Universal Waste Management provide an alternative set of management standards in lieu of regulation under the more stringent Hazardous Waste regulations. Table 5.6, "Summary of Rhode Island Universal Waste Regulations," provides a summary of the Rhode Island Universal Waste Regulations, including the regulatory citations.

5.10.1 Applicability

The provisions of the Rhode Island Standards for Universal Waste Management apply to the following wastes:

- Batteries
- Mercury-Containing Devices
- Mercury-Containing Lamps
- Used Electronic Devices not containing CRTs
- Cathode Ray Tube(s)
- Silver-containing photo fixing solutions (Not a National Grid-generated waste so not discussed further.)
- Pesticides (Not a National Grid-generated waste so not discussed further.)

5.10.2 Universal Waste Batteries

The standards for the management of universal waste batteries are found in Rules 13.5(B) of the Hazardous Waste Regulations. Waste nickel-cadmium, mercury oxide and lead acid dry cell batteries must be managed as a universal waste or hazardous waste; whether or not they exhibit a hazardous characteristic. In addition Lithium or Silver based batteries must be managed as a universal or hazardous waste.

5.10.3 Universal Waste Mercury Containing Devices

The standards for the management of universal waste mercury-containing devices are found in Rules 13.5(C) of the Hazardous Waste Regulations. Waste mercury containing devices must be managed as a universal waste or hazardous waste; whether or not they exhibit a hazardous characteristic.

5.10.4 Universal Waste Lamps

The standards for the management of universal waste Lamps are found in Rules 13.5(D) of the Hazardous waste Regulations. Waste lamps must be managed as a universal waste or hazardous waste; whether or not they exhibit a hazardous characteristic.

5.10.2 Universal Used Electronics not containing CRTs

The standards for the management of universal waste Used Electronic Devices not containing CRTs are found in Rules 13.5(H) of the Hazardous waste Regulations. Used Electronics as defined in Rule 3 must be managed as a universal waste or hazardous waste; whether or not they exhibit a hazardous characteristic.

5.10.2 Universal Cathode Ray Tubes

The standards for the management of universal waste Cathode Ray Tubes are found in Rules 13.5(H) of the Hazardous waste Regulations. Cathode Ray Tubes as defined in Rule 3 must be managed as a universal waste or hazardous waste; whether or not they exhibit a hazardous characteristic.

Table 5.1: Lighting Type and Waste Generated From Each Lighting Type

Light Type	Size (Watts)	Ballast	Lamp	Capacitor
Mercury Vapor Street Light	≤175	No	Yes	No
	>175	No	Yes	Yes

Sodium Vapor Street Light	<250	No	Yes	No
	≥250	No	Yes	Yes
Mercury Vapor Flood Light	≤400	No	Yes	Yes
	1000	No	Yes	Yes
Sodium Vapor Flood Light	250	No	Yes	Yes
	≥400	No	Yes	Yes
Fluorescent Lights (located in buildings)	Various	Most	Yes	Included within the ballast

Table 5.2: National Grid Management of Spent Lighting Materials

Description of Waste	Source	Waste Code	EPA Hazard	Mark	Storage Location	Accumulation Time Limit	Shipping Paper	DOT Shipping Description	Licensed Transporter
Fluorescent Lamps	MA NH VT NY RI VT	None	None	"Universal Waste Mercury Containing Lamps" & Date	Designated location not in high traffic areas; not in HW area[6].	1 year	BOL	Used Mercury-Containing Lamps, Non-DOT Regulated	No _____ NY
High-Intensity Discharge Lamps	MA NH NY RI VT	None	None	"Universal Waste - Mercury Containing Lamps" & Date	Designated location not in high traffic areas; not in HW area[6].	1 year	BOL	Used Mercury-Containing Lamps, Non-DOT Regulated	No _____ NY
Leaking PCB Capacitors and Ballasts*	MA NH RI VT NY	MA-MA02; NH-None; RI-R007; VT-VT01	Toxic	HW PCB RI only - Mark Class 9	HW	30 days	HW Manifest	Polychlorinated, Biphenyls, NON-DOT Regulated	Yes
Intact, Non-leaking PCB Capacitors (from Street Lights)	MA NH RI VT NY	MA-MA02; NH-None; RI-R007; VT-01; NY-None	Toxic	HW (Exempt from TSCA - no PCB mark required) RI only – Mark Class 9	HW	90 days (once in Main Accumulation Area)	HW Manifest	Polychlorinated, Biphenyls, NON-DOT Regulated	Yes
Intact PCB Ballasts* from Fluorescent Lighting[4]	NH NY	NH-None[5] NY-None	None[5]	Non-Hazardous Waste[5] PCB Mark HW Class 9	Not in HW area[5, 6]. Put in DOT containers. Secondary containment	180 days[5] None	Federal HW Manifest[5] BOL	Polychlorinated Biphenyls, NON-DOT Regulated	Yes Yes
	RI MA	RI-R007 MA-MA02	Toxic	Hazardous Waste PCB Mark Class 9 Hazardous Waste	HW	90 days	HW Manifest	Polychlorinated, Biphenyls, NON-DOT Regulated	Yes
	VT	VT-VT01	None	Universal Waste	Not in HW Area	One year	BOL	Used PCB Ballasts, Non-DOT Regulated	No

Notes:
1. When possible, place spent lamps in boxes originally shipped in.
2. Fiber drums are recommended storage containers for small bulbs (minimizes breakage).
3. Items marked with asterisk (*) must be included on the PCB Annual Log (PCB Report), and are considered to be "PCB Bulk Product Waste."
4. When shipped to a consolidation or processing facility and not directly for disposal.
5. If managed as a hazardous waste, the ballasts must be accumulated within a hazardous waste area for less than 90 days and shipped on a state hazardous waste manifest using the state's waste code (e.g., Massachusetts – MA02; New Hampshire – NH01).
6. Universal waste may be stored in hazardous waste storage areas in NY.

Table 5.3: National Grid New England Spent Lighting Materials Inventory Sheet

Date: _____

Company: _____ GSE _____ MECo _____ Nantucket _____ Narragansett

Facility:_____ Contact Person: _____

Address:_____ Telephone Number: _____

_____ Department: _____

Summary of Spent Lighting Materials for Shipment

State Requirements	Material	Number and size of Containers	Labels Needed? *Yes or No*	Containers Needed? Specify Type
NH, RI, MA: Universal Waste	Spent HID Lamps	____ 30 Gallon ____ 55 Gallon ____ Other Specify Type		
NH, RI, MA: Universal Waste	Spent Fluorescent Tubes	____ U-Tubes ____ 4 ft. linear ____ 8 ft. linear ____ Other - Specify Type ____ Other - Specify Type		
NH, MA, RI ; Not TSCA-Regulated	Small Intact PCB Capacitors	____ 30-gallon ____ 55-gallon ____ Other - Specify Type		
NH: TSCA-Regulated; Not Hazardous Waste MA, RI: Hazardous Waste	Intact PCB Ballasts	____ 5-gallon ____ Other - Specify Type		
NH, MA, RI: Hazardous Waste	Leaking PCB Capacitors and/or Ballast	____ 5-gallon ____ 30-gallon ____ 55-gallon ____ Other - Specify Type		

Table 5.4: National Grid Battery Recycling Program

Battery Type	Disposal/Recycling Options	Restrictions
1a. **Large Lead Acid Batteries** (Spent, *Non-Leaking*, Large Lead Acid Batteries - Substations, Reclosers, vehicles)	Return or Exchange at place of purchase or EnerSysy (formerly YUASA) or Veolia	• Do not mix lead acid batteries with other types of batteries. • Large batteries must be intact and placed in a single layer on pallet. Cover terminals with tape to prevent short circuits. Shrink wrap and strap to pallet using non-metallic strap. • Use BOL.
1b. **Small Sealed Lead Acid/Gel Cell Batteries** (Spent, sealed; *Non-Leaking, Non-Cracked*)	EnerSys (formerly YUASA) or Veolia	• Contact vendor for special packaging for shipping requirements. • Label batteries in accordance with Universal Waste requirements. • Ship within 1 year of generating the waste. • Use BOL.
1c. **Lead Acid Batteries** (*Leaking and/or Cracked)*	Clean Harbors Env. Services Inc. will transport to NovaPb	• All leaking or cracked batteries must be shipped on a hazardous waste manifest.
2a. **Nickel-Cadmium Batteries** (Large Ni-Cd batteries generated by substation operations and telecommunications dept's; *Non-Leaking, Non-Cracked*)	INMETCO or Veolia	• Place in single layer on pallet. • Strap with non-metallic strapping. • Label batteries in accordance with Universal Waste requirements. • Ship within 1 year of generating the waste. • Cover terminals. • Use a BOL.
2b. **Nickel - Cadmium Batteries** (Small Ni-Cd batteries generated by radios, laptop computers, and small hand tools; *Non-Leaking; Non-Cracked*)	Return or exchange at place of purchase or INMETCO or	• Contact vendor for special packaging for shipping requirements. • Label batteries in accordance with Universal Waste requirements. • Ship within 1 year of generating the waste. • Cover terminals. • Use BOL.

Table 5.4: National Grid Battery Recycling Program

Battery Type	Disposal/Recycling Options	Restrictions
	Veolia	
3. **Lithium Batteries** (Small Lithium batteries generated by metering equipment; *Non-Leaking; Non-Cracked)*	INMETCO or Veolia	• Contact vendor for special packaging for shipping requirements. • Label batteries in accordance with Universal Waste requirements. • Ship within 1 year of generating the waste. • Cover terminals. • Use BOL.
4. **Alkaline Batteries**	Veolia or INMETCO	• Cover terminals.
5. **Nickel Metal Hydride (NiMH) Batteries**	Return or exchange at place of purchase or Veolia	• Cover terminals.

Table 5.5: Summary of Massachusetts Universal Waste Management Regulations

Regulatory Citation	Summary
310 CMR 30.1020	**Applicability -Types of Wastes Covered**: • Batteries - primarily NiCd's and button batteries • Pesticides • Mercury Thermostats • Mercury-Containing Devices • Mercury-Containing Lamps
310 CMR 30.1030 Standards for Small Quantity Handlers of Universal Waste**:** (SQHUW)	**Standards for Small Quantity Handlers of Universal Waste** • SQHUW can accumulate less than 5,000 kg total universal waste in one year. No notification or recordkeeping required. • Prohibitions: - Disposal is not permitted; - No dilution, treatment or recycling of universal waste unless responding to releases, or as described in 30.1034. • Must manage wastes according to (30.1034). • Marking and Labeling: - Must label wastes appropriately (30.1034). • Notification: - Notification is not required for SQHUW. • Mercury Containing Lamps: - Must not be managed by crushing without a recycling permit; - Lamps must be handled whole; incidental unintentional broken lamps may be shipped as universal waste. • Accumulation Time Limits: - No longer than one year from the date the universal waste is generated, or received from another handler. • Training: - Inform all employees who handle or manage universal waste of proper handling and emergency procedures appropriate to types of waste handled. • Shipment Tracking: - No tracking of shipments is required. • Off-site Shipments: - Must ship only to another universal waste handler, a destination facility, or a foreign destination. Must package, label, mark and placard shipment according with HAZMAT regulations; - Use shipping papers (BOLs) not manifests.

Table 5.5: Summary of Massachusetts Universal Waste Management Regulations	
Regulatory Citation	**Summary**
310 CMR 30.1040 Standards for Large Quantity Handlers of Universal Waste	**Standards for Large Quantity Handlers of Universal Waste** (LQHUW): • LQHUW handles more than 5,000 kg of universal waste in one year. • Notification: - Must notify MA DEP of universal waste handling activity. If a site has a valid EPA Identification Number, then facility must notify DEP of universal waste activity, except batteries. Facilities with valid EPA ID numbers are <u>not</u> required to notify DEP of universal waste battery activity. • Applicability • Accumulation Time Limits • Labeling and Marking • Off-Site Shipping • Response to Releases • Training: - Requirements in these areas for LQHUW are the same as for SQHUW. • Tracking: - LQHUW must keep records of all shipments of universal waste received (30.1048). • Records must be kept for three (3) years.
310 CMR 30.1050	Standards for Universal Waste Transporters
310 CMR 30.1060	Standards for Destination Facilities
310 CMR 30.1070	Import Requirements

Table 5.6: Summary of Rhode Island Universal Waste Management Regulations

Regulatory Citation	Summary
Hazardous waste Regulations	**Applicability -Types of Wastes Covered**: • Batteries • Pesticides • Mercury Thermostats • Mercury-Containing Devices • Mercury-Containing Lamps • Cathode ray Tubes (CRTs)
Hazardous Waste Regulations Rule 13.00	**Standards for Small Quantity Handlers of Universal Waste** (SQHUW): • SQHUW can accumulate less than 20,000 kilograms of CRTs and less than 5,000 kg total of all other universal waste in one year. No notification or recordkeeping required. • Prohibitions: - Disposal of universal waste in regular waste stream is not permitted; - No dilution, treatment or recycling of universal waste unless responding to releases • Must not intentionally break or crush universal waste. • Marking and Labeling: - Must label wastes with the words "Universal Waste" and the identity of the waste. - Must note the Accumulation Start Date • Notification: - Notification is not required for SQHUW. • Accumulation Time Limits: - No longer than one year from the date the universal waste is generated, or received from another handler. • Management: - Must manage unintentional breakage of significant numbers of Universal waste items as hazardous waste. - Must respond to spills/breakage and manage the released material as hazardous waste as applicable - Must take steps to prevent releases to the environment • Training: - Inform all employees who handle or manage universal waste of proper handling and emergency procedures appropriate to types of waste handled. • Shipment Tracking: - No tracking of shipments is required. • Off-site Shipments: - Must ship only to another universal waste handler, a destination facility, or a foreign destination. Must package, label, mark and placard shipment according with HAZMAT regulations; - Use shipping papers (BOLs) not manifests.

6.0 WASTE MINIMIZATION AND RECYCLING

This chapter provides information on waste minimization/recycling regulations and provides an overview of current National Grid waste minimization and recycling programs. Waste minimization and recycling are practices which reduce or eliminate the creation of waste at the source and prevent its release into the environment. Both practices are emphasized in state and federal hazardous waste programs. National Grid promotes a policy to "Reduce, Reuse, and Recycle" all hazardous wastes, materials and by-products, as appropriate.

6.1 Overview of Waste Minimization and Recycling Regulations

The following information summarizes pertinent regulations governing waste minimization and recycling:

6.1.1 Waste Minimization National Plan

The Waste Minimization National Plan is a long-term national effort to reduce the quantity and toxicity of hazardous waste. The goals of the national plan are to:

- Reduce by 50% the most persistent, bio-accumulative and toxic (PBT) chemicals in the nation by the year 2005;
- Emphasize source reduction and environmentally sound recycling over waste treatment and disposal; and,
- Prevent transfers of chemical releases from one medium (air, water, land) to another.

6.1.2 Pollution Prevention Act

The Federal Pollution Prevention Act of 1990 (PPA) sets pollution prevention as a national objective. The PPA required EPA to implement a strategy to promote source reduction. In the PPA, the Congress stated that pollution prevention is the highest goal and that if pollution cannot be prevented or reduced at the source, then it should be recycled; if it is not feasible to prevent or recycle, then pollution should be treated, and only disposed of as a last resort.

6.1.3 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA), was designed to provide "cradle-to-grave" controls on wastes by imposing management requirements on generators, transporters, and treatment, storage and disposal facilities. Subtitle A of RCRA states that as a matter of national policy, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible and that land disposal should be the least favored method for managing hazardous wastes.

Generators of hazardous waste must comply with the set of standards in Section 3002 of RCRA. Section 3002(b) of RCRA states that the generator of the hazardous waste must certify on the hazardous waste manifests that:

1. The generator has a waste minimization program in place to reduce the volume or quantity and toxicity of hazardous waste generated to the degree determined by the generator to be economically practicable; and,

2. The proposed method of treatment, storage, or disposal is the practicable method currently available to the generator which minimizes the present and future threat to human health and the environment.

6.1.4 Universal Waste Rule

On May 11, 1995, the EPA finalized the Federal Universal Waste Rule. The purpose of the rule is to streamline regulatory requirements for certain widely generated hazardous wastes. It was designed to encourage recycling and to reduce the amount of hazardous waste from entering municipal solid waste facilities. Refer to Chapter 5 for additional information on the EPA's Universal Waste Rule.

6.1.5 Rhode Island OSCAR Program

Under Rhode Island's Ocean State Cleanup and Recycling (OSCAR) Program, source reduction and recycling are set as the top priorities for Rhode Island's solid waste management.

This Rhode Island state law requires that businesses recycle numerous solid wastes, including:

- Corrugated cardboard
- Office paper
- Newspaper
- Wood waste
- Used lubricating oil
- Vehicle batteries

Rhode Island's Rules and Regulations for Reduction and Recycling of Commercial and Non-Municipal Residential Solid Waste requires businesses with 50 or more employees to segregate and recycle solid wastes. The Rhode Island Resource Recovery Corporation (RIRRC) assumed responsibility for administering statewide recycling in 2001, when the Ocean State Cleanup and Recycling Program (OSCAR) was suspended. Annual reporting requirements to RI DEM have also been permanently suspended; however, the inventory and tracking of recycled materials is still recommended.

6.1.6 Vermont Hazardous Waste Reduction Plans

Under Vermont regulations Title 10 VSA Chapter 159 and Act 100, facilities are required to prepare Hazardous Waste Reduction (HWR) Plans and HWR Plan

Summaries. This program has been implemented as the state version of EPCRA. The goals of this program include:

- The elimination or reduction of the use of hazardous, toxic, materials;
- A reduction in the generation of hazardous waste;
- A reduction in the number of releases of contaminants that have adverse or serious health effects into the environment;
- Documented efforts towards hazardous waste and toxic use reduction, and the availability of this information to the public, as well as state and local government;
- Plans must be revised every 3 years; only the Plan Summaries are submitted to the Vermont Department of Environmental Conservation. Updated Plans and Plan summaries are due on or before July 1 of every third year. As a part of each Plan, the generator must establish specific performance goals for the reduction of toxins and hazardous waste for specific categories. The Plan Summaries must include a written statement articulating upper management's corporate policy with respect to a toxic use reduction and hazardous waste reduction plan, and a commitment to implement the plan goals.

6.1.7 Massachusetts

310 CMR 19.017(3) restricts the disposal or transfer for disposal of specific materials, such as wood, paper, cardboard and metal. Refer to Table 3 in the regulations for a complete list of materials. Since the MA DEP has actively enforced this regulation, it is important to ensure that restricted wastes are separated from the general trash or that the disposal contractor is bringing the waste to a facility where it will be segregated.

6.1.8 New Hampshire

Env-Wm 800 lists wastes which are exempted from Hazardous Waste regulation providing that they are being recycled. Other than this citation, there are no other specific regulations governing recycling.

6.2 National Grid Waste Minimization and Recycling Programs

The following information summarizes current National Grid waste minimization and recycling programs. The Company strives to **reduce** the quantities of hazardous waste generated by reducing or eliminating as many hazardous chemicals as possible in the work place, by consolidating the chemicals used, by **reusing** materials as much as possible, and by **recycling** increasing quantities of wastes. The following sections provide summaries of National Grid's current waste minimization and recycling programs.

6.2.1 Waste Minimization Program

National Grid Waste Minimization Program supports the national plan for reducing the volume and toxicity of all waste generated. National Grid efforts in this arena include reduction of solid waste through maximum reuse and recycling of materials and changing work practices to reduce or eliminate generation of hazardous waste. These waste minimization efforts allow National Grid to simultaneously improve environmental results and reduce costs.

A variety of initiatives instituted at National Grid as a result of waste minimization assessments include:

- The replacement of chlorinated based cleaners with non-chlorinated;
- Recycling of used oil filters and oily rags;
- Recycling of lighting waste;
- Recycling of corrugated board;
- Recycling of rechargeable batteries;
- Increasing the amount of oily soil recycled via asphalt batching;
- Applying in-situ remediation technologies to contaminated sites, when feasible and appropriate;
- Evaluating a plan to eliminate lead cable in new underground installations; and,
- Burning of waste automotive oil for energy recovery.

Refer to Attachment A for a copy of the National Grid Waste Minimization Program.

6.2.2 Battery Recycling Program

The Universal Waste Rule addresses most waste batteries. Refer to Chapter 5 of this EP for a complete description.

6.2.3 Empty Drum and Can Recycling Program

EPA's definition of an RCRA empty container is slightly different from the DOT definition. Under the EPA definition, a container is empty if all wastes have been removed that can be removed using the practices commonly employed to remove materials from that type of container; *e.g.*, pouring, pumping, and aspirating; *and* there is no more than 2.5 centimeters (one inch) of residue remaining on the bottom of the container or inner liner. A container that has held a hazardous material or hazardous waste that is a compressed gas is empty when the pressure in the container is substantially at atmospheric pressure. Refer to 40 CFR 261.7 and state-specific regulations for additional requirements for managing empty containers of acutely hazardous wastes.

Under DOT rules, a package/container is considered "empty" when it has been cleaned of residue and purged of vapors to remove any potential hazard (49 CFR 173.29). Residues removed from containers of hazardous wastes and hazardous materials must

be collected and managed as hazardous wastes as appropriate. Under no circumstances should residues be allowed to escape from a container, dumped on the ground or otherwise introduced into the environment.

- **Empty Drums:** Empty drums once used to store hazardous materials or wastes, shall be disposed of at an approved Hazardous Waste Disposal and Recycling Facility and shall not be disposed of in the trash or at a scrap dealer. Whenever possible, these empty drums and containers should be returned to the manufacturer.

  Empty drums which were not used to store hazardous materials or wastes should be recycled for scrap metal when possible and as a last choice, disposed of as a solid waste. In all cases, labels should be removed from the drums (or painted over with opaque black paint) prior to disposal.

- **Cans:** In order to minimize the generation of hazardous wastes, the full contents of a container of hazardous materials, such as paint cans and aerosol cans, should be used. Whenever possible, consolidate similar product items from several containers into a single container.

  When empty, these containers may be recycled for scrap metal, or discarded as solid waste. Empty aerosol cans should not be recycled as scrap metal unless the cans have been depressurized and the residues have been collected and appropriately managed.

6.2.4 Fluorescent Lamp and Lighting Waste Recycling Program

The Universal Waste Rule addresses most lighting wastes such as HID and fluorescent lamps, intact fluorescent light ballasts (PCB and non-PCB) and intact capacitors (PCB and non-PCB). Refer to Chapter 5 of this EP for additional information.

6.2.5 Oil Contaminated Soil Recycling

Soil contaminated with oils, including MODF, may be recycled at an approved asphalt batch facility, if the waste meets the criteria outlined in the facility's permit. These facilities cannot accept soils with concentrations of PCBs greater than or equal to 2, nor can they accept soils that contain listed or characteristic RCRA wastes over certain concentrations. The Infonet provides a listing of approved soil recycling facilities including location, permit number and mix type.

6.2.6 Oil Filter Recycling

National Grid recycles oil filters. The following criteria apply to recycling oil filters:

- Gasoline filters are not accepted for recycling.
- Oil filters destined for recycling are not hazardous wastes and can not be stored in the hazardous waste storage areas. The oil filter recycling drums should be labeled with the contents and the words "recyclable material."

- Oil filters should be shipped using a Bill of Lading.

Massachusetts Only

In order for the filters to be considered empty and therefore able to be managed as a recyclable material, the oil filters must be either:

- Drained and crushed to a point where no free flowing liquid remains in the crushed filter, or
- The anti-drain valve or dome end of the filter must be punctured and the filter hot drained for at least 12 hours.

6.2.7 Oily Rag Recycling

Non-saturated oily rags may be handled as non-hazardous waste when the following conditions are met:

- Rags must not have any quantity of oil such that if the rag is twisted oil will flow or drip from the rag;
- State regulations and guidance documents must be followed. See Table 6.1 for a summary of the requirements;
- Oils absorbed on the rags must not contain MODF or PCBs;
- The laundry facility, resource recovery facility, or recycling facility must hold all applicable permits;
- Rags which are non-hazardous should not be stored in a hazardous waste storage area and should not be labeled with any hazardous waste labels. Non-hazardous rags should be labeled with the contents to be in compliance with HazCom requirements.

Except in New York and New Hampshire (if associated with spill cleanup), oily rags must be handled as hazardous wastes if they are **saturated** with oil, chlorinated solvents, or contain PCBs or MODF. In New York, oily rags that originally contained ≥ 50 ppm PCB's must also be treated as hazardous waste.

