FORMER SAG HARBOR MANUFACTURED GAS PLANT SITE
SUFFOLK COUNTY
SAG HARBOR, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: 1-52-159

Prepared for:

KeySpan Gas East Corporation d/b/a National Grid
175 East Old Country Road
Hicksville, New York 11801

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
1	06/03/2020	Modification of Institutional Controls for off-Site Properties located within the SMP limits north of Long Island Avenue. Modification of groundwater sampling frequency and monitoring well list.	05/03/2024

JUNE 2023

CERTIFICATION STATEMENT

I, MATTHEW J. O'NEIL, certify that I am currently a NYS registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Matthew J. O'Neil P.E.

JUNE 7, 2023 DATE

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

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List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
FSP	Field Sampling Plan
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
ISS	In-Situ Stabilization
MTBE	Methyl tert-butyl ether
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PAHs	Polycyclic aromatic hydrocarbons
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision

List of Acronyms (Continued)

RP	Remedial Party and Respondent
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance, and reporting activities required by this Site Management Plan (SMP):

Site Identification:	Site Number: 1-52-159 Former Sag Harbor Manufactured Gas Plant Site 5 Bridge Street Sag Harbor, New York	
Institutional Controls:	1. The property may be used for restricted residential, commercial, or industrial use. 2. Environmental Easements have been placed on the site properties, located at 5 Bridge Street, 11 Bridge Street and 31 Long Island Avenue, to prevent future exposure to impacts. Memorandums of Understanding or other agreements are in place with several off-Site property owners, including the 18 Bridge Street property, the 21 Long Island Avenue property, the Village of Sag Harbor (rights-of-way) and 8 West Water Street to prevent future exposure to impacts. 3. All ECs must be inspected at a frequency and in a manner defined in the SMP.	
Engineering Controls:	1. Soil or Composite Cover Systems. 2. Monitored Natural Attenuation. 3. Passive Dense Non-Aqueous Phase Liquid Collection System.	
Inspections:		Frequency
1. Site-wide Inspection		Annually
Monitoring:		
1. Passive Dense Non-Aqueous Phase Liquid Collection.		Quarterly
2. Groundwater Monitoring Wells.		Semiannually

Site Identification:	Site Number: 1-52-159 Former Sag Harbor Manufactured Gas Plant Site 5 Bridge Street Sag Harbor, New York
Maintenance:	
1. Soil or Composite Cover System Maintenance.	As needed
2. Passive Dense Non-Aqueous Phase Liquid Collection System Maintenance	As needed
Reporting:	
1. Periodic Review Report	Annually
2. Severe Conditions Inspection Report	As Needed

Further descriptions of the above requirements are provided in detail in Sections 3, 4, and 6 of this SMP.

The property owners are required to comply with this SMP including all notifications to National Grid and to the New York State Department of Environmental Conservation (NYSDEC), and the provisions in the Excavation Work Plan ([EWP] Appendix B). If property ownership changes after the submission of the SMP, Institutional Controls (ICs) Environmental Easements, Declaration of Covenants and Restrictions, or Memorandum of Understanding (EE, DCR, or MOU) must be addressed by the property owner's successors. However, the remedial party shall manage off-Site owners with no ICs.

Off-site boundaries that are covered by this SMP will be reevaluated, based on reductions in groundwater concentrations, as appropriate. National Grid is responsible for Manufactured Gas Plant (MGP)-related impacts and costs associated therewith, only. If a remedy is determined to be necessary to address sources of non-MGP-related impacts present at the Site, this will be evaluated separately by NYSDEC, for further action. **While National Grid has voluntarily assumed responsibility for preparation of this SMP, National Grid reserves all its rights under federal and state environmental**

laws to pursue other parties who may have responsibilities at this Site and for violations of the SMP.

Further descriptions of the above requirements are provided in detail in the latter sections of this SMP.

1.0 INTRODUCTION

1.1 General

This SMP is a required element of the remedial program for the Former Sag Harbor MGP Site located in Sag Harbor, New York (hereinafter referred to as the “Site”) (see Figure 1). The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program Site No. 1-52-159, which is administered by NYSDEC.

KeySpan Gas East Corporation, d/b/a National Grid (hereinafter “National Grid” or “Remedial Party and Respondent” [RP]) entered into an Order on Consent (the “Order”) on March 30, 1999, with the NYSDEC to remediate MGP-related impacts at the Site. The Order required National Grid, to investigate and remediate MGP-impacted media at the former MGP site and surrounding off-Site areas. For purposes of further discussion in this SMP, the term “Site” includes the main MGP Site (5 Bridge Street) as well as an adjacent private property to the north (31 Long Island Avenue) and a portion of the adjacent private property to the south (11 Bridge Street). The term “off-Site areas” includes all or portions of adjacent private properties to the north, south, and west of the Site, and The United States Postal Service Post Office property, the Village sidewalk and roads to the north and west, and the Village parking lot to the east as shown on Figure 2 (see Limits of SMP). These properties are located at 2, 4, and 8 West Water Street; 21 and 22 Long Island Avenue; 7 and 18 Bridge Street; and 51 Meadow Street in the Village of Sag Harbor, Town of Southampton, Suffolk County, New York. National Grid presently owns 5 Bridge Street but does not own any of the other Site or off-Site properties. Refer to Section 2.1.1 for Site and off-Site property locations, descriptions, and owner information.

As stated above, a figure showing location and boundaries of this Site is provided in Figure 2. The boundaries of the Site are more fully described in the metes and bounds Site description that are part of the EEs provided in Appendix A. The EEs were granted by the owners of the Site (the "Grantor") to the NYSDEC and were recorded at the Suffolk County Clerk by the RP.

After completion of the remedial work, some target compounds and target analytes were left in the subsurface at the Site and the off-Site areas. ICs and ECs have been incorporated into the Site remedy to control exposure to target compounds and target analytes detected at concentrations exceeding applicable Standards, Criteria and Guidance (SCGs) in environmental samples collected at the Site (i.e., remaining impacts) to ensure protection of public health and the environment. An EE granted to the NYSDEC by the property owners (see Table 1, Site Property Divisions and Owners) and recorded with the Suffolk County Clerk, requires compliance with this SMP and all ECs and ICs placed on the Site. The EE package is located in Appendix A.

ECs and ICs are incorporated into this SMP to control exposure to remaining impacts to ensure protection of public health and the environment. The ECs established on the Site as part of the remedy include a Soil or Composite Cover System, Monitored Natural Attenuation, and Passive Dense Non-Aqueous Phase Liquid (DNAPL) Recovery System. ICs consist of EEs granted to the NYSDEC, by the owners of the Site and recorded with the Suffolk County Clerk which require compliance with the SMP, and all established ECs for the Site as described in Section 3.

Post-remedial monitoring will be conducted, i.e., groundwater monitoring and passive DNAPL recovery system monitoring, to determine the success of the remedy as well as annual inspections of the Site to assess compliance with the provisions of the EEs, MOU, other agreements and this SMP.

ECs and ICs were also incorporated into the remedy for the off-Site areas to control exposure to remaining MGP-related impacts to ensure protection of public health and the environment. The ECs on the off-Site Properties may include one or a combination of Soil or Composite Cover Systems, Monitored Natural Attenuation, or a passive DNAPL Recovery System. The off-Site Properties will be subject to similar post-remedial monitoring as described above for the Site with regard to the ECs. The off-Site property owners will be responsible to maintain the cover systems to address normal wear and tear and shall replace the soil or other cover material if broken during activities conducted on the off-Site Properties (e.g., utility installation). The off-Site property owners will also be responsible to notify National Grid of such events.

This SMP was prepared to manage remaining impacts at the Site until the EEs are extinguished in accordance with Environmental Conservation Law (ECL) Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the Grantor's of the EEs and the Grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the Site-specific implementation procedures that are required by the EEs. Failure to properly implement the SMP is a violation of the EEs, which is grounds for revocation of the Certificate of Completion (COC).
- Failure to comply with this SMP is a violation of ECL Article 71, Title 36 EEs and, 6 New York Codes Rules and Regulations (NYCRR) Part 375 and the Order on Consent (Index #D1-0002-98-11, Site #1-52-159) for the Site, and thereby subject to applicable penalties. If the failure to comply with this SMP occurs, the NYSDEC may take action against the violating party.
- The property owner is required to comply with this SMP including all notifications to National Grid and NYSDEC, and the provisions in the EWP (Appendix B). National Grid is only responsible for costs associated with MGP-related impacts.
- NYSDEC can take action against an on-site and/or off-site owner if they interfere with the remedial program under the ECL. Triggers include improper disposal, release of contaminants of concern to environment, lack of odor control, etc.

Annual inspections of the Site will be conducted to assess compliance with the provisions of the EE and this SMP.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in NYS.

This SMP was prepared by GEI Consultants, Inc., P.C. on behalf of National Grid, in accordance with the requirements of the NYSDEC's Division of Environmental Remediation (DER)-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the

EEs for the Site. **While National Grid has voluntarily assumed the costs of preparing this SMP, National Grid reserves all its rights under federal and state environmental laws to pursue other parties who may have responsibilities at this Site and for violations of the SMP.**

As required by the Record of Decision ([ROD], NYSDEC, 2006) for the Site, this SMP includes the following two plans:

1. An Institutional and Engineering Control Plan that identifies all use restrictions, ICs, and ECs for the Site and details the steps and media-specific requirements necessary to ensure the following ICs and/or ECs remain in place and effective:

    - ICs: EEs, Memorandums of Understanding and other agreements
    - ECs:
        - Soil or Composite Cover Systems
        - Monitored Natural Attenuation
        - Passive DNAPL Collection Systems.

    The Institutional and Engineering Control Plan, which is presented in Section 3 of this SMP, includes the following plans and provisions:

    - An EWP which details the provisions for management of limited excavations in areas of remaining MGP-related impacts
    - A Health and Safety Plan (HASP)
    - Community Air Monitoring Plans (CAMPs)
    - A Quality Assurance Project Plan (QAPP)
    - A Field Sampling Plan (FSP)
    - Further investigation and possible remediation should large-scale redevelopment occur (see Section 3.8)
    - Management and inspection of the identified ECs (see Section 3)
    - Maintenance of Site access controls and NYSDEC notification.

2. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes:
    - A schedule of monitoring and frequency of submittals to the Department.
    - The Monitoring Plan is presented in Section 4 of this SMP.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager as an addendum. Revisions will 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 impacted sediment or soil, or other significant change in condition to the Site and/or off-Site areas. In accordance with the EEs for the Site, the NYSDEC will provide a notice of any approved changes to the SMP and append these notices to the SMP that is retained in its files.

1.3 Notifications

All intrusive activities must be approved by NYSDEC. Sufficient notification must be made to NYSDEC so they can make the decision on the type of reporting. Typically, the type of notification and reporting requirements depend on the scope of work. Large-scale intrusive work will require additional investigation and, depending on findings of the investigation, may require a detailed work plan, such as a Remedial Action Work Plan (RAWP) while smaller scale (i.e., "limited") intrusive activities will comply with the EWP (Appendix B) and may require a Notice of Intrusion letter or a simple letter work plan.

Notifications shall be submitted, in writing, to National Grid and to the NYSDEC, 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 ECL.
- 30-day advance notice of any field activity not pursuant to the EWP.
- Notify National Grid as soon as possible of any proposed ground-intrusive activity pursuant to the EWP. Notify NYSDEC at least 15 days prior to the proposed start of activity.

- 18-month advance notice of any redevelopment or demolition of structures.
- Once identified, notice will be provided to National Grid and 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.
- Verbal notice will be provided to National Grid and NYSDEC 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. National Grid will provide written confirmation to NYSDEC 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 damage or defect to the EC requiring ongoing responsive action will be prepared by National Grid and submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the Site or off-Site areas, use of the Site or off-Site areas, or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, National Grid and the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Order on Consent and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the Site or off-Site areas, the new owner's name, contact representative, and contact information will be confirmed in writing to National Grid and the NYSDEC.

All notifications will be submitted to:

National Grid Project Manager:
Name: Michael Quinlan
Address: 175 E Old Country Road, Hicksville, New York 11801
Telephone: 516-220-4363
Email: michael.quinlan@nationalgrid.com

New York State Department of Environmental Conservation Project Manager:
Name: Matthew Ayers, P.G.
Address: New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau C
625 Broadway Albany, New York 12233-7014
Telephone: 518-402-9662, Fax: 518-402-9679
Email: matthew.ayers@dec.ny.gov

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The Site, as referenced in Section 2.2.1, is located in Sag Harbor, Suffolk County, New York (see Figure 1). The Site (comprised of the 5 Bridge Street, 31 Long Island Avenue, and a portion of the 11 Bridge Street properties) is an approximately 1.55-acre area and is bounded by Long Island Avenue to the north, residences to the south, a United States Post Office and a public parking lot to the east, and Bridge Street and the Harbor Close Condominium to the west (see Figure 2, Site Layout Map). EEs have been placed on the three properties that comprise the Site; however, while the entire 11 Bridge Street property has an easement, only a portion of the property is considered part of the Site. The boundaries of the properties with Easements are more fully described in Appendix A, EEs. The owner(s) of the Site parcel(s) at the time of issuance of this SMP are described in Table 1 and shown in Figure 2.

2.1.1 Off-Site Area Location and Description

The off-site area is located in Sag Harbor, Suffolk County, New York (see Figure 2). The off-Site properties comprise approximately 4.5-acres, which surround the Site. The off-Site properties are bounded by Sag Harbor Cove to the north, residences to the south, Meadow Street and a parking lot to the east, and Sag Harbor Cove and condominiums to the west (see Figure 2, Site Layout Map). The owner(s) of the Site parcel(s) at the time of issuance of this SMP are shown in Table 1 and Figure 2.

2.2 Physical Setting

2.2.1 Land Use

The Site includes the main Site (5 Bridge Street), an adjacent private property to the north (31 Long Island Avenue) and a portion of the adjacent private property to the south (11 Bridge Street). The off-Site areas include all or portions of adjacent private properties to the north (22 Long Island Avenue, 2 West Water Street, 4 West Water Street, and 8 West Water Street), south (7 Bridge Street), and west (18 Bridge Street) of the Site; the United States Postal Service Post Office property and the Village of Sag Harbor sidewalk and roads to the north and west and the Village of Sag Harbor parking lot to the east.

2.2.2 Geology

The Site is located in an area that was a marine wetland before being filled in the 1800s. Today, the ground surface stands a few feet above sea level, with the uppermost soil layer made up of material used to fill the original wetland (sandy soils, brick fragments, ash, etc.). The peat, silt, and clay deposits which formed the original wetland bottom are still present at depths of 8 to 12 feet below the ground surface. Below these lie several hundred feet of unconsolidated sands. A geologic cross section is shown in Figure 3.