6.2.8 Scrap Metals Recycling

The Institute of Scrap Recycling Industries, Inc. (ISRI) divides scrap metals into three types: Home Scrap, generated by steel mills and foundries; Industrial Scrap, generated by the metal working/fabrication industries; and Obsolete Scrap, composed of metal that has outlived its original intended use (such as an empty aerosol can). National Grid generates industrial and obsolete scrap metals, such as lead cable, steel structures, copper wire, aluminum wire and miscellaneous metal parts.

Scrap metals which contain no hazardous wastes are regulated as solid wastes. Metals should be recycled whenever possible through a National Grid approved scrap metal dealer. Refer to the Infonet for a list of approved facilities.

When recycling metals, consider the following:

- Except as provided below, no transformers or other electrical equipment such as circuit breakers, regulators, etc., can be sent to scrap metal dealers.
- Different types of metals such as steel, copper wire, and lead cable should be segregated for higher cost recovery.
- All free liquids should be removed from scrap metal containers prior to stockpiling or placing into a dumpster.

Non-PCB substation electrical equipment may either be recycled through a transformer recycling vendor or, providing certain criteria are met, empty units may be shipped to an approved scrap metal dealer. Investment Recovery will designate a scrap metal dealer in each geographic area to accept units. Unit may only be sent to such designated dealer. Additionally, the following criteria must be adhered to:

- All equipment must be thoroughly drained prior to shipment from the substation. The unit should be inspected several days to a week after draining to determine if a second draining to remove any residual oil is necessary. It should be anticipated that some oil may accumulate as internal walls and components drain over time.
- For states where used oil is treated as hazardous waste, the container must meet the RCRA definition of empty. All oil shall be removed that can be removed using practices commonly employed to remove oil from electrical equipment. In addition, no more than 2.5 cm of residue can remain on the container bottom or no more than 3% by weight of the container oil capacity remains if the capacity is <110 gallons or no more than 0.3% by weight of the container oil capacity remains if the capacity is >110 gallons.
- Stations personnel will attest to the condition of the equipment with a statement such as "I have visually inspected this piece of equipment and there exists no free-flowing or standing oil."
- Only units that contained non-PCB oil may be sold to a scrap dealer. Non-PCB oil is considered to be 49 ppm PCBs or less.
- All units must be sampled and analyzed via gas chromatography. Field testing; e.g., a Clor-N-Oil® test, is not acceptable for use. Analysis is not required if the unit is manufacturer-certified as non-PCB.
- All PCB analyses must be <1 year old. If analytical data is greater than 1 year old, the oil must be re-sampled and analyzed.
- If a unit had been previously drained such that no oil is available for analysis, analytical data >1 year old may be used for evaluating shipment to a scrap dealer.
- If units have more than one compartment with oil, each compartment must be sampled and analyzed separately. If any individual compartment is 50 ppm PCBs or greater, the unit may not be sent to a scrap dealer.

6.2.9 Certificates of Recycling

When shipping oily soil, used oil filters, oily rags and batteries using a shipping paper that does not provide confirmation of receipt of the material by the receiving facility (e.g., a hazardous waste manifest), a Certificate of Recycling should be obtained in order to assure that the material was properly managed. Often Certificates of Recycling are attached to invoices.

6.2.10 Personal Computers, Cellular Telephones, and Monitors

Personal Computers (PCs), cellular telephones, and monitors (CRTs) no longer in service are sold to secondary vendors through the company's Investment Recovery Group. Personal computers (PCs) and monitors (CRTs) do not present either a physical or health hazard during normal use. In the unlikely rare circumstance of a broken CRT, hazardous waste could be generated due to lead and/or mercury. For assistance in cleanup, contact the company's Industrial Hygienist for consultation. A HEPA vac and air sampling may be required due to volatilized lead and/or mercury from the non-intact CRT."

6.2.11 Cardboard and Office Paper

In accordance with state-specific regulatory requirements as well as National Grid's Environmental Policy, cardboard and office paper should be separated from general waste streams whenever feasible in order to ensure it is recycled. Separation is not required if that the disposal contractor is bringing the waste to a facility where it will be segregated.

6.3 Waste Oil Recycling

This section describes the appropriate methods for managing used oils prior to burning or recycling, the registrations, permits and record keeping required by facilities which burn, recycle or market waste oils, and the off-site shipment requirements. The regulations for storing, labeling, and recycling waste oils vary from state to state. Waste oils not destined for recycling may need to be managed as hazardous waste in accordance with state-specific requirements.

Generally, either recycling permits or "permit by rule" govern a Generator wishing to burn waste oils on-site. When shipping waste oils directly to a Burner, the generator likely is considered a "Marketer" of waste oils.

Regulations concerning the management of waste oils differ for specification (spec) and off-specification (off-spec) used oils. In general, spec used oils may be burned at facilities with fewer regulatory burdens. Each state, however, defines spec used oil in a slightly different manner. The following sections define spec and off-spec used oils and details the regulations in each state for both types of oils.

6.3.1 Waste Transformer Oil

Waste transformer oil may not be sent to a facility that processes and then sells the oil as fuel to other entities. An example of this type of facility is Murphy's Waste Oil

(Clean Harbors Environmental Services' facility), located in Woburn, Massachusetts. All waste transformer oil must be disposed at a National Grid-approved incinerator or thermal recovery facility. See the Infonet for a listing of such facilities. In some cases, non-PCB MODF may qualify as MA98, off-specification used oil fuel, and may be manifested as an MA98 waste oil to a National Grid-approved incinerator or thermal recovery facility. However, it is important to ensure that the transporter's permit allows it to act as the marketer. See EP No. 6 for details.

6.3.2 Massachusetts

Waste oil recycling in Massachusetts is regulated by 310 CMR 30.0000. Recycling of waste oil through burning on-site in a space heater for energy recovery is covered as a "permit by rule" activity and no actual permit is issued by the state. Burning of waste transformer oil, with or without PCBs, or chlorinated solvents is prohibited. Requirements for this activity are contained in EG-125MA and summarized below:

- Records must be maintained demonstrating that no speculative accumulative of waste oil has occurred. The records must include: the amount of material being accumulated or stored at the beginning of each calendar year; records showing the amount of material received or generated during the calendar year; and records showing the amount of materials being accumulated or stored at the end of the calendar year.
- Each waste oil tank or container must be labeled with the following: The words "Regulated Recyclable Material"; the identity of the substance; the type of hazard associated with the materials; the date upon which each period of accumulation or storage begins (dating is not required for tanks or containers that are hard piped to space heaters).
- Training must be provided for personnel who are involved in the recycling activities. The training topics must include the conditions of the permit and how to conduct activities to ensure protection of human health and the environment.

When shipping off-specification used oil fuel to a burner, the transporter must have a permit allowing them to act as a "Marketer." Otherwise, the oil must be shipped as a hazardous waste or the generator must obtain a Class B-3 recycling permit.

Waste oil may be shipped as MA01 – hazardous waste, MA97 – specification oil, and MA98 – off-specification oil. Shipments of waste oil utilizing the MA97 and MA98 waste codes are not subject to the Massachusetts hazardous waste transporter fee.
Massachusetts spec oil parameters are described in Table 6.2. Each batch of spec oil must be analyzed to ensure it meets these criteria. Used oil fuel which exceeds the allowable level of any constituent or property, is not transformer oil, and has not been mixed with a hazardous waste (e.g., F001 halogenated solvent), is considered to be off-spec oil. Off-spec oil need only be analyzed to ensure it has not been mixed with hazardous waste. Therefore, generators of waste motor oils or other off-spec oils should utilize the waste code MA98, as the waste oil need only be screened for total halogens to confirm it is not a hazardous waste. The results of the test are recorded on

the manifest. Analytical results from a representative sample of off-spec oil are on file with the Environmental Engineer.

6.3.3 New Hampshire

Generators in New Hampshire that recycle used oils must comply with the regulations set forth in Part Env-Wm 807, Requirements for Management of Used Oil Being Recycled, of the New Hampshire Hazardous Waste Rules. Standards for generators of used oil being recycled are found at Env-Wm 807.06. Table 6.3 summarizes generator, burner and other requirements applicable to used oils being recycled.

As outlined in Table 6.3, direct shipment of used oil to a burner qualifies the generator as a "Marketer." Standards which the Marketer must follow are outlined in Table 6.3 and include:

- Analysis of each load of oil for parameters listed in the regulations (Tables 8.1 and 8.2).
- Assignment of a unique ID number to each batch of oil.

6.3.4 Rhode Island

Generators in Rhode Island which burn used oils are subject to Rhode Island Air Pollution Control Regulation 20 and the requirements of 40 CFR 266, Subpart E, where more stringent. Table 6.4 summarizes the applicable requirements for recycling used oils in Rhode Island.

Rhode Island has a Policy (1991) on the management of waste oils, although DEM personnel do not appear to interpret the Policy consistently. However, if the generator, through repeated analysis, can show that the waste oil does not meet the criteria to be determined hazardous, the generator may manage the waste oil as a non-hazardous waste. The generator should ship the waste utilizing a regular BOL and must maintain analytical data and shipping papers. Additionally, oil that is being managed as a non-hazardous waste must not be stored in the generator's hazardous waste area. Also, the waste oil must not be shipped on a RI hazardous waste manifest form. If the waste oil is shipped out of state and a manifest is required by the destination state, copies must not be sent to RIDEM.

As outlined in Table 6.4, direct shipment of Used Oil to a burner qualifies the generator as a "Marketer". Marketer Standards which must be followed are also listed in Table 6.4

6.3.5 Vermont

Generators in Vermont that burn oils in space heaters on site must comply with the requirements of Section 7-610 of the Vermont Hazardous Waste Management Regulations and all applicable provisions of the Vermont Air Pollution Control Regulations. Table 6.5 summarizes the requirements applicable to used oil recycling.

Generators that recycle waste crank case and motor vehicle oils are exempt from managing these oils as a hazardous waste as long as the oils do not exhibit a hazardous waste characteristic, and are stored in a manner such that no disposal occurs and are transported by a licensed hazardous waste transporter to a facility, such that the waste oil is ultimately burned for energy recovery [VT 7-203(14)(b)]. However, it is National Grid Policy that containers and tanks storing waste oils are managed in accordance with the Generator requirements specified in Chapter 3.

As outlined in Table 6.5, direct shipment of Used Oil to a burner qualifies the generator as a "Marketer." Marketer Standards which must be followed are also listed in Table 6.5.

6.3.6 New York

In New York, used oil is managed according to 6 NYCRR Part 360 (Solid Waste Management Facilities), Subpart 360-14 Used Oil and Part 374-2. On specification, Used Oil is handled as a solid waste. All tanks storing used oil must be registered under the Bulk Petroleum Storage Regulations (6 NYCRR 612) whether or not the minimum threshold volume of 1,100 gallons on site storage is met.

Used oil burned for energy recovery is also subject to Subpart 374-2 and Part 225 of 6 NYCRR. Table 6.6 summarizes the requirements applicable to used oil recycling.

Table 6.1: State-Specific Summary of Regulatory Status of Used Rags and Wipers

Requirement	Massachusetts	New Hampshire	Rhode Island	Vermont	New York
Items Covered	Shop towels, rags and disposable wipers.	Rags, shop towels and wipers.	Towels and sorbents.	Rags, shop towels and reusable absorbents.	Rags, shop towels, reusable absorbents and soiled clothing contaminated with oil or solvents.
No Free Liquids Allowed	"One drop" rule.	Paint filter test.	No free liquids.	"One drop" rule.	No free liquids.
Acceptable Contaminants	Oils and Solvents.	Oils and solvents.	Oils and trace amounts of hazardous wastes.	Oils and trace amounts of hazardous wastes.	Oil and incidental amounts of solvents.
On-Site Management Requirements	Management requirements not specified in DEP policies. May be managed as solid waste.	Material must be placed in containers with lidded drums or sealed laundry bags. Containers are to be kept closed, etc. Containers must be stored away from sources of ignition. Container must be labeled "Contaminated Wipers for Laundering." Containers must be managed and transported in accordance with DOT requirements.	Material must be stored in containers away from any source of heat. No other wastes may be mixed with sorbents.	Must meet all of the VT OSHA requirements regarding the storage of ignitable/flammable materials between the time the solvent-contaminated rags are generated and the time they are picked up.	Must be managed as non-exempt hazardous waste until they are loaded onto a vehicle for transportation Storage must be in fire proof or fire resistant containers Notification is made in accordance with 6 NYCRR Part 376.1(g)(1)(vii) of the LDRs.
Reuse Options	Recycling by laundering rags or by energy recovery at an incinerator.	May be laundered at a commercial off-site laundry or laundered on-site.	May be laundered at a facility which meets the appropriate state and local criteria to handle such material.	Solvent-contaminated rags must be cleaned by a dry-cleaning service. Oil-contaminated rags may be laundered by a commercial service.	Recycling by laundering

Notes: 1. Any contaminated rags, etc., which would allow the release of free liquids determined to be hazardous wastes must be managed and disposed of as a hazardous waste.
2. Solvents should not be poured onto rags, etc.

3. All laundering facilities shall have the appropriate state and local permits, including facilities which will launder on-site. Contact the appropriate Environmental group for information concerning approved commercial laundry facilities.
4. It is National Grid Policy that all facilities managing containers of oil/solvent contaminated rags, shall indicate the contents of the containers, shall keep the containers away from sources of ignition and shall manage and transport the containers in accordance with DOT requirements.

Table 6.2: Summary of Waste Oil Requirements in Massachusetts

Requirement	Description
Recycling Definition	Use, reuse or reclamation of a material
Specification Oil Parameters (Total concentrations)	Halogens 4,000 ppm[1] Lead 100 ppm PCB 2 ppm Flashpoint 100° F Arsenic 5 ppm Cadmium 2 ppm Chromium 10 ppm
Spec Oil Permits/Notifications	Class A
Off-spec Oil Permits/Notifications[2, 3]	Class B(3)
Generator Standards	• Weekly inspections • Training • Ship only to facility with recycling permit, TSDF or other authorized facility • Secondary containment • Security • Floor marking • Satellite accumulation • Container condition • Container management • Posting "Waste Oil" sign • Special requirements for tanks (310 CMR 30.253)
Labeling	• "Regulated Recyclable Material" or "Hazardous Waste" • Name of waste (e.g., used oil fuel, waste oil) • EPA Hazard (e.g., toxic, ignitable, if applicable) • Accumulation start date
Shipping Papers	• Manifest or log • MA97 for spec oil • MA98 for off-spec oil
Recordkeeping	• Show 75% recycled per year
Reporting	• Annual reports
Marketer Definition	A person who transfers used oil fuel to other persons who burn the fuel or a person who operates a facility where used oil fuel is blended to prepare specification used oil fuel
Marketer Standards	• Notification • Analysis of oil • B(3) permit for off-spec used oil • Records - notification - analysis - permit - burner certification - shipping documents - keep as specified in Table 3.4

Table 6.2: Summary of Waste Oil Requirements in Massachusetts	
Requirement	**Description**
Burner Standards	• Notification • Analysis of oil • B(3) permit for off-spec used oil • Burn off-spec oil only in industrial or utility boilers, industrial furnaces, approved space heaters • Records - notification - analysis - permit - marketer certification - shipping documents - keep as specified in Table 3.4

Notes:

1. Used oil containing >1,000 ppm total halogens are presumed to be hazardous wastes unless the generator can prove otherwise.

2. Off-specification used oils are those which do not meet the limitations listed for specification used oil, are not transformer oils, and have not been mixed with hazardous wastes.

3. Generators of spec and off-spec oils are not required to obtain a recycling permit if the oil is being sent to a Marketer, not a burner, and has been authorized to receive that material in compliance with 310 CMR 30.200. National Grid Generators, if not burning waste oil on-site or at another Company location, shall have the oil transported by and to Murphy's utilizing the waste code MA98. Other vendors may be able to provide similar services on a case-by-case basis.

Table 6.3: Summary of Waste Oil Requirements in New Hampshire

Requirement	Description
Recycling Definition	Use, reuse or reclamation of a material
Specification Oil Parameters[1] (Total concentrations) (807.02)	Halogens ≤1,000[1] ppm Lead ≤100 ppm PCB ≤ 2 ppm Flashpoint ≥100° F Arsenic ≤5 ppm Cadmium ≤2 ppm Chromium ≤10 ppm
Spec Oil Permits/Notifications	None for generators
Off-spec Oil Parameters (807.03)	Arsenic 18 ppm max Cadmium 10 ppm max Chromium 35 ppm max Lead 1,000 ppm max Flashpoint 100° F min PCBs 2 ppm, no upper limit specified
Off-spec Oil Permits/Notifications	None for generators
Generator Standards (807.06)	• Must be stored in DOT containers or structurally sound tank • Containers must be kept closed unless adding waste • Prevent releases • Analysis required if other than used automotive oil • May self-transport up to 110 gallons and must use Bill of Lading (BOL)
Labeling (807.06)	"Used Oil for Recycle"
Shipping Papers (807.06)	3-copy BOL or manifest form when required by the destination state. Special language required if using BOL [see 807.06(9)(f)]. If using manifest indicate in Line J. "To be recycled."
Recordkeeping (807.06)	• BOL/Manifest • Analysis • Keep as specified in Table 3.4
Reporting	None for generators
Used Oil Marketer Definition (807.08)	Someone engaged in the act of marketing; e.g., the transfer of oil from one party to another. Does not include used oil generators or transporters who transport used oil received only from generators.

Table 6.3: Summary of Waste Oil Requirements in New Hampshire	
Requirement	**Description**
Marketer Standards (807.09)	• Notification • Analysis of oil • Records - notification - analysis - burner certification - shipping documents - operating logs - keep as specified in Table 3.4
Burner Standards (807.10)	• Notify Waste Management Division and Air Resources Division • Burn off-spec only in industrial furnaces, boilers >10 million Btu/hr at mfg. site, utility boilers, space heaters where the oil was generated on site • Burn spec oil only in oil furnaces and boilers, space heaters <0.5 million Btu/hr which are vented outdoors • Analysis unless only automotive oil or was tested by generator • Records - notifications - analysis - certifications - shipping documents - keep as specified in Table 3.4
Transporters (807.07)	For >110-gallons, use NH permitted hazardous waste transporter.

Note: 1. Used oil containing >1,000 ppm total halogens are presumed to be hazardous wastes unless the generator can prove otherwise.

Table 6.4: Summary of Waste Oil Requirements in Rhode Island

Requirement	Description
Recycling Definition	Use, reuse or reclamation of a material
Alternative Fuel Parameters (20.4) (Total concentrations)	Halogens ≤0.1% (weight); Sulfur ≤1.0% (weight); Lead ≤100 ppm (weight); PCB ≤50 ppm volume Cadmium ≤2 ppm volume; Flashpoint ≥100° F; Chromium ≤10 ppm volume; Arsenic ≤5 ppm volume; Heating Value ≥8,000 BTU
Alternative Fuel Permits/Notifications	Written authority from RIDEM Air Division
Generator Standards	Comply with all Chapter 3 requirements if oil is a hazardous waste, including used oil voluntarily managed as hazardous waste. If oil is not being managed as a hazardous waste, generator should still perform weekly inspections of containers, clearly label contents of containers, etc., but must not accumulate the containers in the hazardous waste accumulation area.
Labeling	Per Chapter 3 if applicable. Otherwise label as "Waste oil for recycling" or comparable wording.
Shipping Papers	• Bill of lading • Manifest • Automotive oil manifest
Recordkeeping	Per Chapter 3, if applicable.
Reporting	None for generators.
Marketer Definition	A person who used oil fuel to other persons who burn the fuel or a person who operates a facility where used oil fuel is blended to prepare specification used oil fuel.
Marketer Standards	• Notification • Analysis of oil • Records - notification - analysis - burner certification - shipping documents - operating logs - keep as specified in Table 3.4
Burner Standards (20.4)	• Notify Waste Management Division and Air Division • Analysis (20.6) • Records (20.9) - notifications - analysis - shipping documents - keep as specified in Table 3.4
Transporters	Permitted transporter for hazardous waste or waste oil being voluntarily managed as hazardous.

Table 6.5: Summary of Waste Oil Requirements in Vermont

Requirement	Description
Recycling Definition	Use, reuse or reclamation of a material
Specification Oil Parameters (7-606) (Total concentrations)	Halogens ≤4,000 ppm[1] Arsenic ≤5 ppm Lead ≤100 ppm Cadmium ≤ 2 ppm PCB ≤2 ppm Chromium ≤10 ppm Flashpoint ≥100° F
Spec Oil Permits/Notifications	None for generators
Off-spec Oil Permits/Notifications[2]	None for generators
Generator Standards (7-608)	See Section 10.3.5 and Chapter 3 requirements.
Labeling	Per Chapter 3 unless the waste oil is exempt from hazardous waste management and then containers should be labeled as "Waste oil for recycling" or comparable wording.
Shipping Papers	• Bill of lading or manifest if shipped out-of-state • Invoice
Recordkeeping	Per Chapter 3
Reporting	None for generators
Marketer Definition	A person who transfers used oil fuel to other persons who burn the fuel or a person who operates a facility where used oil fuel is blended to prepare specification used oil fuel.
Marketer Standards (7-609)	• Notification • Analysis of oil • Records - notification - analysis - burner certification - shipping documents - keep as specified in Table 3.4
Burner Standards (7-610)	• Notify Waste Management Division • Analysis • Records - notifications - analysis - shipping documents - keep as specified in Table 3.4

Notes: 1. Used oil containing >1,000 ppm total halogens are presumed to be hazardous wastes unless the generator can prove otherwise.
2. Off-specification used oils are those which don't meet the limitations listed for specification used oil.

Table 6.6: Summary of Waste Oil Requirements in New York

Requirement	Description
Recycling Definition	Use, reuse or reclamation of a material
Specification Oil Parameters (360-14) (Total concentrations)	Halogens ≤4,000 ppm[1] Lead ≤100 ppm PCB ≤2 ppm Flashpoint ≥100° F Arsenic ≤5 ppm Cadmium ≤ 2 ppm Chromium ≤10 ppm
Spec Oil Permits/Notifications	Registration of used oil tanks
Off-spec Oil Permits/Notifications	Registration of used oil tanks
Labeling	"Used Oil"
Shipping Papers	Bill of lading or manifest if required by receiving state
Recordkeeping	BOL, Tank Inspections per 613
Reporting	None for generators
Marketer Definition	A person who transfers used oil fuel to other persons who burn the fuel or a person who operates a facility where used oil fuel is blended to prepare specification used oil fuel.
Marketer Standards	• Notification • Analysis of oil • Records - notification - analysis - burner certification - shipping documents - keep as specified in Part 374-2.5
Burner Standards	• Notification • Analysis • Records - notifications - analysis - shipping documents - keep as specified in Part 374-2.4
Transporters	Permitted Part 364 Transporter

Notes: 1. Used oil containing >1,000 ppm total halogens are presumed to be hazardous wastes unless the generator can demonstrate otherwise.

ATTACHMENT A

National Grid
Waste Minimization Program

This policy describes the current National Grid Waste Minimization Program for reducing the volume and toxicity of all wastes generated. Past efforts have focused on reducing the amount of hazardous waste generated. Current efforts include reduction of solid wastes through maximum reuse and recycling of materials, and changing work practices to reduce or eliminate the generation of hazardous waste (HW). Waste minimization efforts allow National Grid to simultaneously improve environmental results and reduce costs.

The six elements of the National Grid Waste Minimization Program (modeled using the U.S. EPA interim final guidance published in 58 Federal Register 31114) are:

1. Top Management Support

Management support for waste minimization is demonstrated in both long-term planning documents and the National Grid Environmental Policy and Principles. Specifically, Principle 4 states:

> "We will work to prevent pollution at the source, minimize waste generation, recycle materials when economically feasible, and dispose of remaining wastes only through safe and environmentally sound methods."

2. Characterization of Waste Generation and Waste Management Costs

In 1993, National Grid recognized a need to improve waste tracking data and standardize the way environmental costs were tracked within the company. Initially, Corporate Conservation, Inc. summarized National Grid's 1993 waste generation data, and associated management costs as part of the Green Accounting project. Improved waste tracking was identified as a need, and National Grid responded by modifying contracts such that solid waste and HW disposal vendors provide waste generation data. This information is tracked internally to monitor ongoing performance.