2.2.3 Hydrogeology

The peat, silt, and clay layers described in Section 2.2.2 are important because they are far less permeable than the predominantly sandy soils above and below. Groundwater and other liquids do not readily move through the peat, silt, and clay. In most areas, this has had the effect of limiting the degree to which DNAPL moved downward through the subsurface. However, these deposits are absent in some portions of the Site, and DNAPL has moved downward into the underlying sands in these areas.

The water table at the Site is very shallow. The depth to groundwater varies from approximately 6 to 24 inches below grade. This high groundwater level leads to localized ponding during heavy rains. The groundwater is tidally influenced, but consistently flows in a westerly direction. Shallow groundwater flow at the Site also appears to be influenced by the soil mix wall. The groundwater is brackish and discharges to Sag Harbor Cove.

A groundwater contour map is shown in Figure 4. Groundwater monitoring well construction logs are provided in Appendix C.

2.3 Former MGP Property Investigation and Remedial History

2.3.1 Property History

The former Sag Harbor MGP, located at 5 Bridge Street, operated from 1859 to 1930. The MGP produced gas from coal or wood rosin before being switched to a water gas process in 1892. The byproducts of gas production that spilled, leaked, or were disposed on the former Sag Harbor MGP property are the source of MGP-related impacts.

2.3.2 Investigation and Remedial History

The following narrative provides a remedial history timeline and a summary of the available project records to document key investigative and remedial milestones for the Site and off-Site areas. Full titles for each of the reports referenced below are provided in Section 7.0, References.

The former Sag Harbor MGP was discovered during the investigation of the Sag Harbor Bridge Street Site (Site Number 1-52-126) which was listed as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York in 1988. That site was delisted in 1995. In 1997, a preliminary site assessment was performed on the former Sag Harbor MGP property and, as a result, the NYSDEC listed the former Sag Harbor MGP property as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York in 1997. Following that listing, an Interim Remedial Measure was performed to remove and cap historic piping present at the former Sag Harbor MGP property to prevent migration of MGP by-products.

2.3.3 Investigation Results

The Remedial Investigation was performed to characterize the nature and extent of MGP-related impacts at the Site and surrounding areas. The results of the Remedial Investigation are described in detail in the following reports:

- Sag Harbor former MGP Site Remedial Investigation Report, June 2002 [Dvirka and Barticulli, 2002]
- Final Remedial Investigation Report, Sag Harbor Former MGP Site, New York, December 2003 [Dvirka and Bartilucci, 2003]
- Draft Supplemental Field Program Report, Sag Harbor Former MGP Site, New York, February 2005 [GEI, 2005]

To determine whether the soil, groundwater, surface water, soil vapor, air, and sediment contain MGP-related impacts at levels of concern, data from the Remedial Investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on the NYSDEC "Ambient Water Quality Standards (AWQS) and Guidance Values" and Part 5 of the NYS Sanitary Code.
- Soil SCGs are based on the NYSDEC "Technical and Administrative Guidance Memorandum 4046; Determination of Soil Cleanup Objectives (SCOs) and Cleanup Levels."
- Sediment SCGs are based on the NYSDEC "Technical Guidance for Screening Contaminated Sediments."
- Indoor air SCGs are based on the New York State Department of Health (NYSDOH) Database summary of indoor and outdoor air sample results in control homes collected and analyzed by NYSDOH from 1989 through 1996.

Generally, the Remedial Investigation found that there were no ongoing exposures to MGP-related impacts from the Site or off-Site areas. At the time of the Remedial Investigation, the Site surface was mostly covered which further reduced the likelihood of direct contact with MGP-impacted soil. Exposure to impacted groundwater is not occurring, as there are no supply wells located in the MGP-impacted area. The area surrounding the Site is served by a public water supply, which is regularly tested to ensure that it meets state and federal drinking water standards for a number of constituents, including those associated with the former Sag Harbor MGP property. Indoor air samples from buildings on and surrounding the Site have not shown evidence of MGP-related impacts.

Many soil, groundwater, ambient and indoor air, and sediment samples were collected during the Remedial Investigation to characterize the nature and extent of MGP-related impacts. The main categories of contaminants that exceed their SCGs are volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The principal human health and environmental risks posed by this Site relate to the widespread distribution of MGP source material throughout the Site and surrounding area.

The MGP source material identified at the Site belongs to a group of organic contaminants known as DNAPL. DNAPLs do not readily dissolve in water and tend to sink to the bottom of water bodies and aquifers. When released into the subsurface, these liquids can spread out in complex directions that may or may not be the same direction as groundwater flow. DNAPL associated with MGPs is unusual because its density is only slightly greater than water. The MGP-related DNAPL does tend to sink, the relatively slight difference in density between DNAPL and water makes this sinking effect somewhat unpredictable.

Two classes of chemical compounds contained in the MGP-related DNAPL are of concern:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX) are VOCs, which are also commonly found in unleaded gasoline, paint thinners, and other solvents. They are somewhat soluble in water. Consequently, groundwater which comes into contact with DNAPL often becomes impacted by these compounds. This MGP-impacted groundwater is then free to move away from the source along with the ordinary groundwater flow through the subsurface.
- Polycyclic aromatic hydrocarbons (PAHs). This is a large group of SVOCs with several hundred different individuals known to exist. They are far less soluble than the BTEX, and consequently are far less likely to cause MGP-related groundwater impacts. They are also far less likely to be digested by soil bacteria, and thus are very persistent in the environment. The United States Environmental Protection Agency (USEPA) has identified 17 of the PAHs as hazardous materials, and these are the ones used to define the extent of MGP-related PAH impacts at the Site.

Table 2 and Table 3 summarize the analytical data for the remaining impacts in surface soil, subsurface soil, and groundwater; and compare the data with the SCGs for the Site and off-Site areas. The locations of all the samples are noted on Figure 5.

Below is a summary of the conditions at and in the area surrounding the former Sag Harbor MGP property when the Remedial Investigation was performed between April 2000 and May 2004:

Waste

The waste material associated with the former Sag Harbor MGP property is DNAPL. DNAPL migrated to a depth of roughly 8 to 10 feet below the ground surface. At this level, it encountered a layer of peat, silt, and clay which it could not readily penetrate, and spread laterally on top of this layer beneath the former Sag Harbor MGP property. It also spread beyond the former Sag Harbor MGP property boundaries, roughly 50 feet to the south and 80 feet to the north, where it was found beneath the 11 Bridge Street and 31 Long Island Avenue properties, located within the Site.

Near the center of the former Sag Harbor MGP property, the peat, silt, and clay layer are absent, and the DNAPL spread downward much further, to a total depth of roughly 90 feet. No deep penetration of DNAPL has been found beyond the limits of the former Sag Harbor MGP property.

The DNAPL appeared to be in a steady state, in which the overall limits of the DNAPL migration would not change unless Site conditions changed significantly. However, within the area of MGP-related DNAPL impacts, some pockets of pooled, mobile coal tar may have existed. The extent of the MGP-related DNAPL impacts as identified by BTEX and PAH concentrations during the Remedial Investigation is shown on Figure 6. This material required remediation, as it acted as a source for MGP-related soil and groundwater impacts.

Surface Soil

Surface soil samples were collected from the upper 0 to 2 or 0 to 6 inches across the former Sag Harbor MGP property, as well as off-site. All samples were analyzed for SVOCs, metals, and cyanide. Samples collected outside of the former Sag Harbor MGP property boundaries were also analyzed for VOCs. Although BTEX were detected in samples collected outside of the former Sag Harbor MGP property boundaries, all of the detections were below the NYS Recommended SCOs from Technical Guidance Manual 4046. PAHs were found in the majority of the surface soil samples across the former Sag Harbor MGP property and in some off-site areas. The maximum detections of PAHs were, in the majority of samples, above the individual SCGs. The highest total PAHs in surface soil was 950 parts per million and was found in the historic location of the southeastern gas holder on the former Sag Harbor MGP property. Cyanide was identified in samples collected from Site and off-site areas, with the maximum concentration found on the former Sag Harbor MGP property in the location of the former gas holders. The soils containing cyanide were not above guidance levels and were, most likely, a constituent of the DNAPL.

Subsurface Soil

MGP-related PAH, BTEX impacts to subsurface soils were detected in several areas, with the highest contaminant concentrations found in areas where visible DNAPL was present. Thus, the highest levels of MGP-related impacts to soil are found in the shallow subsurface soils (generally less than eight feet below the ground surface) in the eastern portion of the former Sag Harbor MGP property. Outside of the zones where visible DNAPL was present, PAHs, BTEX concentrations decrease rapidly. Individual BTEX concentrations ranged from not detectable to 500 parts per million, and PAHs concentrations ranged from not detectable to 1,700 parts per million. Cyanide was detected in only a few subsurface samples, at low levels. The highest value, 4.8 parts per million, was found in an area of shallow visible DNAPL, which also contained high levels of PAHs, BTEX.

Groundwater

Both PAHs and BTEX compounds are found in groundwater beneath the former Sag Harbor MGP property and groundwater off the property, with the highest contaminant levels found at shallow depths, in close proximity to the DNAPL. Groundwater flow direction is north toward Sag Harbor Cove. BTEX compounds were found in the majority of the groundwater samples, both on and off the former Sag Harbor MGP property. Benzene was the individual compound detected most frequently, and at the highest concentration, with values ranging from non-detect to 8,700 parts per billion. PAHs compounds are less soluble than BTEX, but due to the extensive distribution of DNAPL, they were detected in most groundwater samples as well. Naphthalene is the PAHs compound detected most frequently, and at the highest concentration, with values ranging from non-detect to 79,000 parts per billion. The extent of MGP-related groundwater impacts detected during the Remedial Investigation are shown on Figure 7.

Surface Water

Surface water and groundwater seep samples were collected. The only Sag Harbor former MGP Site-related contaminant detected was xylene at a concentration of one part per billion (ppb) in one of the 31 surface water samples, which is far below the SCGs for xylene of 19 parts per billion.

Sediments

The sediments in Sag Harbor Cove were sampled for BTEX and PAHs. None of the samples indicate an impact from the Sag Harbor MGP Site. The low levels of BTEX and PAHs which were detected were distributed randomly across the survey area, which suggests that they represent general background conditions in the area and are not the result of MGP-related impacts.

Soil Vapor

Soil vapor samples were collected and analyzed for BTEX compounds, and naphthalene. Naphthalene and other PAHs were not detected in any of the samples. BTEX were detected in samples collected above areas of DNAPLs.

Indoor and Ambient Air

Indoor and ambient air samples were collected during two rounds of sampling from surrounding the former Sag Harbor MGP Site. The samples were analyzed for VOCs, which included BTEX and naphthalene. Although some VOCs were detected in several samples, the NYSDOH determined that these detections are not related to the former Sag Harbor MGP.

2.3.4 Remedial Actions

The Site and portions of the 18 Bridge Street property and select areas of the Village of Sag Harbor rights-of-way including Bridge Street and Long Island Avenue were remediated in accordance with the NYSDEC-approved Remedial Design/RAWP [AECOM, 2008] dated August 2008. In accordance with the ROD, the remediation goals for the Site are to eliminate/reduce VOCs, SVOCs, and cyanide in surface soil, subsurface soil, groundwater, and soil vapor and attain ambient groundwater quality standards and recommended soil cleanup values for surface soils.

The following is a summary of the Remedial Action performed at the Site:

- An excavation support system (Soil Mix Wall) to allow for shallow subsurface soil removal was installed. The commercial building to the north on the 31 Long Island Avenue Property was removed. The top 8 to 15 feet of MGP-impacted soil was then excavated. Soils were transported off-Site for proper treatment and disposal. The excavated areas were backfilled with clean soil materials from an off-Site location to meet or exceed the Unrestricted Use SCOs.
- All vegetated areas were covered with one foot of clean soil and all non-vegetated areas were covered with either concrete or a paving system.

A passive (non-pumping) DNAPL collection system was installed to collect any DNAPL remaining in the subsurface. The wells will collect DNAPL passively at first. Additional wells may be installed if additional areas of recoverable DNAPL are identified following regular monitoring of the DNAPL collection wells. Low-flow pumping may be implemented if early results indicate that this will increase DNAPL recovery. Historically, measurable quantities of NAPL have previously been found in two onsite shallow monitoring wells (MW-02 and MW-05), one onsite intermediate well (SHMW-02I), and one offsite shallow well (SHMW-04S). All the wells identified above in which NAPL has been historically detected were either destroyed or abandoned prior to, or during, remedial activities. Following remediation, measurable amounts of NAPL have primarily been limited to SHMW-02IR. Limited thicknesses of NAPL were also noted in one event in SHMW-04SR and have been noted sporadically in SHMW-07SR.

- This SMP was developed to: (a) address remaining MGP-impacted soils that may be excavated during future redevelopment. Soils beneath the remaining peat layer are considered MGP-impacted, and will require soil characterization and, where applicable, disposal/reuse in accordance with NYSDEC regulations; (b) evaluate the potential for vapor intrusion in any buildings on or adjacent to the Site, including provision for mitigation of any impacts identified; and (c) identify any use restrictions.
- Imposition of ICs in the form of EEs that will (a) require compliance with the approved SMP; (b) limit the use and development of the Site to Restricted Residential; (c) restrict the use of groundwater as a source of potable water, without necessary water quality treatment as determined by the NYSDOH; and (d) require National Grid and, where appropriate, the various property owners

within the Site and off-Site areas, to complete and submit to the NYSDEC a periodic certification.

The Remedial Action consisted of construction of the soil mix wall, removal and disposal of heavily impacted residual MGP-related soils and placing of clean fill material was implemented from August 2008 through June 2009. The Remedial Action was implemented according to the ROD and the Remedial Design/RAWP (AECOM, 2008) on the following properties located within the Site and off-Site areas: 5 Bridge Street (former Sag Harbor MGP property), 31 Long Island Avenue (Site property), portions of 11 Bridge Street (Site property) and 18 Bridge Street, and select areas of the Village of Sag Harbor right-of ways including Bridge Street and Long Island Avenue as shown in Figure 8. A summary of the Remedial Action is included in the Final Engineering Report (FER) (AECOM, 2015).

Implementation of the Remedial Action resulted in the removal of several different types of waste: concrete and debris, spoils from both soil mix wall swell and cured soil mix wall grading, hazardous soils impacted with lead, non-hazardous residual MGP-related soils, construction debris (hay bales, etc.), and treated water generated during construction, including groundwater, stormwater, and decontamination water.

Concrete and debris were generated during the demolition of surface and subsurface structures during the remedial activities including the Commercial Building located on the northern portion of the Site, the support structures for the former Hortonsphere structure, various pavements, chain link fences, former MGP foundations, piping, and monitoring wells. Concrete and debris were broken up using excavation and demolition equipment, segregated from the soil, stockpiled, decontaminated (if required) and transported off-Site for disposal. A total of 505 tons of concrete and debris were transported to Pioneer Crossing Landfill in Birdsboro, Pennsylvania and G.R.O.W.S Landfill in Morrisville, Pennsylvania.