3. Periodic Waste Minimization Assessments

Annual cost and waste disposal summaries are used to assess waste minimization opportunities and evaluate progress. Projects implemented as a result of these assessments include:

- Replacement of chlorinated solvent-based cleaners with non-chlorinated cleaners;
- Recycling of used oil filters (both automotive and process equipment);
- Burning waste automotive oil for energy recovery, and recycling used oily rags;
- Recycling spent rechargeable batteries (instead of disposal as hazardous waste);
- Recycling of lighting wastes (both relamping projects and routine maintenance);

- Centralizing corrugated board recycling (making maximum use of the Worcester baler);
- Increasing the amount of oily soil recycled via asphalt batching;
- Applying in-situ remediation technologies for contaminated sites (where appropriate);
- Developing a plan to eliminate the use of lead cable in new underground installations.

4. Appropriate Cost Allocation

Departments which generate waste are responsible for associated environmental management costs including:

- environmental and emergency response training costs
- contingency plan costs
- recycling program costs
- solid and hazardous waste disposal costs
- site assessment costs, and spill response activities

A National Grid environmental activity and project code-based cost accounting system is in place to simplify ongoing environmental cost tracking.

5. Technology Transfer is Encouraged

National Grid is actively involved with the Electric Power Research Institute (EPRI), State recycling organizations, and State regulatory waste site cleanup committees.

Monthly staff meetings of National Grid environmental personnel provide an opportunity to share information, and obtain feedback regarding current waste reduction and recycling efforts.

6. Program Implementation and Evaluation

National Grid's Environmental Department will lead efforts to eliminate, reduce, reuse, or recycle wastes. Projects and new programs are rolled out to other National Grid facilities as appropriate, and best management practices are shared within the environmental group.

We evaluate progress each December, and set environmental and safety goals which support National Grid's business strategy. Key accomplishments are periodically shared with National Grid employees via National Grid paper articles and memos.

SUMMARY

National Grid's waste minimization program is successful by applying the following three waste minimization principles:

- **Reduce**
  - Changing maintenance practices to reduce the use of hazardous materials;

- Changing operating practices to eliminate/reduce hazardous waste generation;
- Working with vendors to reduce packaging and use recycled packaging when possible;
- Developing partnerships with vendors to reduce National Grid inventory, and thus reduce waste.

- **Reuse**
  - Striving to maximize reuse of National Grid's supplies issued and not used for the original job;
  - Repairing and reusing transformers, relays, and other equipment (when possible);
  - Selling unused/surplus electrical equipment to other utilities for reuse.

- **Recycle**
  - Recycling oily soil via asphalt batching processes;
  - Recycling used treated wood by-products (poles, pallets, boxes) as fuel for utility boilers;
  - Recycling tree-trimming wastes by chipping for use as wood boiler fuel or as mulch;
  - Recycling used oil filters, used oily rags/wipers, and used automotive oil;
  - Recycling corrugated cardboard.

7.0 SOLID WASTE MANAGEMENT

This chapter discusses the proper management of solid wastes that may be generated from National Grid activities and provides a summary of the federal and state regulations governing the management of solid wastes.

7.1 Federal Regulations Pertaining to Solid Wastes

The Resource Conservation and Recovery Act (RCRA) of 1976, as amended in 1980 and 1984, provides federal guidelines and standards for the environmentally sound reuse, handling and disposal of solid waste. The act requires that states incorporate these guidelines into their solid waste management programs.

The primary goals of RCRA are to:

- Protect human health and the environment from potential hazards of waste disposal;
- Conserve energy and national resources;
- Reduce the amount of waste generated;
- Ensure that wastes are managed in an environmentally sound manner.

Solid waste management on the federal level is the responsibility of the United States Environmental Protection Agency (EPA). The Code of Federal Regulations, Title 40, is entitled Protection of the Environment, which includes Subchapter I Solid Wastes (CFR Parts 240 through 280). Direct implementation of solid waste programs is strictly delegated to state and local governments.

7.2 State Regulations Pertaining to Solid Wastes

7.2.1 Massachusetts

Regulation
Two sets of regulations govern solid waste in Massachusetts: 310 CMR 19.00 and 310 CMR 16.00.

- The "Solid Waste Management Regulations" (310 CMR 19.000) pertain to protecting public health, safety and the environment by regulating the storage, transfer, processing or disposal of solid waste in Massachusetts.

- The "Site Assignment Regulations for Solid Waste Facilities" (310 CMR 16.00) are designed to provide information related to the process of determining if a parcel of land is suitable for being a solid waste management facility.

Massachusetts solid waste management regulations, 310 CMR 19.000, are summarized in Table 7.1.

Definition
Massachusetts defines solid waste as: Useless, unwanted or discarded solid, liquid or contained gaseous material resulting from industrial, commercial, mining, agricultural, municipal or household activities that is abandoned by being disposed or incinerated, or is stored, treated or transferred pending such disposal, incineration or other treatment. As defined in 310 CMR 19.00, solid waste *does not include*:

- Ash produced from the combustion of coal when reused as prescribed pursuant to M.G.L.c.111, Subchapter 150A; or

- Those materials and by-products generated from and reused within an original manufacturing process and other items listed in 310 CMR 19.006.

7.2.2 New Hampshire

Regulation
The New Hampshire solid waste regulations are contained in the *Solid Waste Rules* (Chapter Env-Wm 100 to 2800). Table 7.2 provides a brief outline of the New Hampshire waste management regulations.

Definition
New Hampshire defines solid waste as: Any matter consisting of putrescible material, refuse, residue from an air pollution control facility and other discarded or abandoned material. It includes solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining and agricultural operations and from community activities. As defined by RSA 149-M:1, XIX and Env-Wm 101.01, solid waste ***does not include***:

- Hazardous wastes as defined in RSA 147-A:2;
- Solid or dissolved materials in irrigation return flows;
- Cut or uprooted tree stumps incident to clearing of land depicted on a site plan showing burial locations and mailed to the Director, provided that such burial locations are not located within 75 feet of any well as defined in RSA 485:37;
- Municipal and industrial discharges which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act;
- Special nuclear or by-product material as defined by the Atomic Energy Act of 1954;
- Septage or sludge as defined in RSA 285-A.IX-a and XI-a; or
- Deceased persons.

7.2.3 Rhode Island

Regulation

The Rhode Island Recycling Act and The Solid Waste Act (Chapters 23-18, 23-19, 37-15 and 42-1) established a coordinated solid waste system with three state-built resource recovery facilities along with a flow control over municipal solid waste, and a policy of reducing, reusing, recycling or recovering energy from solid waste, in preference to disposal of waste in landfills. Rhode Island Department of Environmental Management (RIDEM) coordinates the statewide recycling efforts, prepared regulations controlling solid waste management in Rhode Island and has set goals for recycling.

Rhode Island's Rules and Regulations for Reduction and Recycling of Commercial and Non-Municipal Residential Solid Waste requires businesses with 50 or more employees to segregate and recycle solid wastes. Annual recycling reports are due March 1 of each year to RI DEM. Table 7.3 provides a summary of Rhode Island's solid waste regulations.

Definition
Rhode Island defines solid waste as: Garbage, refuse and other discarded solid materials generated by residential, institutional, commercial, industrial and agricultural sources. Non-hazardous solid waste ***does not include***:

- Solids or dissolved material in domestic sewage or hazardous waste; or
- Hazardous waste as defined in the Rhode Island Hazardous Waste Management Act, Chapter 23-19.1.

7.2.4 Vermont

Regulation
The Vermont Solid Waste Management Rules (6-100 to 6-1100) provide the procedures and standards for properly managing solid wastes in Vermont. The Rules are regulated by the Vermont Agency of Natural Resources (VANR), Solid Waste Management Division. Table 11.4 summarizes the sections pertinent to National Grid's solid waste activities.

Definition
Vermont defines solid waste as: Any discarded garbage, refuse, septage, or sludge from a waste treatment plant, water supply plant or pollution control facility; and other discarded material, including solid, liquid, semi-solid or contained gaseous materials resulting from industrial, commercial, mining or agricultural operations and from community activities. As defined in Vermont's Solid Waste Management Rules, solid waste ***does not include***:

- Animal manure and absorbent bedding used for soil enrichment; or
- Solid dissolved materials in industrial discharges which are point sources subject to permits under the Water Pollution Control Act, Chapter 47.

7.2.5 New York

Regulation

The New York State Solid Waste Management Regulations, 6 NYCRR Part 360, is the authority by which the state sets standards and criteria for all solid waste management facilities. The purpose is to regulate solid waste management facilities, other than hazardous waste management facilities and facilities managing radioactive materials. All solid waste must be transferred, processed, recovered, stored, reclaimed or disposed of in a manner consistent with the regulation.

Definition

New York defines solid waste as: any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or a pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permitting, or source special nuclear or by-product material.

7.3 Solid Waste Management Practices

The following section provides guidance on the proper management of solid wastes that may be generated from National Grid activities. It also provides information regarding the storage and disposal for asbestos waste. Topics include the management of:

- Demolition/Construction Debris, including Asphalt, Brick and Concrete (ABC) Rubble;
- Woodchips;
- Non-Hazardous Paint Waste;

Personal Computers (PCs) and monitors (CRTs) no longer in-service are sold to secondary vendors through the company's Investment Recovery Group. Personal computers (PCs) and monitors (CRTs) do not present either a physical or health hazard during normal use. In the unlikely rare circumstance of a broken CRT, hazardous waste could be generated due to lead and/or mercury. Please refer to Chapter 3 of this EP for further guidance.

7.3.1 Demolition/Construction Debris, including Asphalt, Brick and Concrete (ABC) Rubble

Waste-building materials and rubble resulting from the construction, remodeling, repair or demolition of structures or roads (i.e., “construction and demolition debris” or “C&D waste”) are regulated as a solid waste under the provisions of various state Solid Waste Rules. The term “C&D waste” includes, but is not limited to, asphalt, brick, concrete (ABC) rubble and other masonry materials, wood, wall coverings, plaster, dry wall,

plumbing, fixtures, insulation, roofing shingles, asphalt pavement, glass, plastics and electrical wiring/related components. Construction/demolition debris should be disposed at a state-approved solid waste/demolition landfill. In Massachusetts, asphalt, brick, concrete, metal and wood are banned for disposal or incineration or transfer for disposal at solid waste facilities. In New York, because of the significant volume of C&D debris generated it is acceptable to place fill on Company and third-party properties. Please refer to EG-119NY – C&D Debris Fill Policy for Guidance. Refer to the National Grid Infonet Site for the Approved Hazardous Waste Vendors. Also, please follow the identified internet links identifying state approved landfills by appropriate state:

MA: Web site: http://www.mass.gov/dep/recycle/

NH: Contact the New Hampshire Department of Environmental Services, Waste Management Division.
Phone: (603) 271-2900
Web site: http://des.nh.gov/index.htm

RI: Contact the Department of Environmental Management, Waste Management Division.
Phone: (401) 222-2797
Web site: http://www.dem.ri.gov/index.htm

VT: Contact the Department of Environmental Conservation, Waste Management Division.
Phone: (802) 241-3888
Web site: http://www.anr.state.vt.us/dec/dec.htm

NY: Contact the New York State Department of Environmental Conservation.
Phone: (518) 357-2234
Web site: http://www.dec.ny.gov

Exceptions are noted below:

- Materials which may be recycled, such as steel rebar, should be collected and sent to an approved recycling vendor (refer to Chapter 10);
- Materials which contain hazardous components, such as roofing materials or floor tiles that contain asbestos, must be properly removed and disposed before demolition;
- Some types of solid waste may be reused in accordance with solid waste regulatory requirements (refer to the sections below).

Beneficial Use Determination - Massachusetts

Some types of solid waste, including waste generated from the demolition of a building, may be reused if approved by the DEP. To obtain approval for "beneficial use" of a solid waste, an application must be submitted to the DEP in accordance with 310 CMR 19.060.

Refer to EG-119MA, Massachusetts Building Demolition Regulatory Requirements for more information regarding Beneficial Use Determination Application Requirements, notification requirements for crushing ABC rubble, and notification requirements for building construction/demolition.

7.3.2 Woodchip Storage

Woodchips are generally generated from tree trimming activities that are necessary for the maintenance of the overhead line rights-of-way. The vegetation is chipped at the site of trimming and then brought to designated areas in the company. The areas are managed by the company arborists. Since wood processing activities do not occur at the storage site, it has been determined that the storage is not subject to solid waste regulations. However, if practices change, compliance with applicable regulations should be evaluated.

Because the woodchips are a combustible material, notification to the local Fire Department might be required before storage. The Vegetation Management Department will submit notification forms with location maps to the appropriate fire departments as required. Copies of the documents are maintained by the company arborists.

Management of the Woodchip Piles

The storage of woodchips requires certain fire protection measures in order to minimize risk of a fire. Woodchip piles have the potential to heat internally and spontaneously combust if not managed correctly. Experience and tests indicate that two different types of fires may occur in storage piles: surface fires and internal fires. Fire prevention activities and fire protection facilities should, therefore, be prepared to cope with both situations. Fire protection measures include:

a. Avoid all refuse and old chips in the chip pile base.
b. The storage site should be reasonably level, solid ground or should be paved with blacktop, concrete or other hard-surface material that has been thoroughly cleaned before starting a new pile.
c. Operating plans (where required) for the buildup and reclaiming of the pile should be based upon a maximum turnover time of one year under ideal conditions. Piles containing other than screened chips made from cleaned and barked logs (for example, whole-tree chip piles containing bark or leaves) may be subject to greater degrees of spontaneous heating and thermal degradation and should be reclaimed more frequently.
d. Pile size should be limited. Pile heights should be kept low, particularly for piles that are subject to greater compaction.
e. Wetting the pile regularly will help keep chips from drying out and help maintain the moisture content of the surface layer of the pile.
f. Vehicles used on all piles should be of a type that minimizes compaction.
g. Smoking must be prohibited in chip pile areas.
h. Ground surface around piles should be kept free of combustible materials.

i. In Rhode Island, storage of greater than 3 cubic yards may require a permit.

7.3.3 Paint Wastes

Paint wastes are typically generated during paint removal operations, during lead abatement activities and during routine maintenance activities. These wastes may include the following:

- Paint chips and sandblast grit;
- Brushes, rollers, rags;
- Waste paint, paint cans;
- Personal protective equipment (PPE).

In some instances, paint waste may be hazardous due to the constituents in the paint, such as lead, chromium, or other metals, or because the paint has been mixed with solvents. A hazardous waste determination must be made through generator knowledge or through testing. Refer to Chapter 3, Hazardous Waste, for more information on handling hazardous waste.

Solid, non-hazardous paint waste, such as latex paint debris, may be disposed at a solid waste landfill. To minimize the generation of paint wastes, the following practices should be followed:

- Reduce waste volumes by segregating hazardous paint wastes from non-hazardous paint wastes.
- Segregate paint chips from other painting debris and other paint removal waste streams. The chips will tend to be more hazardous than the PPE or other wastes.
- Reuse blasting sand or sponges more than once, if possible.
- Liquid paint wastes must not be sent to a solid waste landfill. Although this practice is permitted in some states with specific approval of regulatory agencies, it is not the best management practice. Non-hazardous liquid paints may be incinerated by trash-to-energy incinerators. Solidified/dried paint wastes may be land filled.
- Empty cans by pouring excess liquid paint into a disposal container. ("RCRA empty;" i.e., cans that have had all paint scraped, poured or pumped from original container, and there is less than one (1) inch remaining in the bottom) may be disposed in the trash as non-hazardous waste.
- Solidified paint in cans that are classified as RCRA "empty" may be disposed of in the trash as non-hazardous waste. Ensure all painting wastes (rags, rollers, and brushes) are dry prior to disposal.

- Use all paint in the container and reduce volume of wastes by consolidating paints into as few containers as possible.
- Reduce variety of types/colors of paints in order to minimize the amount of waste paints discarded.
- Minimize solvent use. Buy only small containers of solvents and substitute cleaning solvents that contain non-RCRA constituents.

Table 7.1: Summary of Massachusetts Solid Waste Management Regulations, 310 CMR 19.000	
Regulatory Citation	**Summary**
310 CMR 19.001	**Authority:** M.G.L. c.21A, Subparts 2 and 8; and Chapter 111, Subpart 150A.
310 CMR 19.002	**Purpose:** To protect public health, safety and the environment by regulating the storage, transfer, processing, treatment, disposal, use and reuse of solid waste in Massachusetts.
310 CMR 19.003	**Applicability:** To all solid waste management activities and facilities, including landfills, dumping grounds, transfer stations, solid waste processing facilities, recycling and other waste management areas.
310 CMR 19.006 - Definitions	Solid Waste does NOT include: •Ash produced from combustion of coal when reused as described in M.G.L. c.111, 150A; •Compostable or recyclable materials when composted or recycled in an operation not required to be assigned (in 310 CMR 16.00).
310 CMR 19.017	Restricted materials: •*Lead batteries* (banned from landfills and incinerators). •*Leaves* (banned from landfills and incinerators). •*Tires* (tires must be shredded before disposal in landfills). •*White Goods* (banned from landfills and incinerators). •*Aluminum containers* (banned from landfills and incinerators). •*Metal or glass containers* (banned from landfills and incinerators). •*Single polymer plastics* (banned from landfills and incinerators). •*Recyclable paper* (banned from landfills and incinerators). •*Asphalt Pavement, Brick and Concrete* (banned from landfills and incinerators). •*Metal* (banned from landfills and incinerators). •*Wood* (banned from landfills and incinerators).
310 CMR 19.100 - 19.151	Landfill design and operation requirements.
310 CMR 19.200 - 19.221	Regulations on Transfer Stations.

Table 7.2: Summary of New Hampshire Solid Waste Management Regulations, Solid Waste Rules (Chapter Env-Wm 100-2800)

Regulatory Citation	Summary
Chapter Env-Wm 101	**Applicability**: Statutory Authority: RSA 149-M:8 These regulations apply to the disposal and management of solid waste in New Hampshire, including: • Collection, storage and transfer facilities• Composting facilities and landfills • Recycling centers • Incinerators
Env-Wm 101.02	**Purpose of these rules**: • Prescribe requirements, limitations and procedures for storing, transferring, processing, treating and disposing of solid waste in New Hampshire. • Promote solid waste management practices that minimize risks to public health and the environment. • Encourage regional cooperation and management practices consistent with New Hampshire Solid Waste Management Plan. • Encourage conservation and recovery of natural resources.
Env-Wm 200	Procedural rules.
Env-Wm 202	Waivers. This section describes the procedures and criteria to accommodate situations where strict adherence to the Rules would not be in the best interest of the public.
Env-Wm 300	Permitting.
Env-Wm 301.03	Permit-by-Rule (exemptions from needing permits) Types of facilities deemed to have a valid Permit-By-Rule (as long as the facility complies with Env-Wm 308, the Universal Environmental Performance Standards): • *Stump burial* locations incident to land clearing (as long as locations are shown on a map and are >75 feet away from any well, and the map is submitted to DES). • *Composting* facilities, for yard waste generated at the same location. • *Chipping brush* in the same area that it was generated. • Screening of *sand blast materials.* • *Storage containers* for recyclable materials. • Other facilities listed in 301.03.
Env-Wm 2100	Collection, storage and transfer facility standards.
Env-Wm 2200	Processing or treatment facilities.
Env-Wm 2300	Composting facility standards.
Env-Wm 2400	Incineration facility standards.
Env-Wm 2500	Landfill requirements.
Env-Wm 2600	Management of certain wastes. • Asbestos (Env-Wm 2601) • Ash (Env-Wm 2602) • Batteries (Env-Wm 2603) • Infectious waste (Env-Wm 2604) • Motor oil (Env-Wm 2605) • Stumps (Env-Wm 2606) • Tires (Env-Wm 2607)
Env-Wm 2700	Solid Waste Management Districts.
Env-Wm 2800	Inspection and enforcement.

Table 7.3: Summary of Rhode Island Solid Waste Management Regulations

Regulatory Citation	Summary
Rules and Regulations for Reduction and Recycling of Commercial and Non-Municipal Residential Solid Waste	**Rule 1: Purpose** • To define what are the recyclable parts of commercial and non-municipal residential solid waste.
	Rule 5: Recyclable Materials • Aluminum • Cars • Cardboard • Glass containers • Laser toner cartridges • Leaves and yard waste • Newspaper • Plastic soft drink containers • Steel and tin coated steel cans • Telephone directories • Used lubricating oil • White goods • Wood waste These items must be segregated and kept in a condition to meet recycling standards.
	Rule 6: All commercial solid waste must be segregated, a record must be kept of the total waste generated and amounts and types of recyclable materials segregated.
Rules and Regulations for Reduction and Recycling of Commercial and Non-Municipal Residential Solid Waste	**Rule 7:** All companies with 50 or more employees, who generate solid waste, must submit a Source Reduction and Recycling Plan to RI DEM. Annual reports are due to RI DEM by March 1 of each year.
Rules and Regulations for Solid Waste Management Facilities, April 1992, Regulation DEM-DAHM-SW03-92	These regulations cover the proper management of solid wastes by landfills, incinerators, transfer stations, etc. In general, Rhode Island facilities must have their wastes segregated and recycled as appropriate. Recyclable waste haulers employed by National Grid in Rhode Island provide a summary of recyclable materials transported off-site for recycling.

Table 7.4: Summary of Vermont Solid Waste Management Rules

Regulatory Citation	Summary
Solid Waste Management Rules, 6-101	**Purpose:** To establish procedures and standards to protect the public health and environment by ensuring safe, proper and sustainable management of solid waste in Vermont.
Solid Waste Management Rules, 6-301	Applicability. These rules apply to: • Storage of solid wastes; • Transfer stations; • Transportation; • Incineration; • Landfills; • Recycling operations; • Composting; or • Other solid waste disposal.
Solid Waste Management Rules, 6-301	Exemptions. The following are exempt from Solid Waste Management Rules: • Earth materials from extractions operations • Small volumes (<1 cubic yard) of: - Wastes that are composted - Wastes that pass prequalifying tests in 6-702(a)(10) - Wastes that do not contain chemical contaminants above applicable standards listed in 6-702(a)(10) • Recyclable materials • Insignificant Waste Disposal Event (IWDE) that will not result in a threat to public health and safety, the environment or create a nuisance; written approval needed for IWDE
6-302	Prohibitions.
6-801	Special wastes: • Asbestos waste • Infectious waste
6-1100	Composting and composting certifications.

Table 7.5: Summary of New York Solid Waste Management Regulations, 6 NYCRR Part 360	
Regulatory Citation	**Summary**
6 NYCRR Part 360	**Authority:** Statutory authority: Environmental Conservation Law, Sections 1-0101, 3-0301, 8-0113, 19-0301, 19-0306, 23-2305, 23-2307, 27-0101, 27-0106, 27-0107, 27-0109, 27-0305, 27-0703, 27-0704, 27-0705, 27-0911, 27-1317, 27-1515, 52-0107, 52-0505, and 70-0107
6 NYCRR Part 360-1.1(a)	**Purpose:** The purpose of this Part is to regulate solid waste management facilities.
6 NYCRR Part 360-1.1(b)	**Applicability:** All solid waste other than low-level radioactive waste and NARM waste as defined in Part 382 of this Title which is required to be disposed of at a land disposal facility subject to regulation under Parts 382 and 383 of this Title and other than hazardous waste as defined in Part 371 which is required to be managed at a facility subject to regulation under Part 373 or 374 of this Title must be transferred, processed, recovered, stored, reclaimed or disposed of in a manner consistent with this Part. However, the management of nonhazardous solid waste in a portion of a facility that also handles hazardous waste is subject to the requirements of Part 373 of this Title unless exempted under that Part. Any facility authorized under Part 373, 374, 382 or 383 of this Title is not regulated under this Part. Regulations governing collection and transportation of industrial-commercial waste, waste tires, regulated medical waste, septage, sludges, and used oil are set forth in Part 364 of this Title; however, disposal activities involving those wastes are regulated under this Part and Parts 373 and 374 of this Title.
6 NYCRR Part 360-1.2 - Definitions	Solid waste means, except as described in paragraph (4) of this subdivision, any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 USC 1342, as amended (86 Stat. 880), or source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923) except as may be provided by existing agreements between the State of New York and the government of the United States (see section 360-1.3 of this Part).
6 NYCRR Part 360-1.5	Prohibited disposal.
6 NYCRR Part 360-1.7	Permit requirements, exemptions and variances.