A total of 4,937 tons of soils were generated as soil mix wall swell during the construction of the soil mix wall. A total of 1,589 tons of soil and concrete mixture were excavated during the removal of the top two feet of the soil mix wall. All soil mix wall related soils were shipped for thermal treatment to ESMI of New Jersey in

Keasbey, New Jersey and Clean Earth of Southeast Pennsylvania, Inc. in Morrisville, Pennsylvania.

A total of 30,067 tons of non-hazardous, residual MGP-related soils were excavated and transported off-Site for thermal treatment to Clean Earth of Southeast Pennsylvania, Inc. and Clean Earth of Philadelphia, Inc. in Philadelphia, Pennsylvania. A total of 734 tons of residual MGP-related soils designated hazardous for lead were excavated and transported off-Site for stabilization and disposal to Casie Protank of Vineland, New Jersey.

Table 4 details the total tonnage of MGP-impacted soil removed from the Site and off-Site areas.

Water generated from construction activities (like dewatering, stormwater collection, and decontamination) were treated at an on-Site water treatment plant and discharged under a NYSDEC State Pollution Discharge Elimination System Permit Equivalent through an approximate 3,500-foot high density polyethylene pipeline to Sag Harbor Bay. A total of 15,618,288 gallons of water were treated and discharged into the Bay. An additional 36,220 gallons of water were transported off-Site for disposal to Clean Waters of New York in Richmond, New York. Table 4 details the daily quantities of water treated and discharged.

A total of 31,668 tons of backfill material and 4,843.81 tons of Type 2 and bluestone gravel were transported to the Site and off-Site areas and placed in the excavated areas. All fill material met the Restricted Residential SCOs. All excavated areas meet the SCOs for Restricted Residential.

No long-term treatment systems were installed as part of the Site remedy.

2.4 Remaining MGP-Related Impacts

The Remedial Action resulted in the removal of approximately 90% of the shallow MGP-impacted soil (0 to 15 feet below ground surface) from the Site and off-Site areas. Though some deep MGP-related impacts in soil remain on Site, it is not expected to have any effect on the overlying properties or the public. These deeper MGP-related impacts will naturally attenuate over time. This section provides a summary of the remaining MGP-related impacts following the completion of the Remedial Action.

Table 5 and Figure 9 summarize results of all samples of soil remaining at the Site and off-Site areas after completion of the Remedial Action that exceed the Unrestricted SCOs.

Table 6 and Figure 9 summarize results of all samples of soil remaining at the Site and off-Site areas after completion of Remedial Action that exceed the Restricted Residential SCOs.

2.4.1 5 Bridge Street (Former Sag Harbor MGP) Property

Soil

The soils on the entire property were excavated to a depth of 8 feet to 15 feet below ground surface and backfilled with clean fill meeting the requirements of the Unrestricted Use SCOs. This depth corresponds with the bottom of the peat layer which prevented the migration of MGP-related impacts vertically downwards. Based on the findings of the Remedial Investigation and the observations made during the Remedial Action, MGP-impacted soil is present at a depth of 10 feet below ground surface to a potential depth of 60 feet below ground surface. MGP-impacted soil stabilized with cement is located at 2 feet below ground surface on the eastern and western property perimeter limits. The width of stabilized soil zone is approximately 10 feet on the northern and eastern property boundaries and approximately 15 feet on the northwestern property boundary.

Figure 9 provides details of the existing soil impacts on the 5 Bridge Street property.

Groundwater

Residual MGP-related groundwater impacts above NYSDEC Class GA Groundwater Criteria are present throughout the 5 Bridge Street property. Figure 10 provides details of the locations and depth of existing MGP-related groundwater impacts on the 5 Bridge Street property.

Soil Vapor

No MGP-related soil vapor impacts are believed to be present on the 5 Bridge Street property.

2.4.2 31 Long Island Avenue Property

Soil

The soils on the entire 31 Long Island Avenue property were excavated to a depth of 8 feet to 15 feet below ground surface and backfilled with clean fill meeting the requirements of the Unrestricted Use SCOs. This depth corresponds with the bottom of the peat layer which prevented the migration of MGP-related impacts vertically downwards. Based on the findings of the Remedial Investigation and the observation made during the Remedial Action, MGP-impacted soil may be present at a depth of 10 feet below ground surface to a potential depth of 60 feet below ground surface. MGP-impacted soil stabilized with cement is located at two feet below ground surface on the northern, eastern, and western perimeter of the property.

Figure 9 provides details of the existing soil impacts on the 31 Long Island Avenue property.

Groundwater

Residual MGP-related groundwater impacts above NYSDEC Class GA Groundwater Criteria are present throughout the 31 Long Island Avenue property. Figure 10 provides details of the locations and depth of existing MGP-impacted groundwater impacts on the 31 Long Island Avenue property.

Soil Vapor

No MGP-related soil vapor impacts are believed to be present on the 31 Long Island Avenue property.

2.4.3 11 Bridge Street Property

Soil

The soils on the northern portion of the 11 Bridge Street property, at the location of the current paved parking lot, were excavated to a depth of 8 feet to 15 feet below ground surface and backfilled with clean fill meeting the requirements of the Unrestricted Use SCOs. This depth corresponds with the bottom of the peat layer which prevented the migration of MGP-related impacts vertically downwards. Based on the findings of the Remedial Investigation and the observation made during the Remedial Action, MGP-impacted soils may be present at a depth of 10 feet below ground surface to a potential depth of 60 feet below ground surface in areas of the Remedial Action. MGP-impacted soil stabilized with cement is located at two feet below ground surface on the northern portion of the 11 Bridge Street property perimeter boundary. Localized hot spots of surface and subsurface MGP-related soil impacts are present on the southeastern and southern portion of the 11 Bridge Street property.

Figure 9 provides details of the existing soil impacts on the 11 Bridge Street property.

Groundwater

Remaining MGP-related groundwater impacts above NYSDEC Class GA Groundwater Criteria are present throughout the 11 Bridge Street property. Figure 10 provides details of the locations and depth of existing MGP-related groundwater impacts on the 11 Bridge Street property.

Soil Vapor

No MGP-related soil vapor impacts are believed to be present on the 11 Bridge Street property.

2.4.4 18 Bridge Street Property

Soil

The soils on the northern portion of the 18 Bridge Street property along Long Island Avenue were excavated to a depth of 6 feet to 8 feet below ground surface and backfilled with clean fill meeting the requirements of the Unrestricted Use SCOs. Based on the findings of the Remedial Investigation and the observation made during the Remedial Action, localized hot spots of MGP-related soil impacts may be present below a depth of 2 feet below ground surface in the northeastern portion of the 18 Bridge Street property (the area of the current parking lot along Bridge Street) and below a depth of

8 feet below ground surface on the central portion of the 18 Bridge Street property between the two northern condominium buildings.

Figure 9 provides details of the existing soil impacts on the 18 Bridge Street property.

Groundwater

Remaining MGP-related groundwater impacts above NYSDEC Class GA Groundwater Criteria are assumed to be present on the northern portion of the 18 Bridge Street property along Bridge Street. Figure 10 provides details of the locations and depth of existing MGP-related groundwater impacts on the 18 Bridge Street property.

Soil Vapor

No MGP-related soil vapor impacts are believed to be present on the 18 Bridge Street property.

2.4.5 Village of Sag Harbor Rights-of-Way

Soil

Soils on the northern portion of Bridge Street were excavated to a depth of 6 feet to 8 feet below ground surface and backfilled with clean fill meeting the requirements of the Unrestricted Use SCOs.

Localized hot spots of MGP-related soil impacts are present at a depth of 3 feet below ground surface on the northwestern portion of Bridge Street along the 18 Bridge Street property and at a depth of 6 feet below ground surface on the southern portion of Bridge Street along the 11 and 18 Bridge Street properties. Localized hot spots of MGP-related soil impacts are present below the asphalt cover on the public parking lot southeast of the 5 Bridge Street property. Localized hot spots of MGP-related soil impacts are present below 4 feet below ground surface on Long Island Avenue along the 31 Long Island Avenue property to the eastern portion of the 18 Bridge Street property.

Figure 9 provides details of the existing soil impacts on the Village of Sag Harbor rights-of-way.

Groundwater

Remaining MGP-related groundwater impacts above NYSDEC Class GA Groundwater Criteria are assumed to be present on the northern portion of the Bridge Street and on Long Island Avenue along the 31 Long Island Avenue property and the 18 Bridge Street property. Figure 10 provides details of the locations and depth of existing MGP-related groundwater impacts on the Village of Sag Harbor rights-of-way.

2.4.6 United States Postal Service Property (21 Long Island Avenue)

Soil

No known MGP-related soil impacts are believed to be present on the United States Postal Service property.

Groundwater

Historic groundwater samples collected from the United States Postal Service property have shown no MGP-related groundwater impacts.

Soil Vapor

No MGP-related soil vapor impacts are believed to be present on the United States Postal Service property.

2.4.7 7 Bridge Street Property

Soil

No known MGP-related soil impacts are believed to be present on the 7 Bridge Street property.

Groundwater

A potential for residual MGP-related groundwater impacts above NYSDEC Class GA Groundwater Criteria may be present on the 7 Bridge Street property. Figure 10 provides details of the locations and depth of existing MGP-related groundwater impacts adjacent to the 7 Bridge Street property.

Soil Vapor

No MGP-related soil vapor impacts are believed to be present on the 7 Bridge Street property.

2.4.8 Properties north of Long Island Avenue

Properties north of Long Island Avenue include:

- 22 Long Island Avenue
- 2 West Water Street
- 4 West Water Street
- 8 West Water Street

Soil

No known MGP-related soil impacts are believed to be present on the properties north of Long Island Avenue.

Groundwater

Although ongoing semiannual groundwater monitoring at select locations on the properties north of Long Island Avenue have shown no MGP-related groundwater impacts, historic samples collected during the Remedial Investigation indicated minimal MGP-related groundwater impacts. Figure 10 provides details of the locations and depth of historic MGP-related groundwater impacts on the properties north of Long Island Avenue.

Soil Vapor

No MGP-related soil vapor impacts are believed to be present on any of the properties north of Long Island Avenue.

2.5 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site and off-Site areas as listed in the ROD dated March 2006 are as follows:

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

- exposures of persons at or around the site to VOCs, SVOCs, and cyanide in surface soil, subsurface soil, groundwater, and soil vapor
- environmental exposures of flora or fauna to VOCs, SVOCs, and cyanide in surface soil, subsurface soil, and groundwater
- the release of contaminants from soil into groundwater that may create exceedances of groundwater quality standards; and
- the release of contaminants from surface soil, subsurface soil, groundwater, sediment, and soil vapor into ambient air, indoor air, sediment, and surface water through desorption, storm water erosion, vaporization, wind borne dust and dissolution.

Further, the remediation goals for the site include attaining to the extent practicable:

- ambient groundwater quality standards
- recommended soil cleanup values for surface soils.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since impacts remain in soil and groundwater samples collected at the Site/off-Site areas, ICs and ECs are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the Site/off-Site areas. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This IC/EC Plan provides:

- A description of all IC/ECs on the Site/off-Site areas.
- The basic implementation and intended role of each IC/EC.
- A description of the key components of the ICs set forth in the EEs.
- 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 EWP (as provided in Appendix B) for the proper handling of impacted material that may be disturbed during small-scale (i.e. limited) intrusive work and/or activities on the Site and the off-Site areas, HASP (Appendix D) and CAMP (Appendix E), QAPP (Appendix F), and FSP (Appendix G).
- A description of the roles and responsibilities of each party with respect to this SMP.
- Other provisions necessary to identify or establish methods for implementing the IC/ECs required by the Site remedy, as determined by the NYSDEC:
    - an EWP (provided in Appendix B) that details the provisions for management of small-scale (i.e., limited) excavations, in areas of impacts detected in soil and/or groundwater samples, including the proper handling of impacted material that may be disturbed during small-scale intrusive work and/or activities at the Site.
    - further investigation and remediation should large-scale redevelopment occur, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible.
    - the management and inspection of the identified ECs.
    - maintenance of site access controls and Department notification.

3.2 Roles and Responsibilities

A description of the roles and responsibilities of each party (i.e., the Department, the property owners, and National Grid) with respect to this SMP is included as the Matrix of Responsibility (Tables 7 through 9). A decision tree outlining the steps for on-Site intrusive work by the property owners, included as Figure 11.

3.3 5 Bridge Street Property

3.3.1 Engineering Controls

Soil Cover System

Exposure to remaining MGP-related impacts in soil/fill at the 5 Bridge Street property is prevented by a soil cover system placed over the property. The soil cover system is comprised of a minimum of two feet of clean fill that meets the requirements of 6 NYCRR 375 Restricted Residential SCOs (Figure 12). Additionally, in areas not covered by the subsurface soil mix wall, the soil cover system comprises of a minimum of 8 feet of clean fill that meets the requirements of Restricted Residential SCOs. The EWP that appears in Appendix B outlines the procedures required to be implemented in the event the soil cover system is breached, penetrated, or temporarily removed, and any underlying remaining MGP-related impacts are disturbed. Procedures for the inspection and maintenance of this soil cover system are provided in the Monitoring Plan included in Section 3 of this SMP.

Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will be completed on a semiannual basis. The details of the groundwater monitoring program are provided in Section 4.

Passive DNAPL Collection

Migration of potential DNAPL will be prevented by a passive DNAPL collection system installed on the 5 Bridge Street Property. The DNAPL collection system consists of a groundwater monitoring well which is fitted with a sump to observe and passively collect any potential DNAPL that is remaining in the subsurface. The DNAPL collection well will be inspected quarterly for the presence of DNAPL. DNAPL recovery will be conducted when the measured DNAPL thickness reaches one foot. Currently, DNAPL is recovered approximately semi-annually from one well located on the 5 Bridge Street portion of the Site.

3.3.1.1 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10 [NYSDEC, 2010].

Soil Cover System

The soil cover system is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will continue, as determined by the NYSDEC, until groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. 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 may be evaluated.

Passive DNAPL Collection

DNAPL collection will continue until DNAPL is no longer accumulating in the well and until permission to discontinue is granted in writing by the NYSDEC. If DNAPL is observed at levels that are not acceptable to the NYSDEC, additional source removal, treatment and/or control measures may be evaluated.

3.3.2 Institutional Control

An EE is required by the ROD to: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to remaining impacts; and (3) limit the use and development of the Site to restricted residential uses only. The EE requires compliance with this SMP. Restrictions identified in the EE may not be discontinued without an amendment to or extinguishment of the EE. The IC boundaries are shown on Figure 13 in the figures associated with the EE package included in Appendix A. Key components of the EE are:

- The Controlled Property (as defined in the EE) may be used for: Restricted Residential as described in 6 NYCRR Part 475-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 475-1.8(g)(2)(iii), and Industrial as described in 6 NYCRR Part 475-1.8(g)(2)(iv) use.
- All ECs must be operated and maintained by National Grid as specified in this SMP (see Section 3).
- All ECs must be inspected at a frequency and in a manner defined in the SMP (see Section 4).
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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 SMP (see Section 4).
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP (see Section 6).
- All future intrusive activities that will disturb remaining impacts must be conducted in accordance with this SMP (see Section 3.5).
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP (see Section 4).
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP.
- 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 EE.
- The potential for vapor intrusion will be evaluated and a decision on sampling and/or potential mitigation will be made in consultation with NYSDEC prior to any redevelopment of the 5 Bridge Street property.
- Vegetable gardens and farming on the Site are prohibited.

- Implementation of a HASP and an EWP prior to any ground intrusive activity (with the exception of normal landscaping to a maximum of 24 inches below ground surface or to top of groundwater table whichever is shallower) including utility work, boring completion, monitoring well installation, and excavation.
- The 5 Bridge Street property may only be used for restricted-residential (i.e., multi residential unit) use provided that the long-term ECs/ICs included in this SMP are employed.
- The 5 Bridge Street property may not be used for a higher level of use, such as Residential Use without additional remediation and amendment of the EE, as approved by the NYSDEC irrespective of the local zoning laws.
- National Grid will submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the 5 Bridge Street property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with this SMP. The NYSDEC retains the right to access the 5 Bridge Street property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

Components of the EE may be modified, added, or deleted from this list as warranted by Site-specific conditions with approval with NYSDEC.

3.4 31 Long Island Avenue

3.4.1 Engineering Controls

Soil Cover System

Exposure to remaining MGP-related impacts in soil/fill at the 31 Long Island Avenue property is prevented by a soil cover system placed over the property. The soil cover system is comprised of a minimum of two feet of clean fill that meets the requirements of 6 NYCRR 375 Restricted Residential SCOs (Figure 12). Additionally, in areas not covered by the subsurface soil mix wall, the soil cover system comprises of a minimum of eight feet of clean fill that meets the requirements of 6 NYCRR 375 Restricted Residential SCOs. The EWP that appears in Appendix B outlines the procedures required to be implemented in the event the soil cover system is breached, penetrated, or temporarily removed, and any underlying remaining MGP-related impacts are disturbed. Procedures for the inspection and maintenance of this soil cover system are provided in the Monitoring Plan included in Section 4 of this SMP.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will be completed on a semiannual basis. The details of the groundwater monitoring program are provided in Section 4.

3.4.1.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

Soil Cover System

The soil cover system is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will continue, as determined by the NYSDEC, until groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. 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 may be evaluated.

3.4.2 Institutional Controls

An EE is required by the ROD to: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to remaining impacts; and (3) limit the use and development of the Site to restricted residential uses only. The EE requires compliance with this SMP. Restrictions identified in the EE may not be discontinued without an amendment to or extinguishment of the EE. The IC boundaries are shown on Figure 13 and in the figures associated with the EE package included in Appendix A. Key components of the EE are:

- The Controlled Property (as defined in the EE) may be used for: Restricted Residential as described in 6 NYCRR Part 475-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 475-1.8(g)(2)(iii), and Industrial as described in 6 NYCRR Part 475-1.8(g)(2)(iv) use.
- All ECs must be operated and maintained by National Grid and property owner jointly as specified in this SMP (see Section 3).
- All ECs must be inspected at a frequency and in a manner defined in the SMP (see Section 4).
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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.
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP (see Section 6).
- All future intrusive activities that will disturb remaining impacts must be conducted in accordance with this SMP (see Section 3.5).
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP (see Section 4).
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP.
- 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 EE.
- Vegetable gardens and farming on the site are prohibited.
- Implementation of a HASP and an EWP prior to any ground intrusive activity (with the exception of normal landscaping to a maximum of 24 inches below ground surface or to top of groundwater table whichever is shallower) including utility work, boring completion, monitoring well installation, and excavation.
- The potential for vapor intrusion will be evaluated and a decision on sampling and/or potential mitigation will be made in consultation with NYSDEC prior to any redevelopment of the 31 Long Island Avenue property.
- The 31 Long Island Avenue property may only be used for Restricted-Residential Use (i.e., multi residential unit) provided that the long-term ECs/ICs included in this SMP are employed.

- The 31 Long Island Avenue property may not be used for a higher level of use, such as Residential Use without additional remediation and amendment of the EE, as approved by the NYSDEC irrespective of the local zoning laws.
- National Grid will submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the 31 Long Island Avenue property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with this SMP. The NYSDEC retains the right to access the 31 Long Island Avenue property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

Components of the EE may be modified, added or deleted from this list as warranted by Site-specific conditions with approval with NYSDEC.

The responsibility for the elements of the EE is discussed in Table 7, Matrix of Responsibilities. Table 7 defines the responsibilities for National Grid and the property owner(s).

3.5 11 Bridge Street Property

3.5.1 Engineering Controls

Composite Cover System

Exposure to remaining MGP-impacted soil/fill at the 11 Bridge Street property is prevented by a Composite Cover System placed over most of the 11 Bridge Street property. Figure 12 provides a summary of the Composite Cover System present at the 11 Bridge Street property. The Composite Cover System is an EC that provides a physical barrier that limits potential human and environmental exposures to MGP-impacted subsurface soils and groundwater that remain at the 11 Bridge Street property. The Composite Cover System is comprised of a minimum of 24 inches of clean fill, asphalt pavement, brick-covered sidewalks, and concrete building slabs. The clean fill meets the requirements of 6 NYCRR 375 Restricted Residential SCOs (Figure 12). The Composite Cover System at the 11 Bridge Street property is a permanent control that must remain intact above the remaining MGP-related impacts (Figure 12). The EWP that appears in Appendix B outlines the procedures required to be implemented in the event the Composite Cover System is breached, penetrated, or temporarily removed, and any underlying remaining MGP-related impacts are disturbed. Procedures for the inspection and maintenance of this Composite Cover System are provided in the Monitoring Plan included in Section 4 of this SMP.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will be completed on a semiannual basis. The details of the groundwater monitoring program are provided in Section 4.

3.5.1.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

Composite Cover System

The Composite Cover System is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will continue, as determined by the NYSDEC, until groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. 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 NYSDEC, additional source removal, treatment and/or control measures may be evaluated.

3.5.2 Institutional Controls

An EE is required by the ROD to: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to remaining impacts; and (3) limit the use and development of the Site to restricted residential uses only. EE requires compliance with this SMP. Restrictions identified in the EE may not be discontinued without an amendment to or extinguishment of the EE. The IC boundaries are shown on Figure 13 and in the figures associated with the EE package included in Appendix A. Key components of the EE are:

- The Controlled Property (as defined in the EE) may be used for: Restricted Residential as described in 6 NYCRR Part 475-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 475-1.8(g)(2)(iii), and Industrial as described in 6 NYCRR Part 475-1.8(g)(2)(iv) use.
- All ECs must be operated and maintained by National Grid and property owner jointly as specified in this SMP (see Section 3).
- All ECs must be inspected at a frequency and in a manner defined in the SMP (see Section 4).
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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 monitoring must be performed as defined in this SMP (see Section 4).
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP (see Section 6).
- All future intrusive activities that will disturb remaining impacts must be conducted in accordance with this SMP (see Section 3.5).
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP (see Section 4).
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP.
- 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 EE.
- The potential for vapor intrusion will be evaluated and a decision on sampling and/or potential mitigation will be made in consultation with NYSDEC prior to any redevelopment of the 11 Bridge Street property.
- Vegetable gardens and farming on the site are prohibited.

- Implementation of a HASP and an EWP prior to any ground intrusive activity (with the exception of normal landscaping to a maximum of 24 inches below ground surface or to top of groundwater table whichever is shallower) including utility work, boring completion, monitoring well installation, and excavation.
- The 11 Bridge Street property may only be used for Restricted-Residential Use (i.e., multi residential unit) use provided that the long-term ECs\ICs included in this SMP are employed.
- The 11 Bridge Street property may not be used for a higher level of use, such as Residential Use without additional remediation and amendment of the EE, as approved by the NYSDEC irrespective of the local zoning laws.
- National Grid will submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the 11 Bridge Street property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. The NYSDEC retains the right to access the 11 Bridge Street property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that the NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

Components of the EE may be modified, added or deleted from this list as warranted by Site-specific conditions with approval with NYSDEC.

The responsibility for the elements of the EE is discussed in Table 7, Matrix of Responsibilities. Table 8 defines the responsibilities for National Grid and the property owner(s).

3.6 18 Bridge Street Property

Due to the limited nature of remaining MGP-related impacts at this property, an access agreement was executed between National Grid and the current and future owner(s) of the 18 Bridge Street property that will allow access on the property to National Grid to perform inspections and long-term monitoring as detailed below.

3.6.1 Engineering Controls

Soil Cover System

Exposure to remaining impacts in soil at the 18 Bridge Street property is prevented by a soil cover system present over the 18 Bridge Street property. The soil cover system is comprised of a minimum of two feet of clean fill that meets the requirements of 6 NYCRR 375 Restricted Residential SCOs on the most impacted area of the 18 Bridge Street property (northern portion of the 18 Bridge Street property along Long Island Avenue, Figure 12). The EWP that appears in Appendix B outlines the procedures necessary to be implemented in the event the soil cover system is breached, penetrated, or temporarily removed, and any underlying remaining MGP-related impacts are disturbed. Procedures for the inspection and maintenance of this soil cover system are provided in the Monitoring Plan included in Section 4 of this SMP.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will be completed on a semiannual basis. The details of the groundwater monitoring program are provided in Section 4.

3.6.1.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

Soil Cover System

The soil cover system is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals until a determination has been made by NYSDEC that the inspections are no longer required.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will continue, as determined by the NYSDEC, until groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. 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 may be evaluated.

3.6.2 Institutional Controls

An access agreement was obtained by National Grid to: (1) implement, maintain, and monitor EC systems and (2) prevent future exposure to remaining impacts. The access agreement requires compliance with this SMP and the key components of the SMP are:

- All ECs must be operated and maintained jointly by National Grid and the property owner as specified in this SMP (see Section 3).
- All ECs must be inspected at a frequency and in a manner defined in the SMP (see Section 4).
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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. The exception is the use of groundwater pumped from the existing well located in the southern portion of the property. The groundwater pumped from this well may be used for irrigation purposes only. If a change of use is considered, NYSDEC must be notified and approve the change.
- Groundwater monitoring must be performed as defined in this SMP (see Section 4).
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP (see Section 6).
- All future intrusive activities that will disturb remaining impacts must be conducted in accordance with this SMP (see Section 3.5).
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP (see Section 4).
- Vegetable gardens or farming on the common lands may be considered for approval by NYSDEC.
- Mitigation measures, if recommended by NYSDEC, will be implemented by National Grid for any potential impacts that are identified.
- Implementation of a HASP and an EWP prior to any ground intrusive activity (with the exception of normal landscaping to a maximum of 24 inches below ground surface or to top of groundwater table whichever is shallower) including utility work, boring completion, monitoring well installation, and excavation.
- The 18 Bridge Street property may only be used for Restricted-Residential Use (i.e., multi residential unit) provided that the long-term ECs/ICs included in this SMP are employed.

- Any modification of existing 18 Bridge Street property conditions and for any buildings developed on the 18 Bridge Street property.
- The use of 18 Bridge Street property for a higher level of use such as Residential Use without notification to NYSDEC and an evaluation if additional ICs or ECs would be required.

Components of the access agreement may be modified, added, or deleted from this list as warranted by Site-specific conditions with approval with NYSDEC.

15 business days advance notification and prior approval from the NYSDEC is required by the access agreement and the NYSDEC for the events listed above that apply to the 18 Bridge Street property, excluding a property use change which requires 60 days advance notice. The advance notice will enable National Grid to observe and determine if the activities will pose any environmental risk to human health and the environment and provide oversight if necessary. National Grid will submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the 18 Bridge Street property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with this SMP. The NYSDEC may request access to the 18 Bridge Street property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

Table 8- Matrix of Responsibilities defines the responsibilities for National Grid and the property owner(s) as listed in this SMP.

3.7 Village of Sag Harbor Properties

The Village of Sag Harbor properties include the following:

- Village of Sag Harbor right-of-way areas, including:
  - Long Island Avenue from the west boundary of the United States Postal Service property to the west boundary of the 18 Bridge Street property
  - Bridge Street from the intersection with Long Island Avenue to the south boundary of 11 Bridge Street
  - West Water Street from the intersection with Long Island Avenue to the west boundary of 8 West Water Street
- The entire parking lot area south of the United States Postal Service property and east of the 5 Bridge Street and 11 Bridge Street properties.

These Village of Sag Harbor properties will collectively be referred to as the Village of Sag Harbor SMP Areas. Due to the limited nature of remaining MGP-related impacts at the Village of Sag Harbor parking lot area described above, a Property Access Agreement & MOU was executed between National Grid and the Village of Sag Harbor that allows access on the Village of Sag Harbor right-of-way areas and parking lot to National Grid to perform inspections and long-term monitoring as detailed below. The MOU provides specific requirements for notifications to National Grid prior to any surface intrusive work on the Village of Sag Harbor right-of-way areas described above.

3.7.1 Engineering Controls

Composite Cover System

Exposure to remaining MGP-related impacts in soil/fill on the Village of Sag Harbor SMP Areas is prevented by a Composite Cover System placed over most of the Village of Sag Harbor SMP Areas. Figure 12 provides a summary of the Composite Cover System present on the Village of Sag Harbor SMP Areas. The Composite Cover System is an EC that provides a physical barrier that limits potential human and environmental exposures to the remaining MGP-impacted subsurface soils and groundwater that remain below the Village of Sag Harbor SMP Areas. The Composite Cover System is comprised of a minimum of 24 inches of clean fill, asphalt pavement, and concrete sidewalks. Additionally, the Composite Cover System on portions of

Bridge Street and Long Island Avenue is comprised of a minimum of 7 feet of clean fill that meets the requirements of 6 NYCRR 375 Restricted Residential SCOs (Figure 12). The Composite Cover System on the Village of Sag Harbor SMP Areas is a permanent control that must remain intact above the remaining impacts (Figures 9 and 10). The EWP that appears in Appendix B outlines the procedures required to be implemented in the event the Composite Cover System is breached, penetrated, or temporarily removed, and any underlying remaining impacts are disturbed. Procedures for the inspection and maintenance of the Composite Cover System are provided in the Monitoring Plan included in Section 4 of this SMP.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will be completed on a semiannual basis. The details of the groundwater monitoring program are provided in Section 4.