8.0 MEDICAL AND INFECTIOUS WASTE

Special regulatory requirements apply to the management of medical and infectious wastes because of the potential of the waste to contain contagious agents, such as viruses. The risk of an individual being infected by medical waste can be reduced to a very low level if safe work practices are followed, exposures are promptly reported, and medical care and counseling is obtained if exposure does occur. This chapter provides information regarding management of medical and infectious waste for disposal. Contact a safety representative for information regarding safe work practices and notification procedures should an exposure occur.

8.1 Definitions

Medical and infectious wastes are defined as wastes which may cause or significantly contribute to an increase in mortality or a serious irreversible or incapacitating reversible illness, and pose a hazard to human health or the environment when improperly treated, stored, transported or disposed.

Medical and infectious wastes include:

1. **Human Blood, Body Fluids, and Blood Products**
   - Liquid waste human blood or body fluids;
   - Products of blood;
   - Items saturated and/or dripping with blood;
   - Waste materials that were at one time saturated/dripping with blood but are now caked with dried blood (i.e., gauze, bandages, etc.).

2. **Sharps**
   Discarded medical articles that may cause puncture or cuts, including needles, syringes, scalpels, etc.

3. **Other Medical and Infectious Wastes**
   Wastes from human patient care that were in contact with infectious agents or bodily fluids, including soiled dressings, sponges, surgical gloves, etc.

8.2 Massachusetts

Regulatory Overview

The Massachusetts Department of Public Health (DPH) regulations 105 CMR 480.00 establish requirements for the handling and disposal of medical and biological waste in Massachusetts.

Packaging and Storage

1. Waste generators must contain and store medical waste at all times in leakproof, rodent-proof, flytight containers which ensure that no discharge or release of such waste occurs and that no odor or other nuisance is created.

2. All on-site storage containers shall be held in an area away from general traffic, preferably in a room identified for this purpose. The manner of storage must restrict access or contact with the waste to authorized persons only.

3. Sharps must be segregated from other medical wastes in a leakproof, rigid, puncture-resistant, shatterproof container.

4. All other medical wastes must be placed in a non-permeable, three millimeter or thicker, polyethylene bag which is securely sealed to eliminate leaks.

5. Waste must not be compacted or ground up.

Labeling

1. Every container or bag of waste must be distinctively marked with the international biohazard symbol and colored red to indicate that it contains waste and, in the case of sharps, be distinctively labeled to indicate that it contains sharp waste capable of inflicting punctures or cuts.

2. Every container or bag of waste to be transported off the premises for disposal must be rigid, leak resistant, impervious to moisture, sealed to prevent leakage, and of sufficient strength to prevent tearing or bursting under normal conditions of use and handling.

3. Every container or bag of waste to be transported off the premises for disposal must have a label which states the name, address and telephone number of the generator. The label must be affixed securely.

Transportation/Disposal

1. Generators must prepare manifests prior to shipping waste. The manifest must include the following information:

   a. Description of waste to be shipped;
   b. Total quantity of waste;
   c. Type of container in which waste is transported.

2. The generator must designate on the manifest the address of the site to which the waste is to be delivered and sign it. The transporter must sign the manifest to indicate that the transporter has received the waste and will comply with the generator's transportation instructions. When the waste arrives at the approved off-site disposal facility, and has been disposed of, the disposal facility owner must sign the manifest and return the original to the generator.

3. If the generator does not receive the manifest from the disposal facility within 30 days after shipment of the waste by the generator, the generator must report this fact to the DPH.

4. The generator must maintain a copy of the manifest, both as initially sent out and as returned by the disposal facility, for a period of 3 years.

8.3 Rhode Island

Regulatory Overview

The Rules and Regulations Governing the Management and Disposal of Regulated Medical Waste in Rhode Island are promulgated pursuant to the authority conferred under Chapter 23-19.12 of the General Laws of Rhode Island, as amended, and are established for the purpose of adopting standards for the handling, transportation, treatment, and disposal of medical wastes.

Packaging and Storage

1. Medical wastes must be segregated from the general waste stream into two groups: "Sharps" and "Other regulated medical wastes."

2. All medical wastes must be stored in containers that are rigid, leak-resistant, impervious to moisture, of a strength sufficient to prevent tearing or bursting under normal conditions, and sealed to prevent leakage.

3. In addition, sharps must also be stored in containers that are puncture-resistant. The sharps must be placed directly into the container without recapping, clipping bending or breaking.

4. Sharps containers must be sealable in a manner that prevents spillage of contents during transport.

5. For "other regulated medical wastes," including materials saturated with blood, waste must be packaged in either rigid containers that are designed to be tightly sealable or in plastic bags that are:

   a. Impervious to moisture and tear-resistant;

   b. Colored a distinctive red or orange; or clear/transparent (if the bag is transparent, then the universal biohazard symbol shall be appropriately displayed on the bag);

   c. If the bag is less than 3 millimeters thick, then double-bagging is required.

6. Wastes must be stored in a predesignated location, and protected from rain, snow wind, etc.

7. On-site storage areas must be restricted to authorized personnel only. Outdoor storage areas (dumpsters, trailers, etc.) must be locked.

8. Waste must be stored in a manner that makes it rodent-proof and insect-proof.

9. The storage area must be clearly identified as containing regulated medical waste through the posting of a universal biohazard sign or a sign containing the following wording: "Medical Waste or Regulated Medical Waste."

10. Waste must be maintained in a non-putrescent state. Total storage of regulated medical waste must not exceed 50 pounds or the average quantity of regulated medical waste generated over 5 consecutive calendar days, whichever condition allows for storage for the longer period of time.

11. Medical waste must not be compacted or ground up.

Labeling

1. All packages or containers of medical waste must be provided with a water-resistant label affixed or printed on the outside of the container. The label must include the words "Medical Waste", or display the universal biohazard symbol.

2. The outermost surface of each package or container must be marked before shipment with indelible lettering on a water-resistant ID tag of sufficient dimension and contain the following:

   a. Generator's name and address;
   b. Transporter's name and Permit Number;
   c. Date of shipment;
   d. Identification of contents as medical waste.

3. If the generator has used inner containers, including sharps containers, each inner container must also be provided with the aforementioned information (excluding transporter info).

Transportation/Disposal

1. Generators must use a transporter who has been issued a Rhode Island Regulated Medical Waste Transporter Permit number by the Rhode Island DEM.

2. Generators do not need to use a permitted transporter when transporting waste from the original generation point to a central collection point, or between satellite facilities, provided they meet all of the following conditions:

   a. Waste is transported by the generator in a company-owned vehicle;

   b. The central collection point is owned by the generator;

   c. A variance is applied for with the RIDEM, as per Section 18.00;

   d. The generation point and collection point are located in RI;

e. A shipment log is compiled and maintained at each generation point (if possible) and central collection point.

3. Generators must prepare tracking forms, available through RIDEM, unless an exemption is applied for as noted in Section 13.02(b). With tracking forms, the generator shall:

   a. Provide one copy to each transporter, one copy to each intermediate handler, two copies to the destination facility, and one copy for file;

   b. Sign the certification statement on the tracking form;

   c. Obtain the handwritten signature of the initial transporter and include the date of acceptance on the form; and,

   d. Retain one copy.

4. Generators must retain both copy #4 and the completed generator copy #1 of each signed tracking form for at least 3 years from the date the waste was accepted for disposal.

5. If a Small Quantity Generator exemption from the tracking forms is applied for and granted, generators must comply with the recordkeeping requirements in 13.05(b), 13.05(c), and 13.07.

6. If signed copies of the tracking forms are not returned to the generator within 35 days, the generator must contact the transporter and destination facility to determine the status of the waste.

7. The generator must submit an Exception Report to the Director if a completed copy of the tracking form is not received within 45 days of shipment of the waste. See 13.06(b) for details.

8.4 New Hampshire

Regulatory Overview

Infectious waste is a subcategory of the broader medical waste stream. In New Hampshire, it is defined as any waste which, because of its infectious nature, may cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed or otherwise managed. It is regulated as a solid waste under New Hampshire RSA Chapter 149-M and the New Hampshire "Solid Waste Rules" (reference Part Env-WM 2604), with special treatment and disposal standards.

Packaging and Storage

1. The waste must be stored in a pre-designated location, protected from water, rain and wind.

2. Waste must be maintained in a non-putrescent state, using refrigeration when necessary.

3. Waste must not be stored at room temperatures in excess of 72 hours.

4. Outdoor storage areas containing the waste, such as dumpsters, sheds, trailers, etc, must be locked to prevent unauthorized access.

5. Access to on-site storage areas must be limited to authorized persons.

6. Waste must be stored in rodent-proof, insect-proof containers.

7. Storage containers and packaging must be of sufficient structural integrity to ensure that the waste is not released to the environment during storage.

8. Storage containers and packaging must be labeled conspicuously in a legible manner with the words “infectious waste” or “biohazard waste” or with the universal biohazard symbol.

9. The contents of damaged or ruptured containers must be repackaged.

10. Waste must not be compacted or ground up.

11. Facilities which receive infectious waste from off-site generators must not store the waste in excess of 7 days from the date of receipt.

12. Sharps transported for disposal must be segregated and encased inside rigid, puncture-resistant containers.

13. Medical waste and sharps containers must be placed in a sealed nonpermeable 3 millimeter polyethylene bag or equivalent, which is then placed in a second 3 mil bag and sealed.

Labeling

1. Bags must be labeled with the following:

    a. Clear markings indicating the contents including the words “Infectious Waste,” or “Biohazard Waste,” or the universal biohazard symbol;

    b. The name, address and telephone number of the generator and transporter.

Transportation/Disposal

1. Infectious waste must not be landfilled in New Hampshire unless treated to achieve the standard specified in Env-WM 2604.03(a).

2. The generator must assure that the waste is treated at an authorized facility to achieve high-level disinfection plus the required reduction of Bacillus subtilis or Bacillus stearothermophilus.

8.5 New York

Regulatory Overview

The New York State Department of Environmental Conservation (NYSDEC) regulates medical waste as a solid waste. The standards for the tracking and management of medical waste are provided in 6 NYCRR Part 364.9.

Packaging and Storage

1. Medical waste must be segregated by type: sharps, fluids, and other regulated medical waste.

2. If other types of solid waste are mixed with medical waste, the entire mixture must be treated as a medical waste and handled in accordance with the regulations.

3. Medical waste, other than sharps, must be contained in red bags which are impervious to moisture and will not rip, tear or burst under normal conditions of usage and handling. The bags shall be secure so as to prevent leakage during storage, handling or transport.

4. Sharps must be contained in leak-proof, rigid, puncture-resistant containers which are secured to prevent the loss of the contents. The containers must be red and conspicuously labeled with the word(s) "infectious" or "regulated medical waste."

5. Before medical waste is transported from a facility for disposal, the waste should be placed in disposable or reusable containers such as pails, cartons, drums or portable bins. The containers must be leak-proof, have tight fitting covers, and be kept clean and in good repair. If a container has visible signs of contamination, it should be decontaminated. If decontamination is not possible, the container must be labeled, marked and disposed of as a medical waste as well. In addition, all non-rigid packaging and inner liners must be treated as medical waste.

6. Medical waste must be stored in a location that is protected from the environment and limits exposure to the public. Access to the storage area should be limited to authorized employees only. Medical waste should be stored in a manner that would not cause decomposition, using refrigeration when necessary. Outdoor storage areas must be locked to prevent unauthorized access.

Labeling

1. When preparing medical waste to be shipped for disposal, the outermost container must be marked with a water-resistant identification tag containing the following information: generator's name and address; transporter's name; transporter's State permit or identification number, or if not applicable, then transporter's address; date of shipment; and, identification of the contents as medical waste.

2. Inner containers (red bags, sharps containers, fluid containers, etc.) must be marked with indelible ink or imprinted with water-resistant tags containing the following information:

generator's name and address. In addition, sharps containers must be labeled as "infectious" or "regulated medical waste."

Transportation/Disposal

1. The requirement to use a permitted transporter is waived in the event that medical waste is transported for consolidation to central company locations. For example, if a company nurse generates regulated medical waste at a service center, the medical waste can be transported to a central collection facility (i.e., Syracuse, Buffalo, or Albany offices) by the Company nurse. Two pages of the New York State Medical Waste Tracking Form (available from the NYSDEC) must be prepared and carried with each load. The Medical Waste Tracking Form must be kept for a minimum of three (3) years as a record of the shipment.

2. The generator is responsible for determining the quantity of medical waste generated in a calendar month and the quantity of medical waste transported or offered for transport for disposal in a calendar month.

3. When medical waste is transported for disposal, the following requirements apply;

   - A transporter authorized by the New York State Department of Environmental Conservation to transport medical waste must be used. Company personnel should ensure that the transporter has a current and valid permit to haul medical waste prior to transporting the waste.

   - The generator must prepare a Medical Waste Tracking Form and sign the certification statement on the form by hand. The form must be completed by the initial transporter with a handwritten signature and date of acceptance. One copy of the form is retained by the generator, one copy is provided to the transporter, one copy to each intermediate transporter, if applicable, and two copies are provided to the disposal facility.

4. The disposal facility is responsible for signing and dating the Medical Waste Tracking form to certify that the medical waste listed on the form was received. A signed copy of the form must be returned to the generator within 15 days of the delivery. If there is a discrepancy (such as number of containers, packaging that is broken, etc.), the disposal facility must attempt to resolve the discrepancy with the generator. If the discrepancy is not resolved, the disposal facility must submit a letter to the New York State Department of Environmental Conservation within 15 days of the delivery describing the discrepancy and attempts to reconcile it.

5. If the generator does not receive a Medical Waste Tracking Form that is signed by the owner or operator of the disposal facility within 35 days of the date the shipment was accepted by the initial transporter, the generator is responsible for determining the status of the waste. The generator should contact the disposal facility, initial transporter, and intermediate transporters, as appropriate, to determine the location of the waste.

6. If the generator does not receive a Medical Waste Tracking Form that is signed by the owner or operator of the disposal facility within 45 days of the date the shipment was accepted by the initial transporter, the generator must submit an exception report to the New York State Department of Environmental Conservation. The exception report must be postmarked on or before the 46th day and must include the following information:

   - Copy of the original tracking form for which the generator does not have confirmation of delivery.

   - Cover letter signed by the generator explaining the efforts taken to locate the medical waste and the results of those efforts.

7. The regulations specify that the generator maintain Medical Waste Tracking Forms for a minimum of three (3) years from the date the waste was accepted by the initial transporter. The generator must also maintain exception reports submitted to the New York State Department of Environmental Conservation, as described in the previous section, for a period of at least three (3) years from the due date of the exception report.

9.0 MANHOLE, VAULT AND SECONDARY CONTAINMENT SLUDGE/SEDIMENT WASTE MANAGEMENT

This section describes how the sludge and debris removed from underground structures (e.g., manholes, underground vaults, and secondary containment areas) shall be managed to maintain compliance with hazardous waste management requirements. For information on management of water accumulated in manholes, vaults and secondary containment structures, refer to EP No. 7.

In addition to the possible presence of lead as discussed below, other possible contaminants associated with electrical operations which may be present in the sludge/sediments include asbestos, PCBs, oil. Subsurface structures located in the vicinity of 3rd Party contaminated sites may also contain contaminates which migrated into the structure.

9.1 Asbestos

If the presence of asbestos is of concern due to historical information or visual observations, a sample of the sludge/sediment should be collected for laboratory analysis. If the concentration is greater than 1%, the waste must be managed as an asbestos waste and the removal of the sludge/sediment may need to be performed as an asbestos abatement. Refer to Chapter 11 of this procedure.

9.2 PCBs/Oil

Structures which contain or previously contained oil-filled equipment could potentially be impacted from spills of oil which may contain PCBs. A sample should be collected and analyzed for PCBs. If the source of the PCBs is not known, then sample results greater than 1 ppm PCB should be managed in accordance with state-specific hazardous waste and federal TSCA regulations. PCB wastes, B-series wastes in New York, are restricted from land disposal and require a land disposal restriction form along with the usual hazardous waste manifest. Additionally, the structure may need to be managed in accordance with "Continued Use of Porous Surfaces" requirements contained in 40 CFR 761.30(p). For samples with results < 1 ppm PCB or < 50 ppm PCB where the source PCB concentration is known to be < 50 ppm PCB, the sludge/sediment should be managed as oily debris. Refer to Environmental Procedure No. 5 for additional information on spill response requirements.

9.3 3rd Party Contaminated Site Impacts

Subsurface structures located in the vicinity of 3rd party contaminated sites have the potential to be impacted by contaminant migration from these sites. Contaminant migration could occur either through groundwater flow of surface erosion. If such a condition is believed to exist, it is recommended that a file review be conducted with the appropriate regulatory agency to determine site conditions.

9.4 Lead

Structures which contain (or contained) lead covered cable have the potential to have lead contamination in the sludge/sediment. This section does not apply to more recently constructed underground structures that contain only plastic- or rubber-covered cable, and never contained lead-covered cable. Structures containing primarily demolition type debris (e.g., bricks, concrete, and wood) the debris - **but NOT the sludge** - may be managed as non-hazardous solid waste.

Analysis of sludge samples taken from manholes in districts with older underground systems has shown that some of these samples may fail the *Toxicity Characteristic Leaching Procedure* (TCLP) metals test for lead (e.g., exceeding the 5.0 ppm regulatory limit). Note that in New York, historical analysis of sludge samples from manholes in urban underground systems has shown that the majority of these samples do not exceed the TCLP threshold.

When classifying the sludge for disposal, the following management options exist:

Option 1:
Assume all the sludge is lead contaminated and manage it as hazardous waste. Note that either a temporary EPA ID Number must be obtained or the EPA ID Number from a company service center used. Refer to Chapter 3 of this procedure for information regarding the use of EPA ID Numbers.

Option 2:
Collect a composite sample of the sludge and arrange for a TCLP lead analysis. (The cost of a TCLP lead analysis is about $100.)

Based on the quantity of material to be removed, a roll-off container, drum or vactor truck may be used. Generally it is more cost effective to use a roll-off container when more than 2.5 yards (~ 10 drums) of material requires management.

If the waste is either assumed to be a lead hazardous waste or the laboratory results exceed the TCLP threshold, be aware that lead wastes (D008), B-series wastes in New York, are restricted from land disposal, and require a land disposal restriction form along with the usual hazardous waste manifest. Any other debris in the underground structure that is contaminated with sludge (including pieces of wood, tyvek suits, tyvek boot covers, rubbish, etc.) should be placed in the drums along with the sludge.

10.0 INVESTIGATION AND REMEDIATION WASTE MANAGEMENT

This chapter provides guidance regarding the management of waste generated as the result of environmental investigation and remediation activities. Investigation-derived waste (IDW) refers to waste generated during investigation activities, such as during drilling of soil borings and installation of monitoring wells. Remediation waste refers to waste that is generated during remediation activities, such as excavation of contaminated soils for reuse on-site or disposal, and removal of contaminated ground water or non-aqueous phase liquid (NAPL). The two terms are also used interchangeably in some circumstances. For example, IDW can be characterized as remediation waste for disposal purposes.

10.1 General Requirements For On-site Management of All Wastes

The following general requirements should be implemented for purposes of storing wastes:

- Wastes must be stored within a secure area. Storage of wastes in non-secure areas may be considered as a last resort and evaluated on a case-by-case basis.
- Wastes should be stored in a manner that protects the environment from contamination. In certain instances, storage of wastes directly upon the ground may be appropriate for wastes stored within an Area of Contamination. This may involve the use of drums, roll-off containers or poly sheeting beneath and covering soil piles. The poly sheeting must have a minimum thickness of 6 millimeters (10 ml in Rhode Island). In all cases, the sheeting should be of sufficient strength and weighted on top to prevent tearing by the wind).
- To the extent practicable, wastes should not be stored near wetlands, surface water, water supply wells, playgrounds or other sensitive receptors.
- The amount of time that wastes are stored on-site prior to off-ship shipment should be minimized to the extent feasible. Most states have time limits on storage.
- The wastes must be labeled in accordance with applicable regulatory requirements.
- Whenever possible, movement or aeration of waste should be limited to those activities necessary to manage the stockpiles.

10.2 Investigation-derived Wastes

IDW typically includes groundwater monitoring well development and purge water, soil boring cuttings, and used personal protection equipment (PPE). These wastes are typically placed in 55-gallon drums for management. In addition to the general requirements listed above, the following should also be followed for investigation-derived wastes:

- The contents of each container (e.g., drill cuttings, well purge water, used PPE) should be written on it at the time the container is filled. This information may be needed for waste characterization purposes.
- When feasible, the drums should be stored together in a single location on a site instead of being left separately at each waste drum's point of generation.

- It may be appropriate to consider on-site re-use of investigation-derived wastes such as drill cuttings, well purge water, and test pit excavate, if allowed by State and/or Federal regulations. Follow these guidelines in re-using:

    - Do not re-use the soil in such a way that a stockpile is created.
    - Compact re-used soils properly to prevent settlement and erosion.
    - Do not make soil contamination conditions worse in reusing the soil. For example, dispose of waste at the source area, and do not place contaminated soil from the subsurface near ground surface.
    - If soil is reused on site under a capped/paved surface, restore the surface.
    - Do not reuse contaminated soils in clean areas of the site; re-use the soil in a similarly contaminated area.
    - For test pits, return the soil to the pit in generally the same order it came out.
    - Reuse well development/purge water at the point of withdrawal or upgradient of the point of withdrawal.

Refer to state-specific guidance to determine specific requirements for managing IDW. It should be noted that IDW requirements in NY are contained in the NYSDEC-approved work plans.

10.3 Remediation Waste/IDW Management

Federal

Handling of hazardous waste at sites subject to remediation may be subject to less stringent standards. At the federal level, the management of waste at Superfund sites is discussed in OSWER Directive No. 9347.1-02 (April 17, 1989). Further clarification was provided in an October 14, 1998 memo from the Acting Assistant Administrator for Solid Waste and Emergency Response and Assistant Administrator for Enforcement and Compliance Assurance to RCRA/CERCLA Senior Policy Managers Regional Counsels. This memo states, "In what is typically referred to as the area of contamination (AOC) policy, EPA interprets RCRA to allow certain discrete areas of generally dispersed contamination to be considered RCRA units (usually landfills). Because an AOC is equated to a RCRA land-based unit, consolidation and *in situ* treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation for purposes of RCRA."

Management of waste generated during waste site investigation and remediation is specifically addressed in the site work plan. Work plans are reviewed and approved by regulators in NY and RI.

New York

NYSDEC TAGM #4032 contains specific guidance on the management of IDW. The guidance provides the options for the management of drill cuttings and spoil, and allows for on-site disposal provided that site conditions are not exacerbated by the on-site disposal activity.

Rhode Island

The Rhode Island Department of Environmental Management's (RI DEM) Policy Memo 95-01 *Guidelines for the Management of Investigation Derived Wastes* provides guidance on management of wastes from investigations and interim remedial activities. Items of note in the Policy memo are as follows:

- While solids generated during investigations may be placed back into their excavation, while they out of the excavation they must be placed on poly sheeting (> 10 mil) if less than 48 hours or into containers if a longer period of time.
- Non-decontamination liquids may be returned to the site if < 250 gallons and laboratory analysis demonstrates that groundwater quality standards are met.
- Wastes should be stored in accordance with RI DEM's Hazardous Waste Regulations if the waste is deemed to be hazardous or in accordance with this policy if non-hazardous.
- Wastes associated with PPE and decontamination must be sent for off-site disposal.

Massachusetts

Remediation waste generated in Massachusetts is regulated under the Massachusetts Contingency Plan at 310 CMR 40.0030. The MCP requires that remediation waste is managed in a manner that provides equivalent protection to the requirements contained in the Massachusetts hazardous waste regulations. Site-specific conditions will dictate the level of protection that is feasible. For wastes generated at company-owned operating facilities such as a Service Center, the wastes should be stored indoors, if feasible, preferably in a hazardous waste storage area.

Pursuant to 310 CMR 40.0033, remediation waste may be stored for longer than the 90-day time limit specified in the state hazardous waste regulations (310 CMR 30.000), provided that the storage complies with the management requirements of 310 CMR 30.000 and the following information is provided in the next required MCP response action submittal: the type, quantity and generation rate of the waste; justification for storage for longer than 90 days, and a projected timeline for storage of the waste.