Passive DNAPL Collection System

Potential migration of DNAPL will be prevented by a passive dense nonaqueous phase liquid collection well installed on Long Island Avenue along the north boundary of the 31 Long Island Avenue property. The DNAPL collection system consists of a groundwater monitoring well which is fitted with a sump to observe and passively collect any potential DNAPL that is remaining in the subsurface. The DNAPL collection well will be inspected quarterly for the presence of DNAPL. DNAPL recovery will be conducted when the measured DNAPL thickness reaches one foot. No recoverable NAPL has been identified in the well in the historical monitoring period.

3.7.1.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

Composite Cover System

The Composite Cover System is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will continue, as determined by the NYSDEC, until groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. 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 may be evaluated.

Passive Dense Non-Aqueous Phase Liquid Collection System

The DNAPL collection system will continue until no recoverable DNAPL is observed in the collection well over four consecutive quarterly inspections and until permission to discontinue is granted in writing by the NYSDEC. If DNAPL is observed at levels that are not acceptable to the NYSDEC, additional source removal, treatment and/or control measures may be evaluated.

3.7.2 Institutional Controls

A Property MOU was obtained by National Grid to: (1) implement, maintain, and monitor EC systems and (2) prevent future exposure to remaining impacts. The MOU requires compliance with this SMP and key components of the SMP are:

- The controlled property may be used for: Restricted Residential as described in 6 NYCRR Part 475-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 475-1.8(g)(2)(iii), and Industrial as described in 6 NYCRR Part 475-1.8(g)(2)(iv) use.
- All ECs must be operated and maintained by the Village of Sag Harbor and National Grid as specified in this SMP (see Section 3).
- All ECs must be inspected at a frequency and in a manner defined in the SMP (see Section 4).

- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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 monitoring must be performed as defined in this SMP (see Section 4).
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP (see Section 6).
- All future intrusive activities that will disturb remaining impacts must be conducted in accordance with this SMP (see Section 3.5).
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP (see Section 4).
- Vegetable gardens or farming on the common lands may be considered for approval by NYSDEC.
- Mitigation measures, if recommended by NYSDEC, will be implemented by National Grid for any potential impacts that are identified.
- Implementation of a HASP and an EWP prior to any ground intrusive activity (with the exception of normal landscaping to a maximum of 24 inches below ground surface or to top of groundwater table whichever is shallower) including utility work, boring completion, monitoring well installation, and excavation.
- The Village of Sag Harbor SMP areas may only be used for Restricted-Residential Use (i.e., multi residential unit) provided that the long-term ECs/ICs included in this SMP are employed.
- Any modification of existing Village of Sag Harbor SMP areas conditions and for any buildings developed on the Village of Sag Harbor SMP areas.
- The use of Village of Sag Harbor SMP Areas for a higher level of use such as Residential Use without notification to NYSDEC and an evaluation if additional ICs or ECs would be required.

Components of the SMP may be modified, added, or deleted from this list as warranted by Site-specific conditions with approval by NYSDEC.

15 business days advance notification and prior approval from the NYSDEC is required by the MOU for certain activities that apply to the Village of Sag Harbor SMP Areas. The advance notice will enable National Grid to observe and determine if the activities will pose any environmental risk to human health and the environment and provide oversight if necessary. National Grid will submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the

Village of Sag Harbor SMP Areas are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with this SMP. The NYSDEC may request access to the Village of Sag Harbor SMP Areas at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

The Matrix of Responsibilities in Table 8 defines the responsibilities for National Grid and the for the property owner(s) as listed in this SMP.

3.8 United States Postal Service Property (21 Long Island Avenue)

Due to the limited nature of remaining MGP-related impacts at the United States Postal Service property, an access letter agreement (dated June 6, 2022) was executed between National Grid and United States Postal Service that will allow access on the property to National Grid to perform inspections and long-term monitoring as detailed below.

3.8.1 Engineering Controls

Composite Cover System

The United States Postal Service property is currently comprised of the Post Office building with concrete foundations and a paved parking lot that consists of bituminous pavement. Collectively the building foundations and the parking lot represent a Composite Cover System. The Composite Cover System is an EC that provides a physical barrier that limits potential human and environmental exposures to remaining impacts that might be present at the United States Postal Service property. The Composite Cover System is a permanent control, and the quality and integrity of this system will be inspected annually in accordance with the Monitoring Plan provided below in Section 4 and reported and certified annually as indicated below in Section 6. The EWP that appears in Appendix B outlines the procedures that are recommended to be implemented in the event the Composite Cover System is breached, penetrated, or temporarily removed, and any underlying remaining MGP-impacts are disturbed. Procedures for the inspection and maintenance of this Composite Cover System are provided in the Monitoring Plan included in Section 4 of this SMP.

3.8.1.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

Composite Cover System

The Composite Cover System is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

3.8.2 Institutional Controls

An access letter agreement was obtained by National Grid,-to grant access to the property for inspections and notify National Grid of any planned intrusive activity on the property. If invasive work is planned, a formal site access agreement will be prepared which will require the work to be performed in compliance with the EWP in the SMP, or pursuant to a NYSDEC-approved work plan for a large-scale project. Key components recommended for the formal access agreement (should intrusive work occur) are:

- The controlled property may be used for: Restricted Residential as described in 6 NYCRR Part 475-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 475-1.8(g)(2)(iii), and Industrial as described in 6 NYCRR Part 475-1.8(g)(2)(iv) use.
- All ECs must be operated and maintained by the United States Postal Service as specified in this SMP (see Section 3).
- All ECs must be inspected at a frequency and in a manner defined in the SMP (see Section 4).
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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 SMP.
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP (see Section 6).
- All future intrusive activities that will disturb remaining impacts shall require a formal site access agreement and shall be conducted in accordance with this SMP pursuant to a NYSDEC-approved work plan (see Section 3.5).
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP (see Section 4).
- Vegetable gardens and farming on the site are prohibited.
- Mitigation measures, if recommended by NYSDEC, will be implemented by National Grid for any potential impacts that are identified.
- Implementation of a HASP and an EWP prior to any ground intrusive activity (with the exception of normal landscaping to a maximum of 24 inches below ground surface or to top of groundwater table whichever is shallower) including utility work, boring completion, monitoring well installation, and excavation.
- The United States Postal Service may only be used for Restricted-Residential Use (i.e., multi residential unit) provided that the long-term ECs/ICs included in this SMP are employed.
- Any modification of existing United States Postal Service property conditions and for any buildings developed on the United States Postal Service property.
- The use of United States Postal Service property for a higher level of use such as Residential Use without additional remediation.

Components of the access agreement may be modified, added, or deleted from this list as warranted by Site-specific conditions with approval with NYSDEC.

15 calendar days advance notification for intrusive activity and 60-days advance notification for a change in use are recommended for the portion of the United States Postal Service property located within the SMP limits. The advance notice will enable National Grid to determine if a formal access agreement is needed and if the activities will pose any environmental risk to human health and the environment and provide oversight if necessary. National Grid will submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the United States Postal Service property is unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that

constitute a violation or failure to comply with this SMP. The NYSDEC may request access to the United States Postal Service property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

The Matrix of Responsibilities in Table 8 defines the responsibilities for National Grid and the recommended actions for the property owner(s) as listed in this SMP.

3.9 Properties North of the Long Island Avenue

Properties north of Long Island Avenue (the Properties) include:

- 22 Long Island Avenue
- 2 West Water Street
- 4 West Water Street
- 8 West Water Street

Due to the limited nature of remaining impacts at the Properties, an access agreement may be executed between National Grid and the current and future owners of the Properties as necessary, that will allow access on the Properties to National Grid to perform inspections and long-term monitoring as detailed below.

3.9.1 Engineering Controls

3.9.1.1 Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will be completed, as determined by the NYSDEC, until groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over two consecutive years of monitoring. 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 may be evaluated.

3.9.1.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.6 of NYSDEC DER-10.

Monitored Natural Attenuation

Groundwater monitoring activities to assess Monitored Natural Attenuation will continue, as determined by the NYSDEC, until groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. 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 may be evaluated.

3.9.2 Institutional Controls

An access agreement shall be obtained by National Grid at the off-Site Properties as necessary to: (1) implement, maintain, and monitor EC systems; and (2) control disturbances of any potential impacts within the subsurface. Key recommendations for the off-Site properties north of Long Island Avenue are:

- All ECs must be operated and maintained by the property owners excluding any monitoring wells located on a specific property which would be maintained by National Grid as specified in this SMP (see Section 3).
- All ECs must be inspected at a frequency and in a manner defined in the SMP (see Section 4).
- The use of groundwater underlying the property is prohibited without approval from the Department.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP.
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP (see Section 6).
- All future intrusive activities that will disturb subsurface material must be conducted in accordance with this SMP (see Section 3.5).

- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP (see Section 4).
- Vegetable gardens and farming on the site are prohibited.
- Mitigation measures, if recommended by NYSDEC, will be implemented by National Grid for any potential impacts that are identified.
- Recommendation to implement the HASP and EWP prior to any ground intrusive activity extending deeper than elevation 1.5 feet above mean sea level, including utility work, boring completion, monitoring well installation, and excavation. The recommendation above differs from the properties south of Long Island Avenue since no known MGP-related soil impacts are believed to be present in this area. As such, this recommendation is based on groundwater impacts and the elevation at which groundwater may be encountered in the area.
- Any modification of existing conditions on the Properties and for any buildings developed on the Properties.

Components of the access agreement may be modified, added, or deleted from this list as warranted by Site-specific conditions with approval with NYSDEC.

Three-week advance notification is recommended for intrusive work on the properties north of Long Island Avenue if the work will extend deeper than an elevation of 1.5 feet above mean sea level. The advance notice will enable National Grid to observe and determine if the activities will pose any environmental risk to human health and the environment and provide oversight if necessary. Sixty-day advance notice for a property change of use is also recommended. National Grid will submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with this SMP. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

The Matrix of Responsibilities in Table 9 defines the responsibilities for National Grid and the recommended actions for the property owner(s) as listed in this SMP.

3.10 Plans and Procedures to be Followed for Implementation of IC/ECs

A description of each of the plans to be followed for implementation of IC/ECs is provided below.

3.10.1 Steps to Be Taken in Advance of On-Site Intrusive Work

A decision tree describing notifications and actions to be taken in advance of on-site work by the property owner is included as Figure 11.

3.10.2 Excavation Work Plan

This SMP includes an EWP that is to be used for small-scale (i.e., limited) excavations (Appendix B). NYSDEC will make the determination of small-scale or large-scale, with respect to excavations. This EWP will be implemented to address any intrusive activities prior to the final remedy or any portion of the final remedy at the Site. The property owners, their tenants, consultants, and contractors are required to implement this EWP. National Grid is only responsible for costs associated with MGP-related impacts.

3.10.3 HASP

This SMP includes a HASP that is to be used for small-scale (i.e., limited) excavations and large-scale redevelopment. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in the HASP provided in Appendix D. This HASP establishes policies and procedures to protect personnel from the potential hazards posed by the activities at the Site. Site workers are required to review and sign the HASP, acknowledging that they understand and will adhere to the HASP. Subcontractors will also prepare their own Site-specific HASP for the protection of their employees from the hazards associated with their work tasks and may use this document as a guide.

3.10.4 CAMP

A CAMP was developed for future activities at the Site. This CAMP can be used for small-scale and/or large-scale activities. This plan describes the proposed air monitoring means and methods that will be implemented during intrusive activities. The CAMP is included as Appendix E.

3.10.5 QAPP

The QAPP presents the project scope and goals, organization, objectives, sample handling procedures and specific quality assurance/quality control (QA/QC) procedures. Furthermore, the QAPP identifies project responsibilities, prescribes guidance and specifications to make certain that:

- Samples are identified and controlled through sample tracking systems and chain-of-custody protocols.
- Field and laboratory analytical results are valid and usable by adherence to established protocols and procedures.
- Laboratory data are validated so they can be applied to developing a conceptual understanding of the nature and extent of MGP-impacted soils and ground waters at the Site.
- All aspects of the investigation, from field to laboratory are documented to provide data that are technically sound and legally defensible.

The requirements of this QAPP apply to all contractor activities as appropriate for their respective tasks. This QAPP was prepared based upon guidance provided by the USEPA and NYSDEC including DER-10, Technical Guidance for Site Investigation and Remediation, NYSDEC, May 2010. The QAPP is included as Appendix F.

3.10.6 FSP

The FSP provides the applicable procedures for collecting, transporting, and logging analytical samples during further investigation described in Section 3.13 below. The FSP is a companion document to the QAPP described in Section 3.10.5 and is included as Appendix G.

3.11 Notification of the Department

As stated in Section 1.3, NYSDEC must be notified in advance of all intrusive work performed at the Site. Responsibility for notifications to the Department, including those described in Section 1.3 of this SMP, is per the Matrix of Responsibility (Tables 7 through 15).

3.12 Further Investigation and Possible Remedial Work Plan

Further investigation of the Site will be required should large-scale redevelopment occur, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible. The nature and extent, if any, of impacts in areas where access was previously limited or unavailable, will be investigated pursuant to a plan approved by the Department. Based on the investigation results and the Department's determination of the need for a remedy, a remedial work plan will be developed for the final remedy for MGP-related impacts at the Site and off-Site areas, including removal and/or treatment of any source areas to the extent feasible. If a remedy is determined to be necessary to address sources of non-MGP-related impacts present at the Site, this will be evaluated separately for further action. A Citizen Participation Plan (CPP) will continue through this process. Any necessary remediation will be completed prior to, or in association with, redevelopment.

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 off-Site areas. National Grid, as the RP, maintains responsibility for implementing the requirements of the Monitoring and Sampling Plan. The owner(s) of the off-Site areas maintains the notification requirements included in this SMP. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the Site are included in the QAPP provided in Appendix F and FSP in Appendix G. The Monitoring and Inspection Schedule is provided as Table 10.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, and soil vapor).
- Assessing compliance with applicable NYSDEC SCGs, particularly groundwater standards, Part 375 SCOs for soil and NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York.
- Evaluating Site and off-Site areas 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 all designed monitoring systems
- Analytical sampling program requirements
- Inspection and maintenance requirements for monitoring wells
- Monitoring well decommissioning procedures
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site – wide Inspection

Site-wide inspections will be performed on both the Site and off-Site areas by a Qualified Environmental Professional (QEP) at a minimum of once per year. Per NYSDEC guidance, under normal conditions, a QEP is acceptable for all properties; an engineer will only be required for inspection after excavation work is completed which will intersect the soil mix area. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix H, Annual Inspection and Certification Checklist. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including Site and off-Site areas usage.
- An evaluation of the condition and continued effectiveness of ECs located on the Site and the off-Site areas.
- General Site and off-Site areas conditions at the time of the inspection.
- The Site and off-Site areas management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection.
- Confirm that Site and off-Site areas records are up to date.