New Hampshire

New Hampshire hazardous waste regulations provide an exemption for oily debris associated with spill cleanup activities as well as for oil which will be burned for energy recovery. Use of these two exemptions will result in most investigation derived wastes being exempted from management as a hazardous waste. Env-Ws 412.17 discusses the requirements for soil storage on-site.

11.0 ASBESTOS WASTE MANAGEMENT

Existing federal and state environmental and safety regulations govern the removal and disposal of asbestos and asbestos containing materials. The regulations are administered by the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the Massachusetts Department of Environmental Protection (MADEP), the Massachusetts Department of Labor and Workforce Development (MADLWD), the Rhode Island Department of Health (RIDOH), the New Hampshire Department of Environmental Services (NHDES), the New Hampshire Department of Health and Human Services (NHDHH), New York Department of Labor (NYDOL) and Vermont Department of Health (VTDOH).

This procedure addresses the regulatory notifications and waste management associated with asbestos abatement projects.

11.1 Definitions

Asbestos - The term asbestos describes six naturally occurring fibrous minerals found in certain types of rock formations. The asbestos minerals chrysolite, amosite, and crocidolite have been the most commonly used in building products because of fire resistant and insulating properties. Asbestos minerals separate into microscopic fibers when present in the air and it has been determined that there are adverse health effects associated with exposures to these fibers.

Asbestos Containing Material (ACM) - Any material containing more than one (1) percent asbestos. Asbestos or asbestos containing material may include thermal insulation, transite pipes, transite panels, floor tiles, ceiling tiles, gaskets, cables, wires, siding, cement panels, roofing materials and surfacing materials (decorative or acoustical plaster or other materials on ceilings, concrete slabs, or decking and fireproofing materials on structures).

11.2 Training

Training is required for all employees who conduct asbestos related activities. No employee may conduct asbestos related activities without the appropriate level of training regardless of whether or not it is an emergency.

11.3 Notifications

All emergency work that may involve activities that may disturb ACM must be communicated to the Company Environmental Engineer by the next working day (not required in NY). Information provided must include: the type of work; the type and quantity of material; and the group who will perform (or performed) the work (i.e., outside contractor or appropriate underground department).

Copies of any asbestos notification forms that have been submitted to outside agencies shall be submitted to the Company Environmental Engineer within 3 working days of the submission.

Asbestos Blanket Plan Notifications (Massachusetts Only)
Each year an application must be submitted to the MADEP for each district for DEP approval of planned demolition/renovation operations during a twelve-month period. Only small-scale asbestos abatement projects (< 10 linear ft./< 25 sq. ft.) qualify under the Blanket Plan. Refer to each District Asbestos Removal Blanket Notification approval document for specific details.

Contractor Notification

Contractors must be notified prior to working near asbestos containing material in accordance with the Company O & M Program.

Regulatory Agency Notifications
Notifications to regulatory agencies shall be submitted by the supervisor in charge of the project according to the requirements identified in Attachment 1. In the event a contractor is hired for the project and he or she completes the required notification(s), the supervisor must obtain copies of the notifications before the job begins and ensure that the proper notification forms have been submitted. Additionally, he/she must ensure that one copy of the notification form is submitted to the Company Environmental Engineer.

11.4 Storage

Asbestos waste may be either collected from the site of generation or temporarily stored at a company facility until transported to an approved facility. Before asbestos is placed into storage, it must be adequately wetted, double bagged (6 millimeter poly) and sealed. The bags should be placed into metal or fiberglass drums or into a locked, roll off container. The bags and containers must be labeled. The labels must state:

Danger
Contains Asbestos Fiber
Avoid Creating Dust
Cancer and Lung Disease Hazard

Asbestos is considered a "Special Waste" and must be stored in an area separate from the hazardous waste area. There are no time limits for accumulation.

11.5 Transportation & Disposal

A completed company Asbestos Removal & Disposal Report or Bill of Lading must accompany the waste when transported from the site of generation to a company facility. It serves as the Bill of Lading and assists in tracking the waste and the company asbestos worker's hours on the

job. If a transporter collects the waste at the site of generation, the transporter's manifest or bill of lading may be used.

For all shipments to asbestos waste to a disposal location, a Waste Shipment Record (WSR) or similar form must be used. Please refer to Attachment 1 for a copy of the WSR as well as instructions on its completion. For wastes shipped under a hazardous waste manifest, a Waste Shipment Record or similar form must also be completed. The disposal facility is required to send a copy of the WRS or similar form to the Operator upon receipt at the disposal location. This copy is reviewed to determine if any waste discrepancies exist.

When the asbestos is prepared for transport to the disposal facility, two labels must be added: A Class 9 Hazardous Material Shipping Label and a shipping label stating the company name and address and the DOT shipping name, "RQ Asbestos 9 NA2212 III."

11.6 Regulatory Requirements

Refer to Tables 11.1 thru 11.5 for state-specific notification requirements.

11.7 Records

All notifications, disposal records, monitoring records, training records, etc., as identified in the applicable regulations, shall be retained for a minimum of 30 years.

11.8 Disposal

Refer to the Approved Vendor Listing on the Infonet (under the Supply Chain Management Department's web site) for a current list of National Grid-approved vendors who may receive asbestos for disposal.

11.9 Asbestos Fiber Release

In the event of an emergency release of asbestos containing material, procedures outlined in EP No. 5, Release Response and in the Company O&M Program must be followed, including the immediate notification of the Company Environmental Engineer.

11.10 References

Regulations and standards governing disturbance of asbestos exist on the Federal, State and Local level. The three primary regulations on the Federal level are:

- Environmental Protection Agency's (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61, Subpart M)
- Occupational Health and Safety Administration's (OSHA) Occupational Exposures to Asbestos (29 CFR 1910.1001)
- OSHA, Exposure to Asbestos in Construction Work (29 CFR 1926.1101)

On the State and Local level various asbestos regulations exist, primarily regarding the removal of asbestos materials.

- New York State Parts 56 of Title 12 and 73 of Title 10 of the Official Compilation of Codes, Rules, and Regulations and Applicable Variances
- Massachusetts State Parts 310and 453 of the CMR
- New Hampshire Chapter ENV-A 1800, et. al.
- Rhode Island, Rules and Regulations for Asbestos Control [R23-24.5-ASB]
- Vermont V.S.A Title 18, Chapter 26; Vermont Regulations for Asbestos Control

Local law or regulation as applicable including but not limited to New York City, Boston and other as applicable to the location.

Table 11.1
Massachusetts Requirements

Agency	Notification Quantity Thresholds	Deadline	Form	Fee Required
MADEP	Non-Blanket Jobs Any amount of ACM	10 Days Before Start of Job	ANF-001	$85 decal
MADEP	Blanket Plan Notifications <10 linear ft./25 sq. ft.	Report as required on Blanket: Submit form and decal to Boston and Regional DEP offices w/in 24 hours for each job conducted under Blanket. (E-mail or fax with follow-up paper submittal.)	ANF-001	$35 decal
MADEP	Emergency Jobs	Within 1 working day prior to the beginning of an emergency job, unless a waiver is granted by the DEP, or if <1 working day, make telephone notification with written follow-up.	ANF-001	If qualifies under Blanket Plan Notification use $35 decal: if not use $85 decal
MADEP	Additional Notifications Req'd	• when work is scheduled for widely-spaced geographical locations on the same facility; • when work is scheduled for a single facility but separated by > 1 week; and • when work is postponed by > 30 days from the date on the initial notification.	ANF-001	$85 decal
MADLWD	≥ 3 linear feet or ≥ 3 square feet	10 Days Before Start of Job	ANF-001	DEP Notification and Fees below apply to DLWD per 453 CMR 6.12 for jobs meeting DLWD threshold.

Table 11.2
Rhode Island Requirements

Agency	Notification Quantity Thresholds	Deadline	Specific Notif. Form	Fee Required
RIDOH	Spot Jobs <10 linear ft./25 sq. ft.	None Required	N/A	N/A
RIDOH	Non-Spot Jobs >10 linear ft./ >25 sq. ft.	Must first obtain RIDOH approval of Asbestos Abatement Plan: then submit 10 day start notification (No FAX allowed.) Telephone notice required when on-site preparation begins. Notification to local fire fighting authorities required in writing prior to initiating any activity. Written notice required when amount of asbestos changes by ≥ 20% or when original start date changes. (See B.2.1(e) for details.)	ASB-22	Yes
RI DOH	NA	10 days following shipment of waste – Must submit certification from disposal location or status report on why certification of disposal has not been received.	NA	No
RIDOH	Emergency Non-Spot Jobs	Obtain permission from RIDOH prior to initiating abatement. If not possible, proceed with abatement and notify RIDOH w/in 1 working day from beginning of emergency and follow-up within 10 working days with written report. (See A.4.2(b) for additional requirement.)	ASB-22	
EPA[1]	Only projects in RI ≥160 sq. ft./ ≥ 260 linear ft.	10 days and meet other RI notification requirements.	No – See RI	No – See RI

1 EPA no longer requires that a notification of NESHAPs asbestos abatement projects be submitted for projects in the States of MA, NH, CT and ME as of 1997, as long as a proper notification is submitted to the state regulatory agency.

Table 11.3
New Hampshire Requirements

Agency	Notification Quantity Thresholds	Deadline	Specific Notif. Form	Fee Required
NHDES and local Health Office	Projects > 10 linear feet or 25 square feet	10 days prior to project Must re-notify if the date of the project changes to a time outside of the start/finish dates provided in the original notice		Yes
None	Projects < 10 linear feet or 25 square feet			
NHDES	Emergency projects	Verbal notice within 24 hours; written follow-up within 48 hours		

Table 11.4
Vermont Requirements

Agency	Notification Quantity Thresholds	Deadline	Specific Notif. Form	Fee Required
VTDOH	> 10 linear ft./ > 10 sq. ft.	10 days. Amended notif./fee required w/in 24 hours if permit category increases.	Yes	Sliding fee scale. See 7.2 for details.
VTDOH	Small Scale, Short Duration ≤ 10 linear ft/ ≤ 10 sq. ft.	Within 48 hours of the activity must submit on Department form small scale short duration notification.	Yes	No fees.
VTDOH	Emergency	Within 24 hours of emergency must verbally notify VTDOH and follow-up in writing w/in 48 hours following the beginning of the emergency.	Yes	Sliding fee scale. See 7.2 for details.

Table 11.5
New York Requirements

Agency	Notification Quantity Thresholds	Deadline	Specific Notif. Form	Fee Required
NYSDOL	Minor <10 sq. ft./25 lineal ft.	None Required	N/A	N/A
NYSDOL	Large >200 lineal ft./>160 sq. ft.	10 days prior to commencement of project.		N/A
NYSDOL	Emergency Major Jobs	Notify Program Managers Office – Asbestos Control Bureau Albany NY ASAP prior to abatement. Provide written notification within 48 hrs. after the beginning of the emergency abatement.		N/A
	Asbestos wrapped coal tar pipe	Under DOL waiver File# 54-94, cases 1-14 Employees need one time awareness training	Not required	None

Attachment 1

1. Work site name and mailing address	Owner's Name	Owner's Telephone No.
2. Operator's name and address		Operator's Telephone No.
3. Waste disposal site (WDS) name, mailing address, and physical site location		WDS phone No.
4. Name and address of responsible agency		
5. Description of materials	6. Containers No. Type	7. Total Quantity; m^3 (yd^3)
8. Special handling instructions and additional information		
9. Operator's Certification: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.		
Printed/typed name and title	Signature	Month Day Year
10. Transporter 1 (Acknowledgment of receipt of materials)		
Printed/typed name and title Address and Telephone No.	Signature	Month Day Year
11. Transporter 2 (Acknowledgment of receipt of materials)		
Printed/typed name and title Address and Telephone No.	Signature	Month Day Year
12. Discrepancy indication space		
13. Waste disposal site owner or operator: Certification of receipt of asbestos materials covered by this manifest except as noted in item 12.		
Printed/typed name and title	Signature	Month Day Year

WASTE SHIPMENT RECORD INSTRUCTIONS

(Attachment to Fact Sheet WMD-ASB-14)
Waste Generator Section (Items 1-9)

1. Enter the name of the facility at which asbestos waste is generated and the address where the facility is located. In the appropriate spaces, also enter the name of the owner of the facility and the owner's phone number.
2. If a demolition or renovation, enter the name and address of the company and authorized agent responsible for performing the asbestos removal. In the appropriate spaces, also enter the phone number of the operator.
3. Enter the name, address, and physical site location of the waste disposal site (WDS) that will be receiving the asbestos materials. In the appropriate spaces, also enter the phone number of the WDS. Enter "on-site" if the waste will be disposed of on the generator's property.
4. Provide the name and address of the Local, State, or EPA Regional Office responsible for administering the asbestos NESHAP program.
5. Indicate the types of asbestos waste materials generated. If from a demolition or renovation, indicate the amount of asbestos that is:
   - Friable asbestos material
   - Nonfriable asbestos material
6. Enter the number of containers used to transport the asbestos materials listed in item 5. Also enter one of the following container codes used in transporting each type of asbestos material (specify any other type of container used if not listed below):
   DM - Metal drums, barrels
   DP - Plastic drums, barrels
   BA - 6 mil plastic bags or wrapping
7. Enter the quantities of each type of asbestos material removed in units of cubic meters (cubic yards).
8. Use this space to indicate special transportation, treatment, storage or disposal or Bill of Lading information. If an alternate waste disposal site is designated, note it here. Emergency response telephone numbers or similar information may be included here.
   NOTE: The waste generator must retain a copy of this form.
9. The authorized agent of the waste generator must read and then sign and date this certification. The date is the date of receipt by transporter.

Transporter Section (Items 10 and 11)

10. Enter name, address and telephone number of each transporter used, if applicable. Print or type the full name and title of person accepting responsibility and acknowledging receipt of materials as listed on this waste shipment record for transport. Enter the date of receipt and signature.
11. Same as above.
    NOTE: The transporter must retain a copy of this form.

Disposal Site Section (Items 12 and 13)

12. The authorized representative of the WDS must note in this space any discrepancy between waste described on this manifest and waste actually received as well as any improperly enclosed or contained waste. Any rejected materials should be listed and the destination of those materials provided. A site that converts asbestos-containing waste material to non-asbestos material is considered a WDS.
13. The signature (by hand) of the authorized WDS agent indicates acceptance and agreement with statements on this manifest except as noted in item 12. The date is the date of signature and receipt of shipment.

    NOTE: The WDS must retain a completed copy of this form. The WDS must also send a completed copy to the operator listed in item 2.

Appendix Q: Citizens Participation Plan (CPP)

Citizen Participation Plan
(100% Submission)
Patchogue Former Manufactured Gas Plant Site
Village of Patchogue
Suffolk County, New York
NYSDEC Site No. 1-52-182

Prepared for
National Grid
175 East Old Country Road
Hicksville, New York 11801

May 2019

Project Number: 149322.570

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

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List of Abbreviations

CPP	Citizen Participation Plan
DER	Division of Environmental Remediation
FER	Final Engineering Report
FS	Feasibility Study Report
IRM	Interim Remedial Measure
MGP	Manufactured Gas Plant
NAPL	Non-Aqueous Phase Liquids
NMPC	Niagara Mohawk Power Corporation
NYCRR	New York State Codes, 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
OU	Operable Unit
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PDI	Pre-design Investigation
PID	Photoionization Detector
RD	Remedial Design
RDR	Remedial Design Report
RDWP	Remedial Design Work Plan
RFP	Request for Proposal
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
SMP	Site Management Plan
SVOC	Semi-Volatile Organic Compound
UCWP	Utility Corridor Work Plan
VOCs	Volatile Organic Chemicals

Section 1

Introduction

Citizen participation is an integral component of the remedial programs being administered by the New York State Department of Environmental Conservation (NYSDEC) such as the one being undertaken at the Patchogue Former Manufactured Gas Plant (MGP) Site (hereafter referred to as the "Site), located in at 234 West Main Street in the Village of Patchogue, Town of Brookhaven, Suffolk County, New York (Figure 1-1). To facilitate the citizen participation process and enable citizens, interested individuals or organizations to participate in decisions that relate to their health and environment, this Citizen Participation Plan (CPP) has been prepared. The CPP has been prepared in compliance with the NYSDEC, Division of Environmental Remediation (DER) guidance policy (DER-23) entitled Citizen Participation Handbook for Remedial Programs dated January 21, 2010.

The CPP is a mechanism to inform and involve community residents, public and private leaders, and other stakeholders. This CPP documents the planned project-specific public outreach activities and resources organized for the remedial program associated with the Patchogue (West Main Street) Former Manufactured Gas Plant (MGP) Site.

The primary purpose of citizens' participation is to:

- Promote the development of timely, effective Site investigation and cleanup programs that protect public health and the environment;
- Improve public access to, and understanding of, issues and information related to a Site and that Site's remedial process;
- Provide citizens with early and continuing opportunities to participate in NYSDEC's Site investigation and cleanup process;
- Ensure that NYSDEC makes Site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community; and
- Encourage dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of Site and community issues and concerns, and improves decision making.

This CPP provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the Site identified above. The plan outlines a variety of communication methods that, based on applicable New York State law and New York State Department of Environmental Conservation (NYSDEC) regulations and guidance, provide for constructive communication of program activities between the stakeholders and other interested parties. This CPP includes methods intended to inform interested parties of program developments, elicit responses and public involvement, and provide a central point of contact for inquiries regarding the remedial program for the Patchogue (West Main Street) Former MGP Site. This CPP presents the planned communication and outreach activities, describes how interested individuals and groups can participate in the remedial program, and provides a variety of reference materials to facilitate gaining access to project-specific information and management personnel.

Both the NYSDEC and National Grid are committed to the implementation of this CPP as required by 6 NYCRR Part 375, applicable NYSDEC guidance (DER-23), the Order on Consent (Index No. A2-0552-0606), and the state-wide Inactive Hazardous Waste Site Citizen Participation Plan (NYSDEC, 1988). As required by 6 NYCRR Part 375-1.5, NYSDEC and National Grid will review and update this CPP to account for significant changes in the Watertown (Engine Street) Former MGP Site remedial program.

1.1 Site Background

On March 4, 2007, an Order on Consent, Index Number A2-0552-0606 was signed by KeySpan Corporation (a predecessor company of National Grid) and the NYSDEC to evaluate the nature and extent of MGP-related constituents and, where necessary, remediate the Site for the protection of human health and the environment.

1.1.1 Site Location and Setting

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 chain-link fence. The Site is generally rectangular 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.

The Site is informally divided into three areas: the Northern Area, the Central/Core Area, and the Southern Area. The Northern Area is a rectangular area comprising the northern portion of the Site, bordered by West Main Street, and is enclosed with a chain-link fence. This area is mostly clear of vegetation and 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 and where the Utility Corridor Work Plan (UCWP) was implemented. The Central/Core area is also rectangular and is enclosed by a chain-link fence. This area is vegetated primarily by grass, weeds and low brush and stone installed during the implementation of the UCWP. A steep slope runs along the western boundary of the Site. The Southern Area comprises the tapered southern end of the property. This area has considerable concrete debris and dense vegetation. The overall layout of the Site is shown on Figure 1-2.

The remedy will also be implemented at the adjacent property located at 210 West Main Street, hereafter referred to as the Off-Site Property. The Off-Site Property is bordered to the west by the Central/Core Area of the On-Site property, to the east by the Patchogue River, and to the north by 214 West Main Street. The Off-Site property, at 210 West Main Street, is owned and was formerly occupied by Above All Store Fronts, Inc., and is being leased to National Grid for the duration of remedial activities. The 210 West Main Street property covers approximately 0.80 acres. The surface is completely paved, with the exception of the narrow soil walkway east of the building. Six-foot high chain-link fencing runs along the eastern property line and separates the Patchogue River from the rest of the Off-Site Property. There is a 4-foot wide chain-link gate at the southern corner of the Off-Site Property that allows access to the Patchogue River.

1.1.2 Site History

MGP operations began in 1906 and continued throughout the 1970's. Manufactured gas consisted of heating coal and recovering the vapors to produce raw gas. Byproducts, such as coal tar, sludge, oils, ashes, contaminated wood chips used for gas purification, and other chemicals, were produced from the scrubbing systems used to clean impurities from the raw gas. These were either recycled for energy recover and chemical feedstock or disposed.

A more detailed discussion and review of the Site can be found in:

- "Decision, K-Patchogue MGP, Patchogue, Suffolk County, Site No. 152182", NYSDEC, March 31, 2011.
- "Final Remedial Investigation Report for the Patchogue Former MGP Site, Patchogue, Suffolk County, New York", as prepared by TetraTech EC, Inc. and dated December 2009 (referred to as RIR);
- "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" prepared by Vanasse, Hangen, Brustlin (VHB) and dated March 2002 (referred to as PSA);
- "Focused Feasibility Study, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk" prepared by Brown and Caldwell Associates and dated May 2011;
- "The Record of Decision (ROD), Patchogue Former Manufactured Gas Plant Site, Patchogue, New York" issues by the New York State Department of Environmental Conservation (NYSDEC) and dated March 31, 2011.
- "Remedial Design Work Plan, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York" (Brown and Caldwell Associates, February 2012);
- "Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182" (Brown and Caldwell Associates, February 2012); and
- "Remedial Design Report (50-75% Submittal) NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York." (Brown and Caldwell Associates, December 2012)
- "Explanation of Significant Differences, K – Patchogue MGP Site, Village of Patchogue, Suffolk County, Site No. 152182", (NYSDEC, October 2017).

1.1.3 Regulatory History

A Preliminary Site Assessment Report for the Patchogue Former MGP Site was prepared under an Order of Consent D1-0001-99-05. On March 4, 2007 KeySpan Corporation (a predecessor company of National Grid) signed an Administrative Order on Consent [index number A2-0552-0606 (the Order)] which superseded the previous order. The Decision Document for the Site, specifying the selected remedy was issued by the NYSDEC in 2011 ("Decision, K-Patchogue MGP, Patchogue, Suffolk County, Site No. 152182", NYSDEC, March 31, 2011.). The Site Remedy was subsequently modified as described in the NYSDEC "Explanation of Significant Differences, K – Patchogue MGP Site, Village of Patchogue, Suffolk County, Site No. 152182", October 2017 (ESD).

1.1.4 Investigation Summary

Several investigations were conducted at this Site in order to identify the nature and extent of MGP-related impacts. The first Site investigation was a Preliminary Assessment under the direction of the U.S. Environmental Protection Agency (USEPA) in 1986 and it was concluded that no further action on the Site was required. A final preliminary assessment report was submitted to the NYSDEC by Vanasse, Hangen, Brustlin (VBH) under the direction of the NYSDEC in March 2002. The preliminary assessment

found wastes associated with industrial use and materials related to former MGP operations including subsurface structures. The investigation identified impacts to surface soils, groundwater, sediments, surface water, and soil gas.

A focused feasibility study was conducted by BC and a report was submitted in February 2011 to address the environmental impacts at the Site. This study involved drilling soil borings, installing monitoring wells, excavating pits, probing river sediments and river bank soils, and sampling environmental media. An initial pre-design investigation (PDI) activities led to an agreement between the NYSDEC, National Grid, and BC that additional delineation to further define the horizontal and vertical extent of MGP-related impacts at the Site would be beneficial for a remedial alternative. The field activities are described in a report entitled Remedial Design Report (RDR).

1.1.5 Interim Remedial Measures

This section summarized the interim remedial measures (IRMs) and other related remedial activities previously conducted at the Site.

In order to implement a full-scale remedy, overhead lines located at the Site needed to be relocated from the eastern side of the Site to the western side to allow for overhead clearance of construction equipment and to prevent the undermining of the utility poles during remedial activities. To facilitate this move, an “Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1-52-182” was prepared by Brown and Caldwell Associates and submitted to the NYSDEC on February 8, 2012. The NYSDEC approved the draft UCWP in a letter dated February 9, 2012.

The remedial activities on the western side of the Site were implemented in June-July, 2012 to create a “utility corridor” in which the utility poles and overhead lines were reinstalled prior to the implementation of the remedial activities for the remainder of the Site. National Grid addressed impacted soils identified in the northwestern corner of the Site (around MW-2 cluster) as well as those that required capping on the western side of the Site by means of excavation and off-Site disposal.

Documentation of the implementation of the Utility Corridor Work Plan is presented in the “Construction Completion Report, Utility Corridor Work Plan Implementation, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York” prepared by Brown and Caldwell Associates and dated December 2012.