A comprehensive Site-wide inspection will be conducted and documented according to the SMP schedule. The inspections will determine and document the following:

- Whether ECs located on the Site and the off-Site areas continue to perform as designed
- If these controls continue to be protective of human health and the environment
- Compliance with requirements of this SMP and the EE
- Achievement of remedial performance criteria
- If Site and off-Site areas records are complete and up to date.

Reporting requirements are outlined in Section 6.0 of this plan.

Inspections will also be performed on the Site and 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, the property owner will notify National Grid and NYSDEC as soon as possible but at least before noon the following day. In addition, an inspection of the Site and the off-Site property will be conducted within 5 days of the event (to the extent possible) to verify the effectiveness of the IC/ECs implemented at the Site by a QEP, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event (to the extent possible) 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 Passive Dense Non-Aqueous Phase Liquid Collection Monitoring

A passive DNAPL collection system was installed to mitigate the potential migration of any DNAPL left behind in the subsurface following the Remedial Action. The passive DNAPL collection system consists of a 4-inch groundwater well with a 2-foot sump installed on Long Island Avenue north of the 31 Long Island Avenue property (SHMW-04 SR) and a 4-inch groundwater well with a 2-foot sump installed on the 5 Bridge Street property (SHMW-02IR). Well construction logs are included in Appendix C.

4.3.1 Remedial System Monitoring Schedule

The passive DNAPL collection well will be monitored quarterly until DNAPL can no longer be recovered via pumps from the collection well over four consecutive quarterly inspections.

Inspection frequency is subject to change with the approval of the NYSDEC. Unscheduled inspections and/or sampling may take place when a suspected failure of the DNAPL collection system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. Monitoring deliverables for the DNAPL collection system are specified in Section 6 this SMP.

4.3.2 Monitoring Procedures

A visual inspection of the complete system will be conducted during the monitoring event. The DNAPL collection system components to be monitored include, but are not limited to, the following:

- Integrity of the well including screens
- Integrity and operation of the submersible pump
- Integrity of the DNAPL collection sump.

Standard Operating Procedures (SOPs) for the visual inspection, DNAPL sampling, and DNAPL collection are included in the FSP (Appendix G).

Deliverables for the remedial system sampling program are specified in Section 7.0, Reporting Requirements.

4.4 Groundwater Monitoring

Groundwater monitoring will be performed semiannually to assess the effectiveness of natural attenuation. A network of monitoring wells, shown in Figure 14, has been designed to monitor both up-gradient and down-gradient groundwater conditions at the Site.

Four monitoring well clusters (SHMW-7S/SHMW-7I; SH MW-8S/SHMW-8I; SHMW-12S/SHMW-12I; and SHMW-13S/SHMW-13I), each consisting of one shallow aquifer well and one intermediate aquifer well, were installed in the shallow and intermediate overburden groundwater aquifer underlying the Site to determine the up-gradient groundwater conditions.

Two monitoring well clusters (SHMW-1S/SHMW-1I/SHMW-1D and SHMW-2S/SHMW-2I/ SHMW-2D), each consisting of one shallow aquifer well, intermediate aquifer well, and one deep aquifer well, were installed in the shallow, intermediate, and deep overburden groundwater aquifer underlying the Site to determine the Site groundwater conditions.

One monitoring well cluster (SHMW-9S/SHMW-9I) consisting of one shallow aquifer well and one intermediate aquifer well was installed in the shallow and intermediate overburden groundwater aquifer underlying the Site to determine the side-gradient groundwater conditions.

Five monitoring well clusters (SHMW-3S/SHMW-3I; SHMW-4S/SHMW-4I; SHMW-5S/SHMW-5I; SHMW-10S/SHMW-10I; and SHMW-11S/SHMW-11I), each consisting of one shallow aquifer well and one intermediate aquifer well, were installed in the shallow and intermediate overburden groundwater aquifer underlying the Site to determine the down-gradient groundwater conditions.

Monitoring wells SHMW-01I, SHMW-02I, SHMW-02D, SHMW-04S, SHMW-04I, SHMW-05S, SHMW-05I, SHMW-06S, and SHMW-06I were abandoned prior to the Q4 2008 sampling event due to the remediation activities being conducted at the Site. Seven of the monitoring wells, including SHMW-01SR, SHMW-01IR, SHMW-02IR, SHMW-02DR, SHMW-04SR, SHMW-05SR, and SHMW-05IR, were replaced as part of the post-remediation monitoring well replacement/installation program in Q4 2010.

In addition to the installation of the replacement monitoring wells listed above, new monitoring wells SHMW-01D and SHMW-02S were also installed as part of this program. Monitoring wells SHMW-07S and SHMW-07I, which were damaged presumably during the remedial activities, were abandoned during the replacement well installation program and reinstalled.

The well construction details are included in Table 11.

4.4.1 Groundwater Monitoring Schedule

The monitoring well network will be monitored semiannually. Groundwater monitoring may be discontinued in monitoring wells if concentrations decrease below NYS AWQS for two consecutive sampling events or as directed by the NYSDEC. Monitoring wells removed from the sampling program have not been abandoned and therefore, may be re-introduced into the sampling program if site conditions change.

The current groundwater monitoring program at the Site consists of sampling approximately six monitoring wells on a semiannual basis (SHMW-04SR, SHMW-05SR, SHMW-08S, SHMW-09S, SHMW-09I, and SHMW-12S) and five additional wells on an annual basis (SHMW-03S, SHMW-03I, SHMW-05IR, SHMW-08I, and SHMW-11S) for BTEX, methyl tert-butyl ether (MTBE), and PAHs.

The sampling frequency may be modified with the approval of the NYSDEC. The SMP will be appended to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 6.

4.4.2 Sampling Protocol

All monitoring well sampling activities will be recorded in a field book and a groundwater-sampling log presented in Appendix G. Other observations (e.g., well integrity, etc.) will be noted on the well sampling log. The well sampling log will serve as the inspection form for the groundwater monitoring well network. Each sample will be collected utilizing low flow groundwater sampling collection methods provided in the FSP (Appendix G). Each groundwater sample will be analyzed for BTEX via EPA Method 8260C, PAHs via EPA Method 8270D, and applicable monitored natural attenuation parameters by a NYSDOH environmental laboratory approval program (ELAP)-certified laboratory. The groundwater samples will also be collected, handled, and analyzed according to the example QAPP (Appendix F).

4.4.3 Monitoring Well Repairs, Replacement and Decommissioning

If biofouling or silt accumulation occurs in any Site or off-Site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent periodic report. Well decommissioning without replacement will be done only with the prior approval of the

NSYDEC. Well abandonment will be performed in accordance with the NYSDEC's "Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

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 protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP. If any such systems are developed, the operation and maintenance of the systems will be appended to the SMP.

6.0 REPORTING REQUIREMENTS

6.1 Site Management Monitoring/Inspection Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix H. These forms are subject to revision by NYSDEC for use on the Site or by National Grid for use on the off-Site Property.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the Site and the off-site property during the reporting period will be provided in electronic format to the NYSDEC by the QEP in accordance with the requirements of Table 10 and summarized in the Periodic Review Report (PRR).

Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Severe Conditions Inspection Report	As needed
Periodic Review Report	Annually, or as otherwise determined by the Department

*The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

All interim monitoring/inspections reports 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., sub-slab vapor, indoor air, outdoor air, etc.).
- Copies of all 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 all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format).
- Any observations, conclusions, or recommendations.
- A determination as to whether impact conditions have changed since the last reporting event.

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).
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

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).
- 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^{TM} database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

6.2 Periodic Review Report

A PRR will be submitted by National Grid's QEP to the Department beginning 16 months or other agreed upon submittal date based on required OM&M activities after the COC or equivalent document is issued. After submittal of the initial PRR, 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 off-Site property is subdivided into separate parcels with different ownership, a single PRR will be prepared that addresses the Site and the off-Site property described in Appendix A EE. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the PRR. The report will include:

- Identification, assessment, and certification of all ECs/ICs required by the remedy for the Site/off-Site areas.
- Results of the required annual Site/off-Site area inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the Site/off-Site area during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of all analyses, copies of all laboratory data sheet, and the required laboratory data deliverables for all samples collected 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 EQuISTM database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- A Site/off-Site property evaluation, which includes the following:
    - The compliance of the remedy with the requirements of the Site-specific ROD.

  - Any new conclusions or observations regarding Site/off-Site area impacts based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored.
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan.
  - Trends in impact levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
  - The overall performance and effectiveness of the remedy.

6.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, National Grid's QEP 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 SMP for this control.*
- *Access to the Site will continue to be provided to the Department and National Grid [if not owned by 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 Site, the mechanism remains valid and sufficient for the intended purpose under the document.*
- *Use of the Site is compliant with the EE.*
- *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.*
- *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, [name], of [business address], am certifying as National Grid or National Grid's Designated Site Representative]. I have been authorized and designated by [all Site owners/remedial parties] to sign this certification for the Site."

For the off-Site Property:

"*For each institutional or 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 institutional control and/or engineering control employed at this off-Site property 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 SMP for this control.*
- *Access to the off-Site property will continue to be provided to the Department and 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 the EE [Environmental Notice, Access Agreement or MOU].*
- *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 property remedial program and generally accepted engineering practices.*

- *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, [name], of [business address], am certifying as [National Grid or National Grid's Designated Site Representative]. I have been authorized and designated by [all Site owners/remedial parties] to sign this certification for the off-Site property."

6.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an IC or EC, a Corrective Measures Work Plan will be submitted to the NYSDEC by National Grid's QEP 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.

7.0 REFERENCES

AECOM, 2008. Remedial Design/Remedial Action Work Plan, Former Sag Harbor Manufactured Gas Plant Site, Sag Harbor, NY, Prepared for National Grid, Hicksville, New York. August 2008.

AECOM, 2015. Final Engineering Report, Former Sag Harbor Manufactured Gas Plant Site, Sag Harbor, NY, Prepared for National Grid, Hicksville, New York. July 2015.

Dvirka and Barticulli, Consulting Engineers, 2002. Sag Harbor former Manufactured Gas Plant Site Remedial Investigation Report, Prepared for KeySpan, Brooklyn, New York. June 2002.

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GEI Consultants, Inc., 2005. Draft Supplemental Field Program Report, Sag Harbor Former Manufactured Gas Plant Site, New York, Prepared for KeySpan, Hicksville, New York. February 2005.

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

NYSDEC DER-10 – “Technical Guidance for Site Investigation and Remediation”.

New York State Department of Environmental Conservation, 2005. Order on Consent, Index No. D1-0002-98-11, October 2005.

New York State Department of Environmental Conservation, 2006. Record of Decision, Sag Harbor Manufactured Gas Plant Site, Suffolk County, New York, March 2006.

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).

TABLES

Table 1. Site Property Divisions and Owners
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Property Address	Owner	Block and Lot Number
On-Site Properties		
5 Bridge Street Sag Harbor, NY 11963	National Grid 175 E Old Country Road Hicksville, NY 11801	0002-010
11 Bridge Street Sag Harbor, NY 11963	FRB1 LLC C/O Gale and Freddie Bernheim 5709 North Ocean Boulevard Ocean Ridge, Florida 33435	0002-011
31 Long Island Avenue Sag Harbor, NY 11963	Vacs Enterprises 14 Oakland Ave Sag Harbor NY 11963	0002-009
Off-Site Properties		
7 Bridge Street Sag Harbor, NY 11963	Tito D Saubidet P O Box 2931 Sag Harbor, NY 11963 Antoinette Gay 40 Harrison St New York, NY 10013	0002-012
18 Bridge Street Sag Harbor, NY 11963	Multiple Owners (32) of Condominiums	0001 Multiple Lots
2 West Water Street Sag Harbor, NY 11963	2 West Water Street, LLC Attn:Jay Bialsky, c/o Adam Miller Group, PO Box 1947, Bridgehampton, NY 11932	0002-050
4 West Water Street Sag Harbor, NY 11963	Paul N. and Deborah L. Glickman 15 West Way, Chappaqua NY 10514	0002-002
8 West Water Street Sag Harbor, NY 11963	SGI Marinas, LLC c/o Ditmas Management Corp., 3333 New Hyde Park Rd Suite 411 New Hyde Park, NY 11042	0002-001
21 Long Island Avenue Sag Harbor, NY 11963	United States Postal Service c/o NE Region General Post Ofc, 8th Ave	0002-047
22 Long Island Avenue Sag Harbor, NY 11963	Sag Harbor Building Co., Inc. c/o Staller Associate 1455 Veterans Hwy Suite 201	0002-008
51 Meadow Street Sag Harbor, NY 11963	Sag Harbor Village PO Box 660, Sag Harbor, NY 11963	0002-015
Rights-of Way (Roads and Sidewalks)	Sag Harbor Village PO Box 660, Sag Harbor, NY 11964	--