Section 2

NYSDEC Investigation and Cleanup Process

New York's State Superfund Program (SSF) identifies and characterizes suspected inactive hazardous waste disposal Sites. Sites that pose a significant threat to public health or the environment, such as the Site identified above, undergo a process of investigation, evaluation, cleanup, and monitoring.

The New York State Department of Environmental Conservation (NYSDEC) administers the SSF Program with assistance and input from the New York State Department of Health (NYSDOH). When the parties responsible for the contamination of the Site are known (National Grid), they often pay for or perform the investigation and evaluation of cleanup options under an enforceable consent order. At Sites where responsible parties cannot be found or are unable or unwilling to fund an investigation, the State pays for the investigation and may try to recover costs from a responsible party after the investigation and cleanup are complete. The SSF program contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. The following subsections detail the investigation and cleanup process.

2.1 Investigation

A detailed study of the Site is performed under the oversight of the NYSDEC and NYSDOH. This detailed study is officially called a Remedial Investigation. The investigation work plan is officially called a Remedial Investigation Work Plan and is available for public review at the Document Repositories identified in Sections 4 and 5.

The Site investigation has several goals:

1. Define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
2. Identify the source(s) of the contamination;
3. Assess the impact of the contamination on public health and the environment; and
4. Provide information to support the development of a proposed remedy to address the contamination.

NYSDOH reviews and recommends activities that will be performed during the investigation to ensure that a complete picture of potential health impacts is understood. Such activities include identifying the ways contamination can reach people, such as through direct contact, eating, drinking, or breathing.

The information collected during the Site investigation is summarized in a report.

2.2 Feasibility Study

After the Site investigation has begun, a Feasibility Study is conducted under the oversight of the NYSDEC. This study uses information developed during the Site investigation to develop and evaluate potential ways to clean up contamination related to the Site. Another possibility is that the information collected during the Site Investigation may support the conclusion that no action, or no further action, is needed to address Site-related contamination.

2.3 Proposed Remedy

The evaluation of possible remedies ends with a recommended proposal to eliminate the threat posed by contaminants at the Site. NYSDEC approves or prepares this proposal, officially called a Proposed Remedial Action Plan (PRAP). The PRAP describes the remedy preferred by NYSDEC, or a no action or no further action alternative. The PRAP summarizes the decision that led to the recommendation of the preferred remedy by discussing each alternative and the reasons for choosing or rejecting it. The goal of any cleanup plan is to protect public health and the environment. NYSDEC will present the PRAP to the public for its review and comment during a 30-day comment period and at a public meeting.

2.4 Selected Remedy

NYSDEC considers public comments as it selects the remedy to address contamination related to the Site. The selected remedy will be described in a document officially called a Record of Decision (ROD). The ROD will explain why the remedy was selected and respond to public comments. This document will be placed in the location of reports and information. If the selected remedy is no action or no further action, NYSDEC may then take steps to reclassify the Site or remove the Site from its list of contaminated Sites.

2.5 Cleanup Action

If the Record of Decision for the Site calls for cleanup action, the project then moves to designing and performing the cleanup actions to address the Site contamination. When cleanup actions have been completed, NYSDEC will approve or prepare a final engineering report that describes the cleanup actions undertaken and certifies that cleanup requirements have been achieved or will be achieved.

2.6 Certificate of Completion

Upon approval of the final engineering report, NYSDEC may issue a Certificate of Completion (COC). The COC would recognize the findings of the final engineering report. The COC would note that the cleanup program achieved a cleanup level consistent with specific categories of use for the Site. The recipient of the COC would be entitled to limited liability as long as it complied with the terms of the COC, and other conditions.

A COC may be modified or revoked if, for example, the recipient does not comply with the terms of the COC, or if the recipient commits fraud regarding its certification that it has met cleanup levels.

2.7 Site Management

Site management is the last phase of the Site cleanup program. This phase begins when the COC is issued. Site management may be conducted by NYSDEC, or by the responsible party under NYSDEC oversight, if contamination will remain in place. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the Site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan.

An institutional control is a non-physical restriction on use of the Site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the Site suitable for some, but not all uses.

An engineering control is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that is pumping and treating groundwater. Site management continues until NYSDEC determines that it is no longer needed.

During the Site Management phase, NYSDEC may also take steps to reclassify the Site or remove the Site from the Registry.

Section 3

Summary of Issues of Public Concern

Potential issues of public concern are health effects resulting from exposure to the contaminants found at the Site. These contaminants are compounds commonly found in gasoline and coal tar, and are described in more detail in the 'Site Information' section below. The impacted environmental media of groundwater, subsurface soils, surface soils, sediments, and indoor air, as well as potential receptors specific to those media and the potential exposure mechanisms that may affect the public, are described below.

In general, there are few issues of public concern relating to the Patchogue Former MGP Site. It is expected that further remediation will eliminate and/or contain contaminants, so they will no longer have the potential to impact public health or the Patchogue River (located to the south of the Site) water quality.

3.1 New York State Remedial Program Overview

National Grid has conducted investigation activities at the Site since 1996 to evaluate the nature and extent of MGP constituents. These investigations are described in:

- Order on Consent, Index No. A2-0552-0606 between KeySpan Corporation (a predecessor company of National Grid) and the NYSDEC, executed on March 4, 2007.
- Order on Consent D1-001-99-05 signed between Keyspan Corporation (a predecessor company of National Grid) and NYSDEC, executed on September 30, 1999.
- Final Remedial Investigation Report (RIR) for the Patchogue Former MGP Site (TetraTech EC, Inc., December 2009).
- "Preliminary Site Assessment Report (PSA) ([Vanasse, Hangen, Brustlin (VHB), March 2002]
- Focused Feasibility Study Patchogue Former MGP Site, (Brown and Caldwell Associates, May 2011)
- The Record of Decision (ROD) Patchogue Former MGP Site, [New York State Department of Environmental Conservation (NYSDEC), March 31, 2011].
- Remedial Design Work Plan Patchogue Former MGP Site, (Brown and Caldwell Associates, February 2012).
- Utility Corridor Work Plan (Revision 3), (Brown and Caldwell Associates, February 2012)
- Remedial Design Report (90-95% Submittal), (Brown and Caldwell Associates, October 2017).

These investigation activities were conducted in accordance with the Order on Consent and NYSDEC-approved work plans.

3.2 Surface Soils

MGP-related impacts to surface soils (top-most several inches) were identified in some areas of the Site. The impacts are related to the presence of polyaromatic hydrocarbons (PAHs), total benzene, toluene,

ethylbenzene, and xylenes (BTEX), and cyanide. The redevelopment of the Site could potentially expose future receptors to surface soil.

The potential for exposure by the public is low. The Site is mostly covered by a combination of buildings and pavement, while the area of the exposed soil is very limited.

3.3 Subsurface Soils

MGP-related impacts to subsurface soils (i.e., soils located at depths greater than several inches from the surface) were identified in the core area. The logs of the borings in these areas indicated visual MGP-related impacts. This area generally corresponds with the historical location of the gas holder, purifier house boiler, and oil tanks. Addressing the impacted soils would eliminate the secondary source of MGP impacts to soil, groundwater, and sediment. Because of the depth of occurrence, subsurface soils are not expected to impact the general public; however, they represent a potentially complete exposure pathway for on-Site construction workers engaged in excavation-related activities.

3.4 Groundwater

The MGP-related impacts to the groundwater within the overburden (i.e., within soils above the bedrock) are very limited. Contaminant levels in monitoring wells located downgradient of the source area are low and will diminish after the source area has been remediated. Drinking water in Patchogue is provided though the municipal water supply which relies on a single-source aquifer. The single public supply well that was identified during the well search is located hydraulically side-gradient of groundwater flow at the Site. Two potable wells located downgradient of the Site will not be impacted by the Site due to their distance from the Site.

The impact to public health could occur if the public were exposed to the groundwater. However, there is no established exposure pathway between the groundwater and the public. Groundwater is not being used either at or immediately adjacent to the Site; instead, the local population is served by a public water supply system. The Site and the surrounding area are predominantly covered by buildings and pavement, so the potential for direct contact with shallow groundwater is very limited. The exposure of on-Site workers engaged in excavation-related activities may occur, as the groundwater table is located within approximately five feet of the surface.

3.5 Patchogue River Sediments and Soils

Based on the dispersion of contaminants both upstream and downstream of the Site, it was concluded that the sediment would not impact both ecological or human health receptors. Remedial activities will minimize or isolate the source of any future Site-related impacts to the sediment.

Although these impacts within the Patchogue River represent a potentially complete exposure pathway to the recreational users, this exposure path is likely to be very limited, given the minimal number of sediment depositional areas in the Patchogue River.

3.6 Air Quality in Site Buildings

Vapor intrusion investigations were performed beneath the concrete slab of a former building on-Site and a building off-Site. An additional sub-slab sample, indoor air sample, and ambient air sample were collected. The results detected volatile organic carbon (VOCs), but did not detect MGP-related constituents were not detected at concentrations above indoor air screening criteria. Potential worker exposure to indoor air in both buildings are expected to be minimal since MGP contaminants are not expected to impact indoor air.

Section 4

Citizen Participation Plan

This section presents the citizen participation and outreach activities planned for implementation during the remedial program. The program will be implemented in accordance with the Order and in compliance with 6 NYCRR Part 375. Operating under project-specific citizen participation goals, clearly defined objectives will be achieved by implementing a range of communication tools and methods. The planned activities are geared toward making project-specific information (e.g., work plans, technical reports, information sheet summaries) available to the public; facilitating communication among stakeholders including the creation of contact lists; scheduling and conducting public meetings; establishing comment periods; and notifying the public of document availability, public meetings, comment periods and major program milestones.

4.1 Goals and Objectives

The primary goal of this CPP is to achieve effective, open communication among stakeholders and interested parties, National Grid, the NYSDOH, and the NYSDEC. Common goals include:

- Provide a process for the affected/interested public to effectively participate in the decision-making process for remedial actions;
- Encourage meaningful public participation that reflects the diversity of interests and perspectives found within a community;
- Solicit public comments at formal milestones, while encouraging public input throughout the Site remedial process;
- Encourage communication among the interested parties and regulatory agencies that promotes the exchange of information and strengthens trust among the parties;
- Minimize unnecessary delays caused by uncertainty or lack of publicly available information; and
- Provide local media outlets.

To accomplish these goals, the following specific objectives will be pursued through the implementation of this CPP:

- Consistently communicate goals, accomplishments and status of the project to the contact list (including community leaders, public officials and the wider community, as necessary) through appropriate means at appropriate milestones;
- Establish, maintain, update and utilize the contact lists;
- Educate the community, in lay terms, about the nature and magnitude of potential Site risks, including instructions for mitigating risk (if appropriate) and assurances that the environment and worker/public health and safety are protected;
- Provide interested parties the opportunity to review and comment on technical reports generated through the remedial program (e.g., public comment periods and document repository as required by 6 NYCRR Part 375);
- Provide interested parties the opportunity to present opinions and ideas during the remedial program (e.g., conduct public meeting/comment period and availability session as required by 6 NYCRR Part 375);

- Provide responses to public review and comment (e.g., prepare a responsiveness summary as required by 6 NYCRR Part 375);
- If requested, provide the news media with interviews or press releases of National Grid authorized spokesperson, as available, to ensure accurate coverage of remedial program activities;
- Provide a designated project spokesperson as point of contact through which community inquiries regarding the project can be addressed consistently and effectively; and
- Periodically review the effectiveness of citizen participation and outreach activities during the remedial program and make adjustments in the CPP's methods and/or activities, if necessary.

The Watertown (Engine Street) Former MGP Site project contacts (NYSDEC, NYSDOH and National Grid representatives) and the community contact list are provided in Section 4.

4.2 Tools and Methods

There are many ways to reach and communicate with the community and other interested parties as this CPP is implemented over the course of the remedial program. A variety of outreach tools and methods will be used to ensure proper communication with the interested parties that include various organizations, public and business leaders, and a diverse assemblage of individuals of all ages, education backgrounds and cultures. Interested parties will be informed and invited to participate in the planned citizen participation activities through appropriate means such as mailings to the contact list, legal notice in newspapers, press releases, information sheets and other documents made available in the document repository.

Specific public participation activities will be implemented as required by 6 NYCRR Part 375 and current NYSDEC guidance as described below.

4.2.1 Document Repository and List of Available Documents

Two document Repositories were established early on in publicly accessible locations that have accommodations necessary to house and make project-related documents available for community reference and review. The use of Document Repositories is intended to maximize public access to Site information while minimizing abuse, destruction, or theft of project documentation.

The Document Repositories for the Patchogue (West Main Street) Former MGP Site are:

Patchogue Medford Library
54-60 East Main Street
Patchogue, NY 11772
(631) 654-4700
www.pmlib.org

NYSDEC Region 1
50 Circle Road
Stony Brook, New York 11718
Mr. Walter Parish
Hours: 9:00 am to 5:00 pm (by appointment)
(613) 444-0240

When Site-related documents are completed, they will be made available in the repositories.

4.2.1.1 Public Meetings and Comment Period

After completion of the 100% Remedial Design Report, the report will be included in the project Document Repositories. Prior to the start of the remedial action at the Site, a Fact Sheet will be mailed to the Site Contact List that describes the upcoming remedial action and presents a general timeline for the activities. The Fact Sheets will be sent so that they are received before Site activities occur. The Fact Sheet will also be included in the project Document Repositories.

In addition, an availability session may be conducted by the NYSDEC prior to the start of remedial actions at the Site. An availability session is an informal gathering of the NYSDEC staff, National Grid representatives, and the public. The NYSDEC will distribute public notification at least two weeks prior to the scheduled session. The availability session would be used to describe to the public the upcoming remedial construction activities. Sessions would provide citizens with the opportunity to interact with project experts one-on-one.

4.2.1.2 Telephone Hotline

National Grid has established a Telephone Hotline for neighbors of the Patchogue Former MGP Site. The phone number is (631) 348-6250 There will be occasional news updates about the investigation, and the Hotline can be used at any time to leave questions about the investigation.

4.2.1.3 Website (www.patchoguemgpsite.com)

National Grid has established a Website at which interested parties can find information about the former MGP Site, former MGP operations, and their environmental impacts and the NYSDEC's MGP program. Updates will be provided on developments in the investigation program and electronic copies of major documents associated with that program will be posted.

4.3 Roles and Responsibilities

The specific roles and associated responsibilities for implementing this CPP are as follows:

- **NYSDEC Project Manager** – The NYSDEC Project Manager is responsible for enforcement, oversight and management of the overall remedial program. Typical citizen participation-related activities include making presentations at public meetings, reviewing project documents such as information sheets and providing technical assistance in preparing the responsiveness summary or answering public inquiries.
- **NYSDOH Project Manager** – The NYSDOH Project Manager is responsible for review and comment of technical information generated during the remedial program and protection of public health. Typical citizen participation-related activities include making presentations at public meetings, reviewing project documents such as information sheets and addressing public inquiries.
- **NYSDEC Citizen Participation Specialist** – The Citizen Participation Specialist assists the project managers in implementing the CPP. Typical activities include preparation and/or review of information sheets and the responsiveness summary, assistance with the development of the Site contact list, and coordination of public meetings and availability sessions.
- **National Grid Project Manager** – The National Grid Project Manager, in cooperation with the NYSDEC Project Manager, is responsible for implementing the overall remedial program at the Site. Typical citizen participation-related activities include management of CPP implementation, presentations at public meetings and technical assistance to the NYSDEC Project Manager and Citizen Participation Specialist.

Current project management staffing is identified in Section 5.

4.4 Schedule for Implementing Elements of the CPP

Implementing elements of this CPP depends upon completion by National Grid and final approval by the NYSDEC of various plans and reports required by the Order governing the Patchogue (West Main Street) Former MGP Site, such as the Remedial Design. National Grid has established document repositories and has placed completed documents in the repository for public review. Public comments and presentation will be scheduled according to milestones established by the NYSDEC with appropriate public notification.

Section 5

Project Contacts and Document Repositories

5.1 Project Contacts

For information about the Site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC)

NYSDEC Division of Environmental Remediation
625 Broadway F111
Albany, New York 12233
Mr. William Wu
(518) 402-9662

New York State Department of Health

Bill Fonda
Citizen Participation Specialist
NYSDEC, Region 1
SUNY – Stony Brook
50 Circle Road
Stony Brook, NY 11790
(631) 444-0350

National Grid

Sarah Aldridge
Project Manager
National Grid
175 East Old Country Road
Hicksville, NY 11801
(860) 334-0554

5.2 Document Repositories

The facilities identified below are being used to store the project document and provide the public with convenient access to important project documents:

Patchogue Medford Library
54-60 East Main Street
Patchogue, NY 11772
(631) 654-4700
www.pmlib.org

NYSDEC Region 1

50 Circle Road
Stony Brook, New York 11718
Mr. Walter Parish
Hours: 9:00 am to 5:00 pm (by appointment)
(613) 444-0240

5.3 Project Contact List

Adjacent Property Owners

Village of Patchogue

Paul V. Pontieri Jr.
Mayor
14 Baker Street,
Patchogue, NY 11772
(631) 472-4300

Jack A. Krieger
Deputy Mayor
14 Baker Street,
Patchogue, NY 11772
(631) 472-4300

Marian Russo
Executive Director
(631) 475-4300 option 6

Patricia M. Seal
Village Clerk
14 Baker Street,
Patchogue, NY 11772
(631) 475-4300 ext. 113

Joseph P. Dean
Superintendent of Public Works
(631) 475-4300

Village of Patchogue Planning Board

Carol Giglio
Planning and Zoning Coordinator
14 Baker Street,
Patchogue, NY 11772
(631) 475-4300

John Rocco
Chairperson
14 Baker Street,
Patchogue, NY 11772
(631) 475-4300

Eva Rodriguez-Greguski, Member
Planning Board
14 baker Street
Patchogue, NY 11772
(631) 475-4300

City Water Supplier

Suffolk County Water Authority
Jeffrey W. Szabo
Chief Executive Officer
(631) 698-9500

Local Library

Patchogue Medford Library
54-60 East Main Street
Patchogue, NY 11772
(631) 654-4700

Local Media Outlets

Long Island Advance
20 Medford Ave.
P.O. Box 780
Patchogue, NY 11772
(631) 475-1000

La Tribuna Hispana
P.O. Box 186
Hempstead, NY 11550
(888) 900-2811 ext 3

Section 6

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.

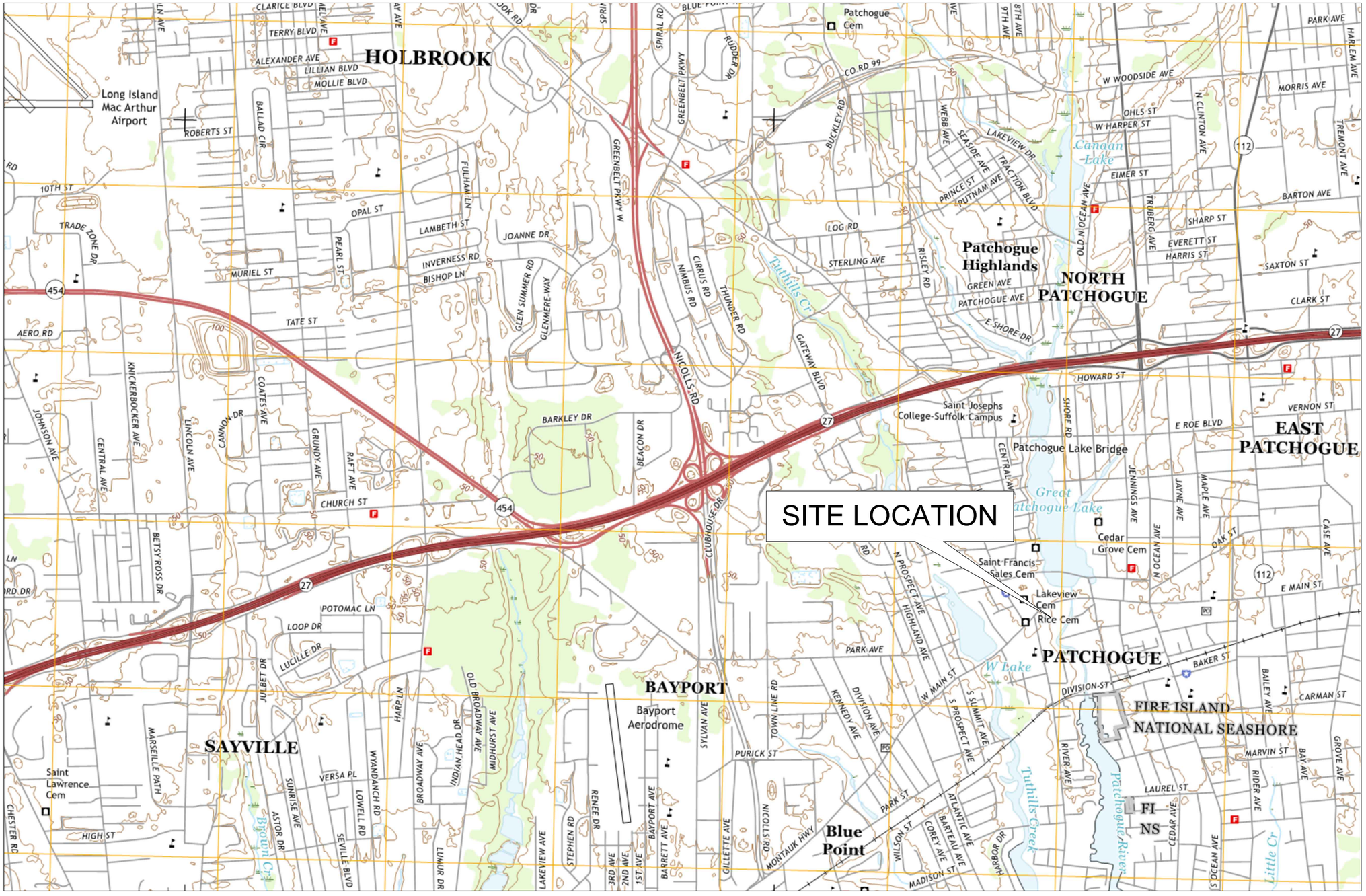
NYSDEC, 2017. "Explanation of Significant Differences, K – Patchogue MGP Site, Village of Patchogue, Suffolk County, Site No. 152182", October.

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.

Brown and Caldwell Associates, 2012. "Construction Completion Report, Utility Corridor Work Plan Implementation, Patchogue Former Manufactured Gas Plant Site, NYSDEC Site No. 1-52-182, Village of Patchogue, Suffolk County, New York", December.

Brown and Caldwell Associates, 2012. "Utility Corridor Work Plan (Revision 3), Patchogue Former MGP Site, Patchogue, Suffolk County, New York, Site No. 1 52 182", February.

Figures



N

0 2000 4000

SCALE IN FEET

SOURCE:
USGS 7.5 MINUTE TOPOGRAPHIC MAPS
PATCHOGUE QUADRANGLE
NEW YORK-SUFFOLK CO.
PATCHOGUE, NY 2016

Brown AND Caldwell

SCALE: 1" = 2000'

149322

DATE: August 7, 2017

DESIGN FOR REMEDIAL CONSTRUCTION
NATIONAL GRID
PATCHOGUE FORMER MGP SITE
VILLAGE OF PATCHOGUE, NEW YORK

SITE LOCATION MAP

FIGURE

1-1

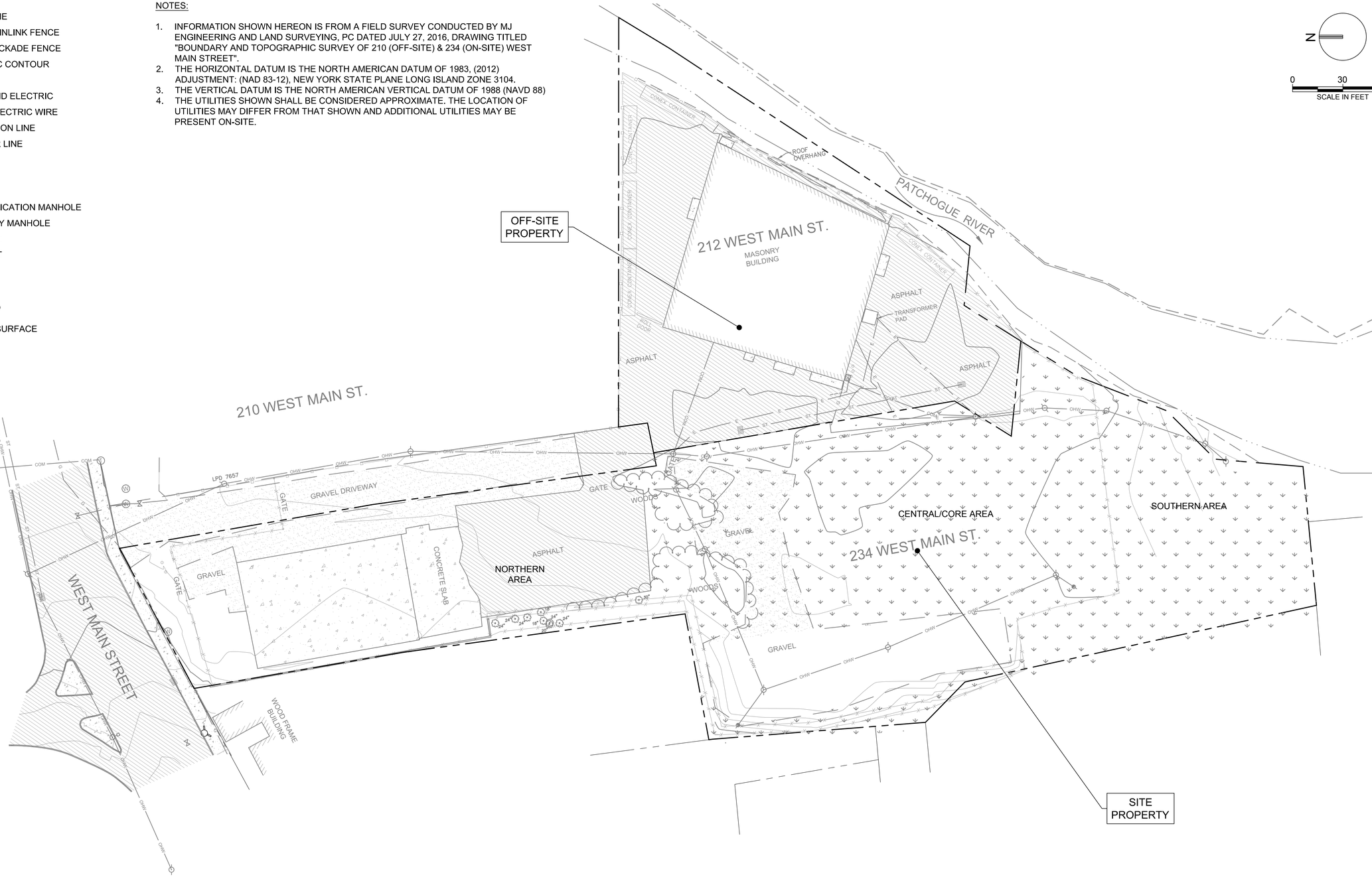
Path: \\bcusr□01□ro\ects\National_Grid\Patchogue\149322_NG_Patchogue_RDR\90□-95□_Remedial_Design_Re□ortA□□endicesA□1_CAMP\Figures File Name: FIG 1-1 Plot Date: August 7, 2017 9:25 AM Cadd User: Alan Santiago

LEGEND:

- PROPERTY LINE
- EXISTING CHAINLINK FENCE
- EXISTING STOCKADE FENCE
- TOPOGRAPHIC CONTOUR
- TOP OF BANK
- UNDERGROUND ELECTRIC
- OVERHEAD ELECTRIC WIRE
- COMMUNICATION LINE
- STORMWATER LINE
- GAS LINE
- WATER LINE
- UTILITY POLE
- TELECOMMUNICATION MANHOLE
- WATER UTILITY MANHOLE
- WATER VALVE
- FIRE HYDRANT
- CATCH BASIN
- CONCRETE
- GRAVEL ROAD
- VEGETATIVE SURFACE

NOTES:

1. INFORMATION SHOWN HEREON IS FROM A FIELD SURVEY CONDUCTED BY MJ ENGINEERING AND LAND SURVEYING, PC DATED JULY 27, 2016, DRAWING TITLED "BOUNDARY AND TOPOGRAPHIC SURVEY OF 210 (OFF-SITE) & 234 (ON-SITE) WEST MAIN STREET".
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983, (2012) ADJUSTMENT: (NAD 83-12), NEW YORK STATE PLANE LONG ISLAND ZONE 3104.
3. THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
4. THE UTILITIES SHOWN SHALL BE CONSIDERED APPROXIMATE. THE LOCATION OF UTILITIES MAY DIFFER FROM THAT SHOWN AND ADDITIONAL UTILITIES MAY BE PRESENT ON-SITE.



Path: P:\National_Grid\Patchogue\149322_NG_Patchogue_RDR_CAD\2-SHEETS\C-CIVIL File Name: FIG_1-2 Plot Date: October 9, 2017 5:15 PM Cadd User: Radhika Patel

Brown AND Caldwell

SCALE: 1" = 30'

147663

DATE: October 9, 2017

NATIONAL GRID PATCHOGUE FORMER MGP SITE
234 WESTMAIN STREET, VILLAGE OF PATCHOGUE, NY
SITE PLAN

FIGURE

1-2

Appendix R: Stormwater Management System Design and Wetland Permitting

Appendix S: Freshwater Wetland Permit

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Permits, Region 1
SUNY @ Stony Brook, 50 Circle Road, Stony Brook, NY 11790
P: (631) 444-0365 I F: (631) 444-0360
www.dec.ny.gov

May 2, 2018

KeySpan Gas East Corporation
DBA National Grid
175 E. Old Country Road
Hicksville, NY 11801
Attn: Sarah Aldridge

Re: NYSDEC # 1-4722-06825/00001
Patchogue Former MGP Site, 234 W Main St., Patchogue
Remediate Former MGP Site

Dear Permittee:

In conformance with the requirements of the State Uniform Procedures Act (Article 70, ECL) and its implementing regulations (6NYCRR, Part 621) we are enclosing your permit

Please carefully read all permit conditions and special permit conditions contained in the permit to ensure compliance during the term of the permit. If you are unable to comply with any conditions, please contact us at the above address. This permit must be kept available on the premises of the facility at all times

Also enclosed please find a permit sign which is to be conspicuously posted at the project site and protected from the weather.

Sincerely,

Kevin Kispert
Environmental Analyst II

Enclosures
KAK/file
cc: NYSDEC Habitat
Brown and Cauldwell

PERMIT

Under the Environmental Conservation Law (ECL)

Permittee and Facility Information

Permit Issued To:
KEYSPAN GAS EAST CORPORATION
DBA NATIONAL GRID
175 E OLD COUNTRY RD
HICKSVILLE, NY 11801
(516) 545-2559

Facility:
PATCHOGUE FORMER MGP SITE
234 W Main St|SCTM# 204-12-9-6.4
Patchogue, NY 11772

Facility Application Contact:
BROWN AND CAULDWELL
2 PARK WAY
STE 2 A
UPPER SADDLE RIVER, NJ 07458
(201) 574-4782

Facility Location: in BROOKHAVEN in SUFFOLK COUNTY **Village:** PATCHOGUE
Facility Principal Reference Point: NYTM-E: 666.958 NYTM-N: 4514.567
Latitude: 40°45'54.5" Longitude: 73°01'18.7"

Authorized Activity: Conduct activities related to the remediation of this former Manufactured Gas Plant (MGP) site including removal of former MGP structures, removal of drainage structures, excavation of contaminated soil, In-Situ Solidification (ISS) of impacted soil, restoration of the site to existing grade with a gradient so that stormwater drains to a swale and/or a vegetated wet meadow all as shown on the attached plans prepared by Brown and Cauldwell, sheets C-110, C-111, C-113 & C-401, dated 10/9/17, 10/10/17 & 3/29/18, all stamped "NYSDEC Approved" on 5/2/18.

Permit Authorizations

Freshwater Wetlands - Under Article 24
Permit ID 1-4722-06825/00001
New Permit Effective Date: 5/2/2018 Expiration Date: 5/1/2023

NYSDEC Approval

By acceptance of this permit, the permittee agrees that the permit is contingent upon strict compliance with the ECL, all applicable regulations, and all conditions included as part of this permit.

Permit Administrator: ROGER EVANS, Regional Permit Administrator
Address: NYSDEC Region 1 Headquarters
SUNY @ Stony Brook|50 Circle Rd
Stony Brook, NY 11790 -3409

Authorized Signature: Roger Evans Date 5/3/2018

Distribution List

BROWN AND CAULDWELL
Habitat
KEVIN A KISPERT

Permit Components

NATURAL RESOURCE PERMIT CONDITIONS

GENERAL CONDITIONS, APPLY TO ALL AUTHORIZED PERMITS

NOTIFICATION OF OTHER PERMITTEE OBLIGATIONS

Permit Attachments

Site Plan 3/29/2018

NATURAL RESOURCE PERMIT CONDITIONS - Apply to the Following Permits: FRESHWATER WETLANDS

1. **Conformance With Plans** All activities authorized by this permit must be in strict conformance with the approved plans submitted by the applicant or applicant's agent as part of the permit application. Such approved plans were prepared by Brown and Cauldwell, sheets C-110, c-111, C-113 & C-401, dated 10/9/17, 10/10/17 & 3/29/18, all stamped "NYSDEC Approved" on 5/2/18.

2. **Notice of Commencement** At least 48 hours prior to commencement of the project, the permittee and contractor shall sign and return the top portion of the enclosed notification form certifying that they are fully aware of and understand all terms and conditions of this permit. Within 30 days of completion of project, the bottom portion of the form must also be signed and returned, along with photographs of the completed work.

3. **Post Permit Sign** The permit sign enclosed with this permit shall be posted in a conspicuous location on the worksite and adequately protected from the weather.

4. **Area Limits** The limits of clearing, grading and ground disturbance line is equal to the chain link fence as shown on sheet C-110 of the approved plans , as shown on the approved plans.

5. **Work Area Limits** Any work, disturbance, and or storage of construction materials shall be confined to within the limit of clearing and ground disturbance as described above.

6. **Dewatering Restriction** No dewatering discharge may be directed to or allowed to reach the river, the wetland or the vegetated adjacent area to the wetland.

7. **Equipment Storage 100' from Wetland, Water Body** All equipment and machinery shall be stored and safely contained greater than 100 feet landward of the regulated wetland or water body at the end of each work day. This will serve to avoid the inadvertent leakage of deleterious substances into the regulated area.

8. **Materials Disposed at Upland Site** Any demolition debris, excess construction materials, and/or excess excavated materials shall be immediately and completely disposed of on an approved upland site more than 100 feet from any regulated freshwater wetland. These materials shall be suitably stabilized so as not to re-enter any water body, wetland, or wetland adjacent area.

9. **Clean Fill Only** All fill shall consist of clean soil, sand and/or gravel that is free of the following substances: asphalt, slag, flyash, broken concrete, demolition debris, garbage, household refuse, tires, woody materials including tree or landscape debris, and metal objects. The introduction of materials toxic to aquatic life is expressly prohibited.

10. **Key in Riprap** The upstream end of the rock riprap shall be keyed back into the stream bank at least 85 feet to prevent the water from cutting behind (flanking) the rock and causing it to fail from erosion. The downstream end of the rock riprap shall be keyed back into the stream bank at least 85 feet.

11. **Final Grading Requirements** The final grade and pitch of all areas of site disturbance must be such that storm water is directed to the proposed swale and wet meadow. No storm water from any project area may be allowed to enter the river, the wetland or the vegetated adjacent area to the wetland without first passing through the wet meadow.

12. **Planting Restriction** All species planted in the swale and wet meadow must be appropriate native species.

13. **Straw Bales** Prior to commencement of any construction activities, a continuous row of straw bales shall be staked end to end along the Limit of Clearing and Ground Disturbance (LCGD) described above.

14. **Straw Bales to Be Entrenched** Straw bales shall be entrenched two to four inches into the ground.

15. **Maintain Bales** The bales shall be maintained, repaired and replaced as often as necessary to ensure proper function, until all disturbed areas are permanently vegetated. The average useful life of a bale is approximately 3-4 months. Sediments trapped by the bales shall be removed to an approved upland location before the bales themselves are removed.

16. **Silt Screen** Prior to commencement of any construction activities, a continuous line of silt screen (maximum opening size of U.S. Sieve #20) shall be staked along the LCGD described above.

17. **Silt Screen to Be Recessed** Silt screen shall be recessed six inches into the ground.

18. **Maintain Silt Screen** The screen shall be maintained, repaired and replaced as often as necessary to ensure proper function, until all disturbed areas are permanently vegetated. Sediments trapped by the screen shall be removed to an approved upland location before the screen is removed.

19. **Seed, Mulch Disturbed Areas** All areas of soil disturbance resulting from this project shall be seeded with an appropriate perennial grass, and mulched with straw immediately upon completion of the project, within two days of final grading, or by the expiration of the permit, whichever is first.

20. **Temporary Mulch, Final Seeding** If seeding is impracticable due to the time of year, a temporary mulch shall be applied and final seeding shall be performed at the earliest opportunity when weather conditions favor germination and growth but not more than six months after project completion.

21. **State May Order Removal or Alteration of Work** If future operations by the State of New York require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Department of Environmental Conservation it shall cause unreasonable obstruction to the free navigation of said waters or flood flows or endanger the health, safety or welfare of the people of the State, or cause loss or destruction of the natural resources of the State, the owner may be ordered by the Department to remove or alter the structural work, obstructions, or hazards caused thereby without expense to the State, and if, upon the expiration or revocation of this permit, the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the owners, shall, without expense to the State, and to such extent and in such time and manner as the Department of Environmental Conservation may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable and flood capacity of the watercourse. No claim shall be made against the State of New York on account of any such removal or alteration.

22. **State May Require Site Restoration** If upon the expiration or revocation of this permit, the project hereby authorized has not been completed, the applicant shall, without expense to the State, and to such extent and in such time and manner as the Department of Environmental Conservation may lawfully require, remove all or any portion of the uncompleted structure or fill and restore the site to its former condition. No claim shall be made against the State of New York on account of any such removal or alteration.

23. **Precautions Against Contamination of Waters** All necessary precautions shall be taken to preclude contamination of any wetland or waterway by suspended solids, sediments, fuels, solvents, lubricants, epoxy coatings, paints, concrete, leachate or any other environmentally deleterious materials associated with the project.

24. **State Not Liable for Damage** The State of New York shall in no case be liable for any damage or injury to the structure or work herein authorized which may be caused by or result from future operations undertaken by the State for the conservation or improvement of navigation, or for other purposes, and no claim or right to compensation shall accrue from any such damage.

GENERAL CONDITIONS - Apply to ALL Authorized Permits:

1. **Facility Inspection by The Department** The permitted site or facility, including relevant records, is subject to inspection at reasonable hours and intervals by an authorized representative of the Department of Environmental Conservation (the Department) to determine whether the permittee is complying with this permit and the ECL. Such representative may order the work suspended pursuant to ECL 71- 0301 and SAPA 401(3).

The permittee shall provide a person to accompany the Department's representative during an inspection to the permit area when requested by the Department.

A copy of this permit, including all referenced maps, drawings and special conditions, must be available for inspection by the Department at all times at the project site or facility. Failure to produce a copy of the permit upon request by a Department representative is a violation of this permit.

2. **Relationship of this Permit to Other Department Orders and Determinations** Unless expressly provided for by the Department, issuance of this permit does not modify, supersede or rescind any order or determination previously issued by the Department or any of the terms, conditions or requirements contained in such order or determination.

3. **Applications For Permit Renewals, Modifications or Transfers** The permittee must submit a separate written application to the Department for permit renewal, modification or transfer of this permit. Such application must include any forms or supplemental information the Department requires. Any renewal, modification or transfer granted by the Department must be in writing. Submission of applications for permit renewal, modification or transfer are to be submitted to:

Regional Permit Administrator
NYSDEC Region 1 Headquarters
SUNY @ Stony Brook 50 Circle Rd
Stony Brook, NY11790 -3409

4. **Submission of Renewal Application** The permittee must submit a renewal application at least 30 days before permit expiration for the following permit authorizations: Freshwater Wetlands.

5. **Permit Modifications, Suspensions and Revocations by the Department** The Department reserves the right to exercise all available authority to modify, suspend or revoke this permit. The grounds for modification, suspension or revocation include:

a. materially false or inaccurate statements in the permit application or supporting papers;

b. failure by the permittee to comply with any terms or conditions of the permit;

c. exceeding the scope of the project as described in the permit application;

d. newly discovered material information or a material change in environmental conditions, relevant technology or applicable law or regulations since the issuance of the existing permit;

e. noncompliance with previously issued permit conditions, orders of the commissioner, any provisions of the Environmental Conservation Law or regulations of the Department related to the permitted activity.

6. Permit Transfer Permits are transferrable unless specifically prohibited by statute, regulation or another permit condition. Applications for permit transfer should be submitted prior to actual transfer of ownership.

NOTIFICATION OF OTHER PERMITTEE OBLIGATIONS

Item A: Permittee Accepts Legal Responsibility and Agrees to Indemnification
The permittee, excepting state or federal agencies, expressly agrees to indemnify and hold harmless the Department of Environmental Conservation of the State of New York, its representatives, employees, and agents ("DEC") for all claims, suits, actions, and damages, to the extent attributable to the permittee's acts or omissions in connection with the permittee's undertaking of activities in connection with, or operation and maintenance of, the facility or facilities authorized by the permit whether in compliance or not in compliance with the terms and conditions of the permit. This indemnification does not extend to any claims, suits, actions, or damages to the extent attributable to DEC's own negligent or intentional acts or omissions, or to any claims, suits, or actions naming the DEC and arising under Article 78 of the New York Civil Practice Laws and Rules or any citizen suit or civil rights provision under federal or state laws.

Item B: Permittee's Contractors to Comply with Permit
The permittee is responsible for informing its independent contractors, employees, agents and assigns of their responsibility to comply with this permit, including all special conditions while acting as the permittee's agent with respect to the permitted activities, and such persons shall be subject to the same sanctions for violations of the Environmental Conservation Law as those prescribed for the permittee.

Item C: Permittee Responsible for Obtaining Other Required Permits
The permittee is responsible for obtaining any other permits, approvals, lands, easements and rights-of-way that may be required to carry out the activities that are authorized by this permit.

Item D: No Right to Trespass or Interfere with Riparian Rights
This permit does not convey to the permittee any right to trespass upon the lands or interfere with the riparian rights of others in order to perform the permitted work nor does it authorize the impairment of any rights, title, or interest in real or personal property held or vested in a person not a party to the permit.

95-20-1 (8/87)—9d

New York State
Department of Environmental Conservation

NOTICE

The Department of Environmental Conservation (DEC) has issued permit(s) pursuant to the Environmental Conservation Law for work being conducted at this site. For further information regarding the nature and extent of work approved and any Departmental conditions on it, contact the Regional Permit Administrator listed below. Please refer to the permit number shown when contacting the DEC.

Regional Permit Administrator
ROGER EVANS

Permit Number 1-4722-06825/00001

Expiration Date 5/1/2023

NOTE: This notice is **NOT** a permit

NOTICE OF COMMENCEMENT OF CONSTRUCTION

RETURN THIS FORM TO: COMPLIANCE Or Fax to: 631-444-0272
Bureau of Habitat-Freshwater Wetlands - NYSDEC
50 Circle Road
Stony Brook, NY 11790-3409

PERMIT NUMBER: _____ EXPIRATION DATE: _____

PERMITTEE NAME & PROJECT ADDRESS: _____

_____

CONTRACTOR NAME & ADDRESS: _____

_____ TELEPHONE: _____

Dear Sir:

Pursuant to the special conditions of the referenced permit, you are hereby notified that the authorized activity shall commence on _____ _____. We certify that we have read the referenced permit and approved plans and fully understand the authorized project and all permit conditions. We have inspected the project site and can complete the project as described in the permit and as depicted on the approved plans. We can do so in full compliance with all plan notes and permit conditions. The permit, permit sign, and approved plans will be available at the site for inspection in accordance with General Condition No. 1. (Both signatures required)

PERMITEE: _____ DATE _____

CONTRACTOR: _____ DATE _____

THIS NOTICE MUST BE SENT TO THE ABOVE ADDRESS AT LEAST TWO DAYS PRIOR TO COMMENCEMENT OF THE PROJECT AND /OR ANY ASSOCIATED ACTIVITIES. FAILURE TO RETURN THIS NOTICE, POST THE PERMIT SIGN, OR HAVE THE PERMIT AND APPROVED PLANS AVAILABLE AT THE WORK SITE FOR THE DURATION OF THE PROJECT MAY SUBJECT THE PERMITTEE AND/OR CONTRACTOR TO APPLICABLE SANCTIONS AND PENALTIES FOR NON-COMPLIANCE WITH PERMIT CONDITIONS.

Cut along this line X X X X X X X

NOTICE OF COMPLETION OF CONSTRUCTION

RETURN THIS FORM TO: COMPLIANCE Or Fax to: 631-444-0272
Bureau of Habitat- Freshwater Wetlands - NYSDEC
50 Circle Road
Stony Brook, NY 11790-3409

PERMIT NUMBER: _____ EXPIRATION DATE: _____

PERMITTEE NAME & PROJECT ADDRESS: _____

_____

CONTRACTOR NAME & ADDRESS: _____

_____ TELEPHONE: _____

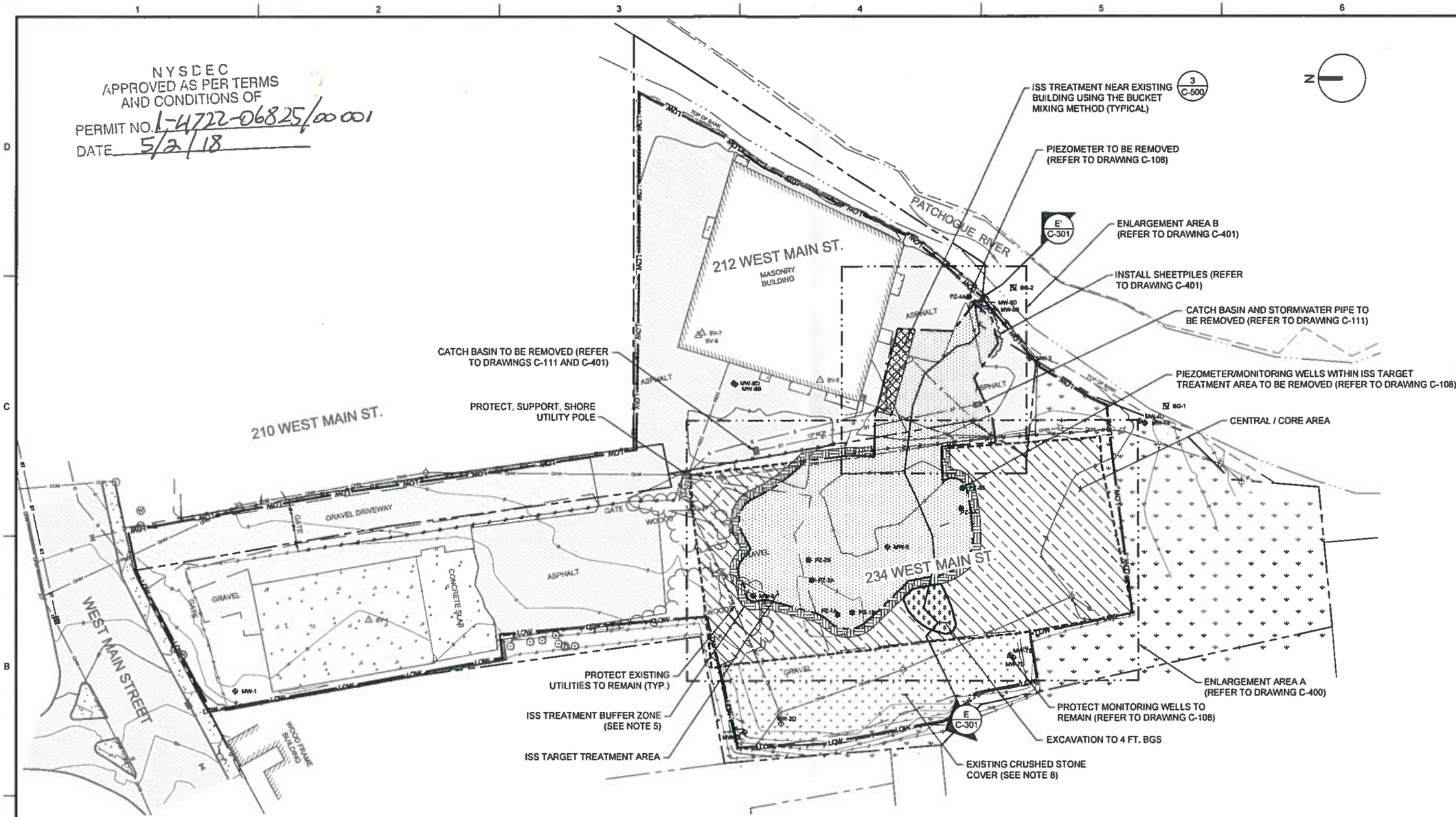
Pursuant to special conditions of the referenced permit, you are hereby notified that the authorized activity was completed on _____ _____. We have fully complied with the terms and conditions of the permit and approved plans. (Both signatures required)

PERMITEE: _____ DATE _____

CONTRACTOR: _____ DATE _____

THIS NOTICE, WITH PHOTOGRAPHS OF THE COMPLETED WORK AND/OR A COMPLETED SURVEY, AS APPROPRIATE, MUST BE SENT TO THE ABOVE ADDRESS WITHIN 30 DAYS OF COMPLETION OF THE PROJECT.