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	6NYCRR Part 375 UNRESTRICTED USE (italics)	6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)	6NYCRR Part 375 RESTRICTED USE COMMERCIAL	SHCP-01 0-2" 1/5/1999	SHCP-02 0-2" 1/6/1999	SHCP-03 0 1/6/1999	SHCP-04 0 1/6/1999	SHMW-02D 78 4/18/2000	SHSB-01 0_5 3/20/2000	SHSB-01 26 3/20/2000	SHSB-01 5 3/20/2000	SHSB-02 0_5 3/20/2000	SHSB-02 16 3/20/2000	SHSB-02 52 3/22/2000	SHSB-02 6 3/20/2000	SHSB-03 1 3/20/2000
BTEX (mg/kg)																
Benzene	0.06	4.8	44	*0.83*	**0.031**	12 U	**0.039**	0.005 U	0.006 U	**0.001**	**6.5**	0.006 U	92	0.001 U	140	**0.002 J**
Toluene	0.7	100	500	*0.92*	**0.029**	12 U	**0.018**	**0.011**	0.006 U	0.001 U	*2.5*	0.006 U	**270**	**0.001**	**370**	**0.006**
Ethylbenzene	1	41	390	**41**	*1.1*	**52**	**0.96**	**0.31**	0.006 U	**0.001**	**47**	0.006 U	**240**	**0.003**	**380**	0.006 U
Xylene, total	0.26	100	500	*51*	*1.7*	**120**	*0.87*	*0.58*	0.006 U	**0.002**	*70*	0.006 U	**380**	**0.005**	500	0.006 U
PAHs (mg/kg)																
Acenaphthene	20	100	500	*57*	*22*	**110**	**0.045 J**	*30*	19 U	0.38 U	**270**	1.9 U	*38*	**0.12 J**	**370**	1.8 U
Acenaphthylene	100	100	500	**5.5 J**	**1.4 J**	4.4 J	**0.69 J**	**6.3**	**19 J**	0.38 U	25 J	**4.6**	**54**	**0.21 J**	**73**	**1.3 J**
Anthracene	100	100	500	**31**	**9.7**	58 J	**0.24 J**	**19**	**8.6 J**	0.38 U	**130**	**1.5 J**	**31**	**0.21 J**	**170**	**0.53 J**
Benz[a]anthracene	1	1	5.6	28	7.6	38 J	**0.73 J**	22	68	0.38 U	93	**1.7 J**	16 J	**0.15 J**	98	**1.8**
Benzo[a]pyrene	1	1	1	29	4.8 J	28 J	**0.84**	18	**70**	0.38 U	69	6.1	12 J	**0.13 J**	79	3.1
Benzo[b]fluoranthene	1	1	5.6	12 J	**1.8 J**	14 J	**1.3**	15	**77**	0.38 U	57	**5**	9.4 J	**0.11 J**	59 J	**3.3**
Benzo[g,h,i]perylene	100	100	500	29	**3.6 J**	16 J	**2.1**	10	**62**	0.38 U	25 J	**10**	**6.3 J**	**0.064 J**	**42 J**	4
Benzo[k]fluoranthene	0.8	3.9	56	**15 J**	*3.6 J*	**17 J**	***1.2***	**5.5**	**22**	0.38 U	**22 J**	*1.2 J*	**4 J**	0.39 U	**17 J**	*0.9 J*
Chrysene	1	3.9	56	**29**	**8**	**34 J**	*1.1*	**20**	**74**	0.38 U	89	*2.4*	**14 J**	**0.14 J**	86	*2*
Dibenz[a,h]anthracene	0.33	0.33	0.56	8.4 J	1 J	3.8 J	**0.49 J**	2 J	**11 J**	0.38 U	51 U	1.2 J	29 U	0.39 U	8.8 J	**0.32 J**
Dibenzofuran	7	59	350	NA	NA	NA	NA	**1.3 J**	19 U	0.38 U	51 U	1.9 U	29 U	0.39 U	**6.8 J**	**1.8 U**
Fluoranthene	100	100	500	**33**	**11**	**69 J**	**0.76 J**	**40**	**81**	0.38 U	**160**	**1.6 J**	**36**	**0.3 J**	**220**	**1.8**
Fluorene	30	100	500	**29**	**8.2**	*54 J*	**0.086 J**	**17**	19 U	0.38 U	**110**	1.9 U	29 U	**0.18 J**	**160**	1.8 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	13 J	**2.2 J**	11 J	**1.6**	8.9	**51**	0.38 U	51 U	5.8	**5 J**	**0.053 J**	32 J	**2.8**
Methylnaphthalene,2-	NE	NE	NE	**89**	**13**	**98**	0.8 U	**26**	**2.4 J**	0.38 U	280	**0.76 J**	**120**	**0.27 J**	**540**	1.8 U
Naphthalene	12	100	500	**180**	*19*	**330**	**4.4**	*38*	**0.012 B**	0.38 U	580	0.006 U	**270**	**0.31 J**	1600 D	0.006 U
Phenanthrene	100	100	500	**120**	**37**	**210**	**0.77 J**	**58**	**12 J**	0.38 U	**460**	**0.84 J**	**160**	**0.83**	720	**0.44 J**
Pyrene	100	100	500	**160**	**37**	**130**	**2.6**	**51**	**180**	0.38 U	**330**	**4**	**49**	**0.42**	**310**	**3.1**

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-03 10 3/20/2000**	**SHSB-03 34 3/20/2000**	**SHSB-04 0_5 3/13/2000**	**SHSB-04 24 3/15/2000**	**SHSB-04 4 3/13/2000**	**SHSB-05 0_5 3/13/2000**	**SHSB-05 22 3/13/2000**	**SHSB-05 4 3/13/2000**	**SHSB-05 88 5/22/2000**	**SHSB-06 0_5 3/13/2000**	**SHSB-06 50 3/13/2000**	**SHSB-06 6 3/13/2000**	**SHSB-07 0_5 3/17/2000**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	0.15 U	**0.001**	0.001 U	0.001 U	*0.39*	0.001 U	0.001 U	0.05 U	0.001 U	0.001 U	0.001 U	0.05 U	0.001 U
Toluene	0.7	100	500	0.15 U	**0.003**	0.001 U	0.001 U	0.66	0.001 U	0.001 U	0.05 U	0.001 U	0.001 U	0.001 U	0.05 U	0.001 U
Ethylbenzene	1	41	390	*4.8*	**0.004**	0.001 U	0.001 U	*15*	0.001 U	0.001 U	**0.28**	0.001 U	0.001 U	0.001 U	**0.23**	**0.003**
Xylene, total	0.26	100	500	*5.2*	**0.005**	0.001 U	0.001 U	*19*	0.001 U	0.001 U	***0.62***	0.001 U	0.001 U	0.001 U	*0.42*	**0.01**
PAHs (mg/kg)																
Acenaphthene	20	100	500	**16**	0.41 U	4.4 U	0.4 U	*27*	3.4 U	0.38 U	520	0.38 U	3.9 U	0.39 U	**16**	0.39 U
Acenaphthylene	100	100	500	**1 J**	0.41 U	**36**	0.4 U	2.9 J	**39**	0.38 U	**54 J**	**0.081 J**	**25**	0.39 U	**1.8 J**	**0.26 J**
Anthracene	100	100	500	**3 J**	0.41 U	**19**	0.4 U	17	**22**	0.38 U	**260**	**0.12 J**	**15**	0.39 U	**7.9**	**0.097 J**
Benz[a]anthracene	1	1	5.6	**1.3 J**	0.41 U	35	0.4 U	11	56 D	0.38 U	180	**0.1 J**	51	0.39 U	**5.2**	**0.62**
Benzo[a]pyrene	1	1	1	1 J	0.41 U	56	0.4 U	7.5	82 D	0.38 U	130	**0.076 J**	58	0.39 U	4.2	**0.72**
Benzo[b]fluoranthene	1	1	5.6	10 U	0.41 U	62	0.4 U	6.4	78 D	0.38 U	110	**0.06 J**	59	0.39 U	**3.2 J**	**1**
Benzo[g,h,i]perylene	100	100	500	10 U	0.41 U	**71 E**	0.4 U	3.5 J	**76 D**	0.38 U	**63 J**	0.38 U	**47**	0.39 U	**1.8 J**	**0.86**
Benzo[k]fluoranthene	0.8	3.9	56	10 U	0.41 U	**18**	0.4 U	*1.9 J*	**23**	0.38 U	**32 J**	0.38 U	**20**	0.39 U	*1.1 J*	**0.3 J**
Chrysene	1	3.9	56	*1 J*	0.41 U	**42**	0.4 U	**8.9**	59 D	0.38 U	160	**0.11 J**	56	0.39 U	**4.4**	**0.82**
Dibenz[a,h]anthracene	0.33	0.33	0.56	10 U	0.41 U	12	0.4 U	0.7 J	14	*0.38 U*	14 J	0.38 U	8.1	0.39 U	**0.43 J**	0.39 U
Dibenzofuran	7	59	350	10 U	0.41 U	4.4 U	0.4 U	0.66 J	3.4 U	0.38 U	***20 J***	0.38 U	3.9 U	0.39 U	**0.51 J**	0.39 U
Fluoranthene	100	100	500	**2.8 J**	0.41 U	**28**	0.4 U	23	**73 D**	0.38 U	**380**	**0.2 J**	**54**	0.39 U	**10**	**0.63**
Fluorene	30	100	500	**4.2 J**	0.41 U	4.4 U	0.4 U	13	3.4 U	0.38 U	**270**	**0.084 J**	3.9 U	0.39 U	**7.4**	0.39 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	10 U	0.41 U	56	0.4 U	**3.1 J**	58 D	0.38 U	**53 J**	0.38 U	39	0.39 U	**1.5 J**	**0.72**
Methylnaphthalene,2-	NE	NE	NE	**32**	0.41 U	3.6 J	0.4 U	21	**1.9 J**	0.38 U	**470**	0.38 U	**0.92 J**	0.39 U	**16**	0.39 U
Naphthalene	12	100	500	**160**	**0.045 J**	*14*	0.4 U	*29*	**4.2**	0.38 U	790	0.38 U	**1.9 J**	0.39 U	***35***	**0.05 J**
Phenanthrene	100	100	500	**13**	**0.094 J**	**5.1**	**0.064 J**	50	**23**	**0.072 J**	960	**0.51**	**8.4**	0.39 U	**28**	**0.26 J**
Pyrene	100	100	500	**4.3 J**	**0.056 J**	**60**	0.4 U	28	**130 D**	0.38 U	**490**	**0.29 J**	**100 D**	0.39 U	**16**	**1.4**

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-07 26 3/17/2000**	**SHSB-07 8 3/17/2000**	**SHSB-08 2 3/20/2000**	**SHSB-08 5 3/20/2000**	**SHSB-08 50 3/20/2000**	**SHSB-09 1 3/22/2000**	**SHSB-09 26 3/23/2000**	**SHSB-09 8 3/22/2000**	**SHSB-10 2 3/16/2000**	**SHSB-10 24 3/16/2000**	**SHSB-11 1_8 3/23/2000**	**SHSB-11 30 3/23/2000**	**SHSB-11 6 3/23/2000**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	0.001	**6.2**	*1.9*	**26**	0.001 U	0.056 U	0.001 U	*0.39*	**11**	0.001 U	0.001 U	**0.002**	0.063 U
Toluene	0.7	100	500	0.001 U	0.1 U	1 U	0.5 U	0.001 U	**0.056**	**0.001**	0.065 U	*18*	0.001 U	**0.003**	0.001 U	0.063 U
Ethylbenzene	1	41	390	0.001 U	*5.4*	*21*	*34*	0.001 U	*1.4*	0.001 U	*1*	**63**	**0.002**	**0.005**	**0.018**	**0.22**
Xylene, total	0.26	100	500	0.002	*3.8*	*24*	*39*	0.001 U	*2.9*	0.001	*1.2*	*85*	**0.002**	**0.005**	**0.011**	**0.22**
PAHs (mg/kg)																
Acenaphthene	20	100	500	0.4 U	2.4 U	*66 D*	**170**	0.38 U	**110**	0.4 U	**6.2**	500	0.41 U	0.38 U	**2.6**	*39*
Acenaphthylene	100	100	500	0.4 U	2.4 U	**11**	**11 J**	0.38 U	**11 J**	0.4 U	**0.66 J**	**71 J**	0.41 U	0.38 U	**0.41**	**4 J**
Anthracene	100	100	500	0.4 U	2.4 U	44 D	**78**	0.38 U	**56**	0.4 U	**3.4**	**270**	0.41 U	0.38 U	**1.3**	**19**
Benz[a]anthracene	1	1	5.6	0.4 U	2.4 U	49 D	52	0.38 U	31	0.4 U	**1.9**	160	0.41 U	**0.042 J**	**1.2**	13 J
Benzo[a]pyrene	1	1	1	0.4 U	2.4 U	36 D	32 J	0.38 U	19 J	0.4 U	1.4 J	110	0.41 U	**0.071 J**	1.1	9.3 J
Benzo[b]fluoranthene	1	1	5.6	0.4 U	2.4 U	37 D	27 J	0.38 U	15 J	0.4 U	**1.1 J**	88 J	0.41 U	**0.085 J**	**0.84**	7 J
Benzo[g,h,i]perylene	100	100	500	0.4 U	2.4 U	**16 DJ**	42 U	0.38 U	**8.3 J**	0.4 U	**0.7 J**	**58 J**	0.41 U	**0.1 J**	**0.66**	**2.4 J**
Benzo[k]fluoranthene	0.8	3.9	56	0.4 U	2.4 U	**9.6**	**10 J**	0.38 U	**5.2 J**	0.4 U	**0.44 J**	**29 J**	0.41 U	0.38 U	**0.26 J**	***2.8 J***
Chrysene	1	3.9	56	0.4 U	2.4 U	59 D	**47**	0.38 U	**27**	0.4 U	*1.7*	140	0.41 U	**0.048 J**	*1*	**11 J**
Dibenz[a,h]anthracene	0.33	0.33	0.56	0.4 U	2.4 U	4.1	42 U	0.38 U	22 U	0.4 U	1.7 U	94 U	0.41 U	0.38 U	**0.1 J**	16 U
Dibenzofuran	7	59	350	0.4 U	2.4 U	**1.6**	42 U	0.38 U	**4 J**	0.4 U	**0.21 J**	*24 J*	0.41 U	0.38 U	**0.046 J**	16 U
Fluoranthene	100	100	500	0.4 U	2.4 U	88 D	**98**	0.38 U	**63**	0.4 U	**4.2**	**350**	0.41 U	**0.046 J**	**2.6**	**25**
Fluorene	30	100	500	0.4 U	2.4 U	*36 D*	*65*	0.38 U	*49*	0.4 U	**2.8**	**250**	0.41 U	0.38 U	**1.3**	**16 J**
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	0.4 U	2.4 U	14 DJ	42 U	0.38 U	7.3 J	0.4 U	**0.61 J**	47 J	0.41 U	**0.069 J**	**0.52**	**3.7 J**
Methylnaphthalene,2-	NE	NE	NE	0.4 U	2.4 U	56 D	**170**	0.38 U	**110**	0.4 U	**4.9**	**600**	0.41 U	0.38 U	**2.4**	**48**
Naphthalene	12	100	500	0.4 U	**4.8**	**170 D**	**480**	0.38 U	**180**	0.4 U	**9.1**	1300	0.41 U	0.38 U	**5.7**	**170**
Phenanthrene	100	100	500	0.4 U	2.4 U	**120 D**	**280**	0.38 U	**170**	0.4 U	**11**	900	**0.049 J**	0.38 U	**5.7**	**61**
Pyrene	100	100	500	0.4 U	2.4 U	**190 D**	**210**	0.38 U	**84**	0.4 U	**5.9**	**450**	0.41 U	**0.083 J**	**3.5**	**33**