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4722-06825/00001
DATE 5/2/18



SITE REMEDIATION PLAN

0 30 60
SCALE IN FEET

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. ISS TREATMENT AND EXCAVATION OF ISS AREA NEAR THE EXISTING BUILDING SHALL PROCEED AS DIRECTED ON DRAWING C-500, DETAIL 3.
3. ESTABLISH AND MAINTAIN AN EXCLUSION, DECONTAMINATION AND SUPPORT ZONE AROUND THE ISS AREA. PERSONNEL AND EQUIPMENT SHALL BE DECONTAMINATED IN A DECONTAMINATION ZONE BETWEEN THE EXCLUSION ZONE AND SUPPORT ZONE.
4. ISS DELINEATION DENOTES MINIMUM AREA TO BE TREATED. CONTRACTOR MAY EXPAND TREATMENT AREA TO ACCOMMODATE ISS TREATMENT TECHNIQUE REQUIREMENTS.
5. AT THE LOCATIONS INDICATED HEREON, CONTRACTOR SHALL PERFORM ISS TO A 5 FT WIDE BUFFER ZONE BEYOND THE LIMITS OF THE ISS TARGET TREATMENT AREA. THE BUFFER ZONE DEPTH SHALL MATCH THE TARGET DEPTH OF THE ADJACENT ISS AREA. IF THE ISS TREATMENT BUFFER ZONE IS ADJACENT TO MULTIPLE ISS AREAS OF DIFFERING TARGET DEPTHS, THE BUFFER ZONE DEPTH SHALL MATCH THE DEEPEST TARGET DEPTH.
6. ISS TREATMENT SHALL PROCEED GENERALLY FROM NORTH-NORTHWEST TO SOUTH-SOUTHEAST, FOLLOWING THE GROUNDWATER GRADIENT. REFER TO DRAWING C-107 FOR GROUNDWATER CONTOURS.
7. THE ISS TARGET TREATMENT AREA SHALL BE EXCAVATED TO A DEPTH OF APPROXIMATELY 4 FT BELOW FINAL GRADE FOLLOWING IMPLEMENTATION OF ISS.
8. CONTRACTOR SHALL NOT DISTURB THE EXISTING CRUSHED STONE COVER.
9. ISS TREATMENT AND BACKFILLING OF THE ISS AREA SHALL BE COMPLETED PRIOR TO INSTALLATION OF CRUSHED STONE COVER WITHIN THE CENTRAL/CORE AREA.
10. FOLLOWING ISS IMPLEMENTATION, EXCAVATE CENTRAL/CORE AREA (BEYOND THE LIMITS OF ISS) TO A TARGET DEPTH OF 2 FT. BELOW FINAL GRADE. INSTALL CRUSHED STONE COVER OVER ENTIRE CENTRAL/CORE AREA INCLUDING THE ISS AREA AS SHOWN ON DRAWING C-112.
11. DUE TO SHALLOW GROUNDWATER, A WORK PLATFORM AND CONTAINMENT BERMS MAY BE NECESSARY FOR ISS. DESIGN, CONSTRUCTION, MANAGEMENT, AND REMOVAL OF WORK PLATFORMS AND CONTAINMENT BERMS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
12. TREATMENT DEPTHS VARY THROUGHOUT ISS TARGET AREA AND ARE INCLUDED IN DRAWINGS C-400 AND C-401.
13. FOR SOIL BORING LOCATIONS ON CROSS-SECTION E-E' REFER TO DRAWINGS C-400 AND C-401.

LEGEND:

- LOW — LIMIT OF WORK
- TOP OF BANK
- ENLARGEMENT AREA (REFER TO DRAWINGS C-400 AND C-401)
- CENTRAL / CORE AREA
- TARGETED EXCAVATION AREA (TO 4 FT. BGS)
- ISS TARGET TREATMENT AREA
- ISS TREATMENT BUFFER ZONE
- EXISTING 2-FT CRUSHED STONE COVER
- ISS TREATMENT NEAR EXISTING BUILDING

Brown AND Caldwell
BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

WARNING: IT IS A VIOLATION OF THE NEW YORK STATE EDUCATION LAW ARTICLE 145, SECTION 7209(2) FOR ANY PERSON, UNLESS HE/SHE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY. IF THIS ITEM, BEARING THE SEAL OF AN ENGINEER, IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS/HER SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS/HER SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

DRAFT

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (90-95%)

REVISIONS		
REV	DATE	DESCRIPTION

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	P. PETRINO
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-110.DWG
BC PROJECT NUMBER
149322
CLIENT PROJECT NUMBER
—

CIVIL

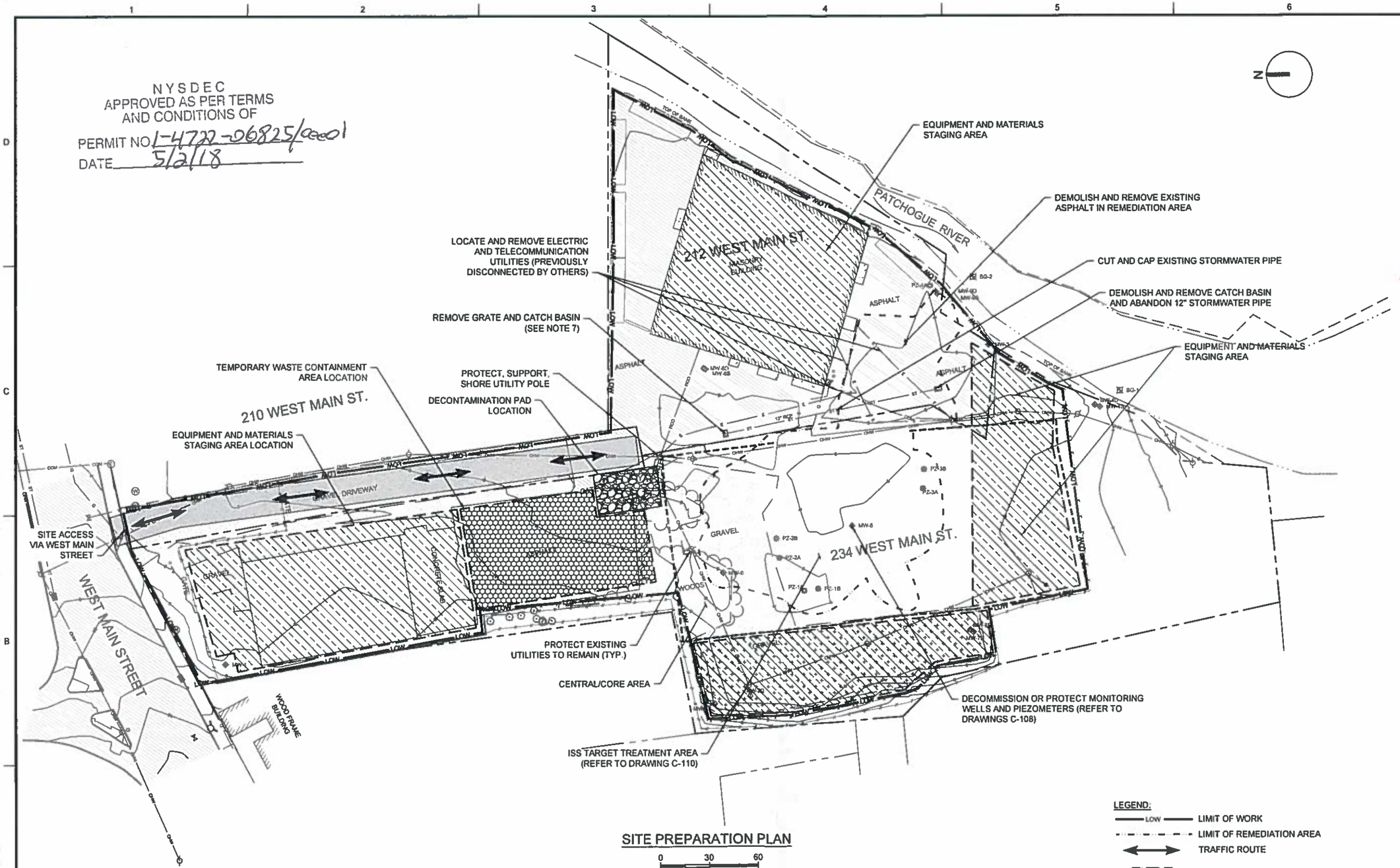
SITE REMEDIATION PLAN

DRAWING NUMBER
C-110

SHEET NUMBER
11 OF 20

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CADD\2-SHEETS\C-CIVIL FILENAME: C-110.DWG PLOT DATE: 10/10/2017 11:55 AM CAD USER: ROBERT NEAR

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4722-06825/00001
DATE 5/2/18



SITE PREPARATION PLAN

0 30 60
SCALE IN FEET

LEGEND:
- LOW — LIMIT OF WORK
- LIMIT OF REMEDIATION AREA
- TRAFFIC ROUTE
- EQUIPMENT AND MATERIALS STAGING AREA
- DECONTAMINATION PAD
- TEMPORARY WASTE CONTAINMENT AREA
- TEMPORARY ACCESS ROADWAY
- EXISTING CRUSHED STONE COVER

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. REFER TO TECHNICAL SPECIFICATIONS AND DRAWING C-110 FOR CONSTRUCTION SEQUENCE.
3. STAGING AREAS AND DECONTAMINATION PAD LOCATIONS ARE SHOWN FOR REFERENCE ONLY. FINAL LOCATION OF THESE AREAS WILL BE DETERMINED BY THE CONTRACTOR AND INCLUDED IN THE 100% DESIGN DOCUMENTS.
4. LOCATION AND AERIAL EXTENT OF WASTE CONTAINMENT AREA, EQUIPMENT AND MATERIAL STAGING AREA, AND DECONTAMINATION PAD ARE SHOWN AS AVAILABLE AREAS FOR THESE ACTIVITIES. CONTRACTOR SHALL PROPOSE ACTUAL AREAS, LIMITS AND LOCATIONS. ANY DAMAGE TO THE EXISTING STRUCTURES/SURFACE IN THESE AREAS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST.
5. CONTRACTOR MAY USE FIRST FLOOR OF EXISTING BUILDING FOR EQUIPMENT AND MATERIALS STAGING AREA. USE OF SECOND FLOOR IS NOT PERMITTED.
6. CONTRACTOR SHALL LOCATE AND PROTECT EXISTING MONITORING WELLS TO REMAIN.
7. CONTRACTOR SHALL REMOVE GRATE AND CATCH BASIN. CONTRACTOR SHALL DISPOSE OF CATCH BASIN, GRATE AND MATERIAL CONTAINED IN THE CATCH BASIN AT AN APPROVED OFF-SITE FACILITY. BACKFILL WITH CRUSHED STONE TO EXISTING GRADE.

Brown AND Caldwell
BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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DRAFT

MAREK OSTROWSKI,
N.Y. PROFESSIONAL ENGINEER
N.Y. LIC NO. 073661

NATIONAL GRID
PATCHOGUE
FORMER MGP SITE
234 WEST MAIN
STREET
VILLAGE OF
PATCHOGUE, NY

REMEDIAL DESIGN
DRAWINGS (90-95%)

REVISIONS

REV	DATE	DESCRIPTION

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	C. OLIVEIRA
DRAWN:	A. SANTIAGO / R. NEAR
CHECKED:	P. PETRINO
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-111.DWG
BC PROJECT NUMBER
149322
CLIENT PROJECT NUMBER

CIVIL

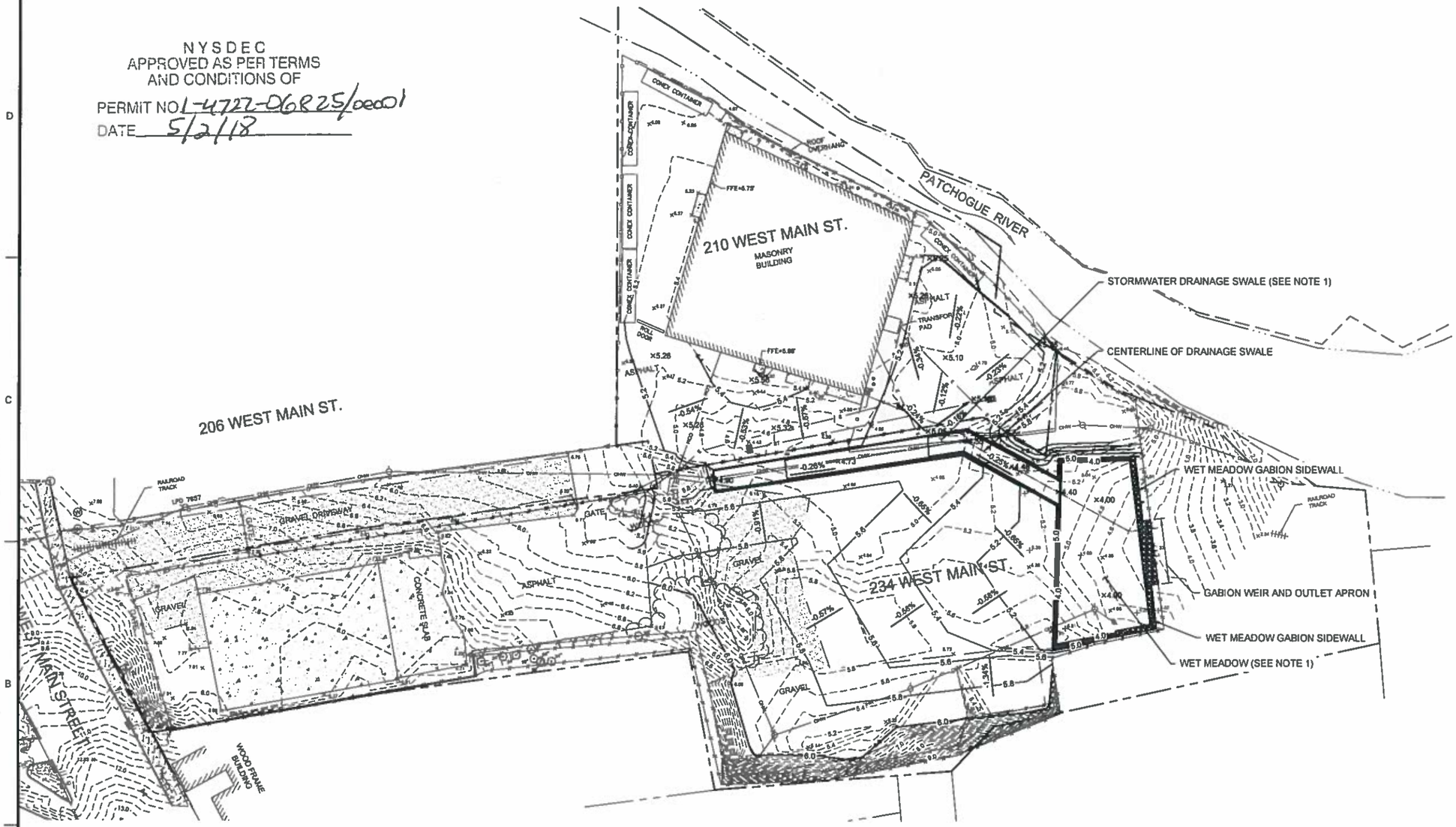
SITE PREPARATION
PLAN

DRAWING NUMBER
C-111

SHEET NUMBER
12 OF 20

Path: P:\NATIONAL_GRID\PATCHOGUE\149322_NG_PATCHOGUE_RDR_CAD\2-SHEETS\C-CIVIL FILENAME: C-111.DWG PLOT DATE: 10/10/2017 11:34 AM CAD USER: ROBERT NEAR

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO 1-4722-06825/00001
DATE 5/2/18



SITE RESTORATION GRADING PLAN

0 30 60
SCALE IN FEET

LEGEND:

- PROPERTY LINE
- EXISTING TOPOGRAPHIC CONTOUR (FT., NAD 88)
- FINAL GRADE CONTOUR (FT., NAD 88)
- EXISTING GRADE SPOT GRADE (FT., NAD 88)
- FINAL GRADE SPOT GRADE (FT., NAD 88)
- FINAL GRADE SLOPE
- CHAIN-LINK FENCE

NOTES:
1. SEE DRAWING C-114 FOR ADDITIONAL INFORMATION ON THE DRAINAGE SWALE AND WET MEADOW.

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BROWN AND CALDWELL ASSOCIATES
2 PARK WAY, SUITE 2A
UPPER SADDLE RIVER, NJ

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PATCHOGUE
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VILLAGE OF
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REMEDIAL DESIGN
DRAWINGS (90-95%)

REVISIONS

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CHECKED:	P. PETRINO
CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-113.DWG
BC PROJECT NUMBER
149322
CLIENT PROJECT NUMBER
—

CIVIL

SITE RESTORATION
GRADING PLAN

DRAWING NUMBER
C-113

SHEET NUMBER
14 OF 24

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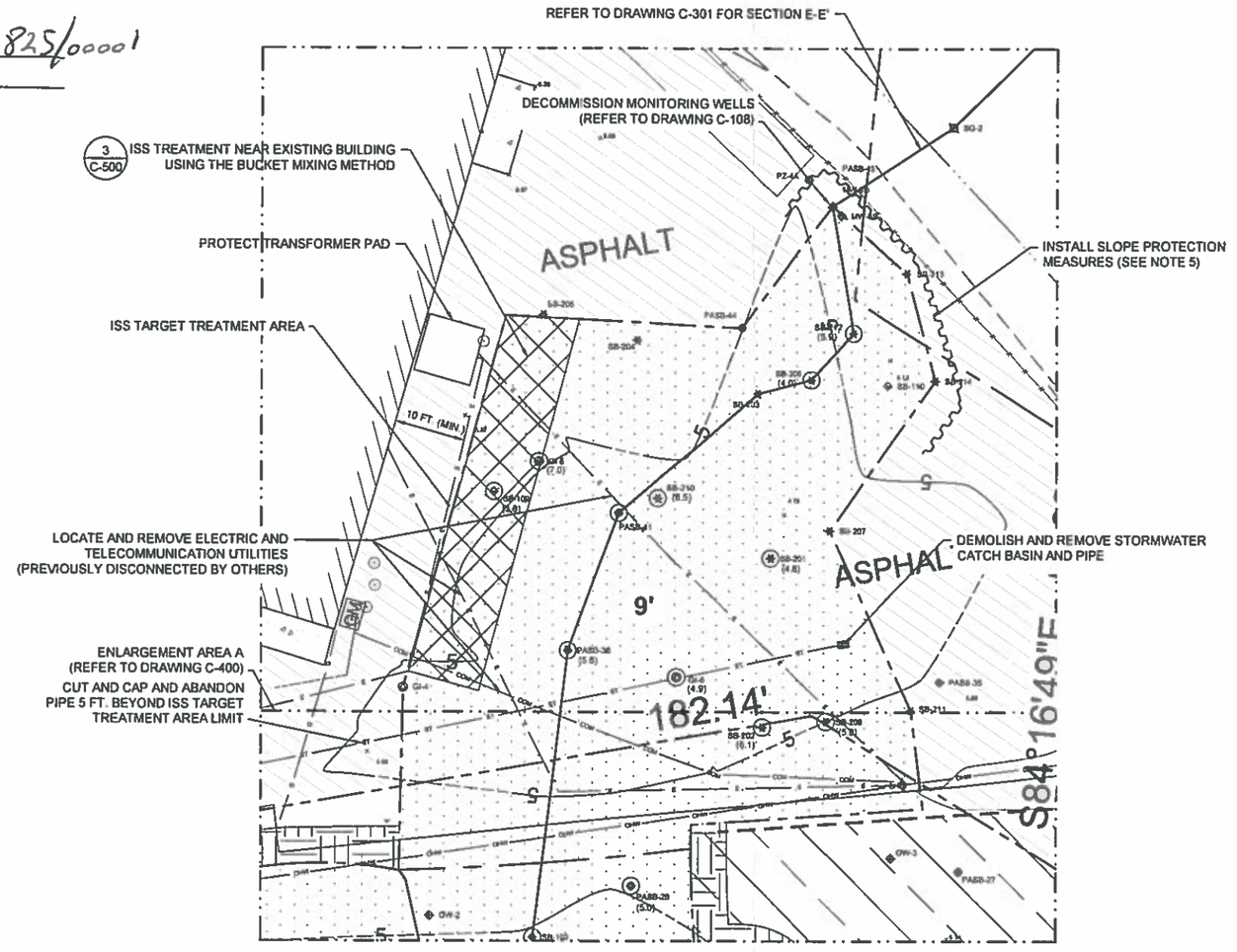
PERMIT NO. 1-4722-06825/00001
DATE 5/2/18



SITE REMEDIATION PLAN - ENLARGEMENT B

0 10 20
SCALE IN FEET

NOTES:

1. REFER TO DRAWING C-101 FOR BASE MAP INFORMATION.
2. WORK SHALL BE SEQUENCED SUCH THAT ISS TREATMENT PROGRESSES FROM GROUNDWATER UPGRADIENT TO DOWNGRADIENT (I.E., ISS TREATMENT PROGRESSES FROM NORTH TO SOUTH FOLLOWING GROUNDWATER GRADIENT).
3. ISS DELINEATION DENOTES MINIMUM AREA TO BE TREATED. CONTRACTOR MAY EXPAND TREATMENT AREA TO ACCOMMODATE ISS TREATMENT TECHNIQUE REQUIREMENTS.
4. THIS AREA WAS PREVIOUSLY EXCAVATED TO A DEPTH OF 2 FT. BGS AND A CRUSHED STONE COVER CONSISTING OF 2 FT OF CRUSHED STONE AGGREGATE WAS INSTALLED. CONTRACTOR SHALL NOT DISTURB THE EXISTING COVER.
5. CONTRACTOR SHALL INSTALL A SHEETPILE SUPPORT SYSTEM PRIOR TO ISS RELATED ACTIVITIES IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS. SHEETPILES SHALL HAVE A MINIMUM EMBEDMENT DEPTH OF 12 FT. BGS. SHEETPILE SYSTEM TO BE INSTALLED BY HYDRAULIC PRESSING. VIBRATORY OR HAMMER DRIVING WILL NOT BE ALLOWED.

LEGEND:

- 5 — EXISTING TOPOGRAPHIC CONTOUR
- TOP OF BANK
- CENTRAL / CORE AREA
- EXCAVATION AREA
- ISS TARGET TREATMENT AREA
- ISS TREATMENT BUFFER ZONE
- ISS TARGET TREATMENT AREA (BUCKET MIXING)
- 9' TARGET DEPTH FROM BELOW GRADE SURFACE OF ISS TREATMENT ZONE
- SLOPE PROTECTION MEASURES

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CHECKED:	K. BOGATCH
APPROVED:	M. OSTROWSKI

FILENAME
C-401.DWG
BC PROJECT NUMBER
149322
CLIENT PROJECT NUMBER

CIVIL

SITE REMEDIATION
PLAN -
ENLARGEMENT B

DRAWING NUMBER
C-401
SHEET NUMBER
16 OF 20

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