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-11 8 3/23/2000**	**SHSB-12 1 3/24/2000**	**SHSB-12 34 3/24/2000**	**SHSB-12 6 3/24/2000**	**SHSB-13 10 3/27/2000**	**SHSB-13 18 3/27/2000**	**SHSB-13 2 3/27/2000**	**SHSB-13 34 3/27/2000**	**SHSB-14 48 3/6/2000**	**SHSB-14 5 3/6/2000**	**SHSB-15 16 3/6/2000**	**SHSB-15 26 3/6/2000**	**SHSB-15 48 3/7/2000**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	44	0.064 U	0.001 U	**0.003**	**7.8**	0.005 U	0.013	0.001 U	0.001 U	3.1 U	0.001 U	0.012 U	0.001 U
Toluene	0.7	100	500	*10*	0.064 U	0.001 U	0.001 U	*10*	**0.022**	0.004	**0.002**	0.001 U	3.1 U	0.001 U	0.012 U	0.001 U
Ethylbenzene	1	41	390	**160**	0.86	0.001 U	**0.031**	**59**	**0.11**	0.007	**0.002**	0.001 U	*22*	0.001 U	**0.086**	0.001 U
Xylene, total	0.26	100	500	**150**	*1.3*	0.001 U	**0.024**	*66*	**0.14**	0.021	**0.002**	0.001 U	*42*	0.001 U	**0.1**	0.001 U
PAHs (mg/kg)																
Acenaphthene	20	100	500	**16**	**11**	0.4 U	*21 J*	19 U	0.39 U	1 U	0.4 U	0.39 U	*89 D*	0.38 U	**1.8**	0.39 U
Acenaphthylene	100	100	500	**2.1**	2.1 U	0.4 U	**24 J**	19 U	**3.4**	**5.9**	0.4 U	0.39 U	**9.1**	0.38 U	**13**	0.39 U
Anthracene	100	100	500	**6.6**	**1 J**	0.4 U	**55**	19 U	**2.6**	**2.7**	0.4 U	0.39 U	44 D	0.38 U	**7.5**	0.39 U
Benz[a]anthracene	1	1	5.6	6.5	2.1 U	0.4 U	96	19 U	**2**	**2.8**	0.4 U	0.39 U	29	0.38 U	**5**	0.39 U
Benzo[a]pyrene	1	1	1	5.3	2.1 U	0.4 U	100	19 U	1.6	4.1	0.4 U	0.39 U	19	0.38 U	3.8	0.39 U
Benzo[b]fluoranthene	1	1	5.6	**4.2**	2.1 U	0.4 U	84	19 U	**1.2**	**4.8**	0.4 U	0.39 U	15	0.38 U	**3.1**	0.39 U
Benzo[g,h,i]perylene	100	100	500	**2.8**	2.1 U	0.4 U	**48**	19 U	**0.79**	**11**	0.4 U	0.39 U	8.4	0.38 U	**1.7**	0.39 U
Benzo[k]fluoranthene	0.8	3.9	56	*1.3 J*	2.1 U	0.4 U	**31 J**	19 U	**0.42**	*1.3*	0.4 U	0.39 U	**5.3**	0.38 U	*0.92 J*	0.39 U
Chrysene	1	3.9	56	**4.7**	2.1 U	0.4 U	98	19 U	*1.6*	*3.3*	0.4 U	0.39 U	**26**	0.38 U	**4.5**	0.39 U
Dibenz[a,h]anthracene	0.33	0.33	0.56	**0.53 J**	2.1 U	0.4 U	34 U	19 U	**0.14 J**	0.91 J	0.4 U	0.39 U	2 J	0.38 U	**0.36 J**	0.39 U
Dibenzofuran	7	59	350	**0.26 J**	**0.27 J**	0.4 U	34 U	19 U	**0.1 J**	1 U	0.4 U	0.39 U	**2.6**	0.38 U	**0.71 J**	0.39 U
Fluoranthene	100	100	500	**14**	**0.63 J**	0.4 U	**140**	19 U	**4.2**	**1.8**	**0.058 J**	0.39 U	57 D	0.38 U	**10**	0.39 U
Fluorene	30	100	500	**7.1**	**2.8**	0.4 U	**20 J**	19 U	**2.2**	1 U	0.4 U	0.39 U	*43 D*	0.38 U	**7.2**	0.39 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	**2.4**	2.1 U	0.4 U	42	19 U	**0.66**	5.7	0.4 U	0.39 U	7.3	0.38 U	**1.5 J**	0.39 U
Methylnaphthalene,2-	NE	NE	NE	**17**	**11**	0.4 U	**10 J**	**4.9 J**	**3.3**	**0.5 J**	0.4 U	0.39 U	77 D	0.38 U	**14**	0.39 U
Naphthalene	12	100	500	**130 D**	*32*	0.4 U	*13 J*	**150**	**5.9**	**0.21 J**	0.4 U	0.39 U	**100 D**	0.22 J	*22*	0.39 U
Phenanthrene	100	100	500	34 D	**5.9**	0.4 U	**110**	**2.1 J**	10 D	**0.38 J**	**0.1 J**	0.39 U	**130 D**	0.38 U	**23**	**0.08 J**
Pyrene	100	100	500	**18**	**1.3 J**	0.4 U	**280**	19 U	**5.4**	**3.2**	**0.079 J**	0.39 U	75 D	0.38 U	**14**	**0.052 J**

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-15 5 3/6/2000**	**SHSB-16 50 3/8/2000**	**SHSB-16 6 3/7/2000**	**SHSB-17 14 3/8/2000**	**SHSB-18 1 3/27/2000**	**SHSB-18 30 3/27/2000**	**SHSB-18 6 3/27/2000**	**SHSB-19 2 3/20/2000**	**SHSB-19 5 3/20/2000**	**SHSB-19 50 3/20/2000**	**SHSB-20 31 3/22/2002**	**SHSB-20 79 3/25/2002**	**SHSB-20 9 3/21/2002**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	1.2 U	0.001 U	1.2 U	0.001 U	0.001 U	0.001 U	0.62 U	**0.002 J**	*0.24*	**0.001**	**0.003**	0.001 U	*0.55*
Toluene	0.7	100	500	1.2 U	0.001 U	1.2 U	0.001 U	**0.003**	0.001 U	0.62 U	**0.011**	0.065 U	**0.002**	0.001 U	0.001 U	**0.23**
Ethylbenzene	1	41	390	*12*	0.001 U	*17*	0.001 U	0.001 U	0.001 U	*29*	**0.016**	*2.6*	0.001 U	**0.002**	0.001 U	*6.6*
Xylene, total	0.26	100	500	*9.4*	0.001 U	*8.6*	0.001 U	0.001 U	0.001 U	*34*	**0.018**	*2.6*	**0.002**	**0.004**	**0.002**	*11*
PAHs (mg/kg)																
Acenaphthene	20	100	500	**3.2**	0.41 U	**19**	0.37 U	1.8 U	0.39 U	**220**	**0.34 J**	18 D	0.39 U	0.4 U	0.39 U	*30 D*
Acenaphthylene	100	100	500	0.4 U	0.41 U	**1.2 J**	0.37 U	**1.7 J**	0.39 U	25 J	**0.057 J**	**1.2**	0.39 U	0.4 U	0.39 U	**2.6**
Anthracene	100	100	500	**1.6**	0.41 U	**5.9**	0.37 U	**0.85 J**	0.39 U	**110**	**0.21 J**	**6.5**	0.39 U	0.4 U	0.39 U	17 D
Benz[a]anthracene	1	1	5.6	**1**	0.41 U	**5**	0.37 U	**3.3**	0.39 U	78	**0.2 J**	**4.6**	0.39 U	0.4 U	0.39 U	12 D
Benzo[a]pyrene	1	1	1	**0.87**	0.41 U	3.8	0.37 U	3.1	0.39 U	50	**0.13 J**	3	0.39 U	0.4 U	0.39 U	6.3
Benzo[b]fluoranthene	1	1	5.6	**0.69**	0.41 U	**3**	0.37 U	**4.3**	0.39 U	42	**0.07 J**	**2.4**	0.39 U	0.4 U	0.39 U	**4.9**
Benzo[g,h,i]perylene	100	100	500	**0.45**	0.41 U	**1.6**	0.37 U	**3.3**	0.39 U	25 J	**0.073 J**	**1.3**	0.39 U	0.4 U	0.39 U	**2.5**
Benzo[k]fluoranthene	0.8	3.9	56	**0.17 J**	0.41 U	*0.98 J*	0.37 U	*1.5 J*	0.39 U	**12 J**	0.4 U	*0.85*	0.39 U	0.4 U	0.39 U	*2.1*
Chrysene	1	3.9	56	**0.98**	0.41 U	**4.6**	0.37 U	**4.2**	0.39 U	67	**0.16 J**	**3.9**	0.39 U	0.4 U	0.39 U	**12 D**
Dibenz[a,h]anthracene	0.33	0.33	0.56	**0.11 J**	0.41 U	**0.41 J**	0.37 U	**0.48 J**	0.39 U	40 U	0.4 U	**0.31 J**	0.39 U	0.4 U	0.39 U	0.82
Dibenzofuran	7	59	350	0.4 U	0.41 U	**0.53 J**	0.37 U	1.8 U	0.39 U	5.8 J	0.4 U	**0.43**	0.39 U	0.4 U	0.39 U	**0.36 J**
Fluoranthene	100	100	500	**2**	0.41 U	**9.9**	0.37 U	**5.7**	0.39 U	**160**	**0.39 J**	12 D	0.39 U	**0.046 J**	0.39 U	20 D
Fluorene	30	100	500	**1.3**	0.41 U	**5.7**	0.37 U	**0.2 J**	0.39 U	**100**	**0.2 J**	8.8 D	0.39 U	0.4 U	0.39 U	15 D
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	**0.33 J**	0.41 U	**1.4**	0.37 U	**2.7**	0.39 U	21 J	**0.056 J**	**1.2**	0.39 U	0.4 U	0.39 U	**1.9**
Methylnaphthalene,2-	NE	NE	NE	**3.9**	0.41 U	**17**	0.37 U	1.8 U	0.39 U	200	**0.051 J**	11 D	0.39 U	0.4 U	0.39 U	39 D
Naphthalene	12	100	500	**1.8**	0.41 U	*83 D*	0.37 U	1.8 U	0.39 U	**430**	**0.092 J**	*24 D*	0.39 U	0.4 U	0.39 U	*60 D*
Phenanthrene	100	100	500	**5.6**	0.41 U	23 D	0.37 U	**1.7 J**	0.39 U	**410**	**0.89**	32 D	0.39 U	**0.12 J**	0.39 U	60 D
Pyrene	100	100	500	**3.5**	0.41 U	**14**	0.37 U	**9.1**	0.39 U	**200**	**0.48**	14 D	0.39 U	**0.072 J**	0.39 U	34 D

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-20 99 3/25/2002**	**SHSB-21 15 3/27/2002**	**SHSB-21 7 3/27/2002**	**SHSB-21 71 3/28/2002**	**SHSB-21 95 3/29/2002**	**SHSB-22 20 4/1/2002**	**SHSB-22 52 4/2/2002**	**SHSB-22 6 4/1/2002**	**SHSB-22 98 4/2/2002**	**SHSB-23 17 4/4/2002**	**SHSB-23 37 4/4/2002**	**SHSB-23 58 4/4/2002**	**SHSB-23 8 4/4/2002**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	0.001 U	**11**	*3.5*	0.001 U	0.001 U	0.001 U	0.001 U	**15**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Toluene	0.7	100	500	0.001 U	*16*	*3.7*	0.001 U	0.001 U	0.001 U	0.001 U	**0.2 J**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethylbenzene	1	41	390	0.001 U	*28*	*13*	0.001 U	0.001 U	0.001 U	0.001 U	*22*	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Xylene, total	0.26	100	500	0.001 U	*37*	*15*	0.001 U	0.001 U	0.001 U	0.001 U	*22*	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
PAHs (mg/kg)																
Acenaphthene	20	100	500	0.4 U	**5.7**	**130**	0.39 U	0.38 U	**0.048 J**	0.36 U	*65*	0.37 U	0.4 U	0.39 U	0.4 U	0.41 U
Acenaphthylene	100	100	500	0.4 U	**2.2**	**110**	0.39 U	0.38 U	0.4 U	0.36 U	**5.9 J**	0.37 U	0.4 U	0.39 U	0.4 U	**0.33 J**
Anthracene	100	100	500	0.4 U	**2.8**	**140**	0.39 U	0.38 U	**0.05 J**	0.36 U	35	0.37 U	0.4 U	0.39 U	0.4 U	**0.12 J**
Benz[a]anthracene	1	1	5.6	0.4 U	**1.4**	170	0.39 U	0.38 U	**0.058 J**	0.36 U	25	0.37 U	0.4 U	0.39 U	0.4 U	**0.8**
Benzo[a]pyrene	1	1	1	0.4 U	1.2	170	0.39 U	0.38 U	0.4 U	0.36 U	19	0.37 U	0.4 U	0.39 U	0.4 U	**0.91**
Benzo[b]fluoranthene	1	1	5.6	0.4 U	**0.89**	140	0.39 U	0.38 U	0.4 U	0.36 U	14	0.37 U	0.4 U	0.39 U	0.4 U	**0.89**
Benzo[g,h,i]perylene	100	100	500	0.4 U	**0.5**	**120**	0.39 U	0.38 U	0.4 U	0.36 U	**10**	0.37 U	0.4 U	0.39 U	0.4 U	**0.5**
Benzo[k]fluoranthene	0.8	3.9	56	0.4 U	**0.31 J**	74	0.39 U	0.38 U	0.4 U	0.36 U	**6**	0.37 U	0.4 U	0.39 U	0.4 U	**0.32 J**
Chrysene	1	3.9	56	0.4 U	***1.4***	180	0.39 U	0.38 U	**0.051 J**	0.36 U	**24**	0.37 U	0.4 U	0.39 U	0.4 U	**0.93**
Dibenz[a,h]anthracene	0.33	0.33	0.56	0.4 U	**0.14 J**	22 J	0.39 U	0.38 U	0.4 U	0.36 U	2.4 J	0.37 U	0.4 U	0.39 U	0.4 U	**0.1 J**
Dibenzofuran	7	59	350	0.4 U	0.4 U	*14 J*	0.39 U	0.38 U	0.4 U	0.36 U	**1.4 J**	0.37 U	0.4 U	0.39 U	0.4 U	0.41 U
Fluoranthene	100	100	500	0.4 U	**2.4**	**330**	**0.063 J**	**0.044 J**	**0.095 J**	0.36 U	**47**	0.37 U	0.4 U	0.39 U	0.4 U	**0.86**
Fluorene	30	100	500	0.4 U	**2.9**	**130**	0.39 U	0.38 U	0.4 U	0.36 U	**29**	0.37 U	0.4 U	0.39 U	0.4 U	0.41 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	0.4 U	**0.41**	100	0.39 U	0.38 U	0.4 U	0.36 U	8	0.37 U	0.4 U	0.39 U	0.4 U	**0.39 J**
Methylnaphthalene,2-	NE	NE	NE	0.4 U	9.3 D	190	0.39 U	0.38 U	0.4 U	0.36 U	**59**	0.37 U	0.4 U	0.39 U	0.4 U	0.41 U
Naphthalene	12	100	500	0.4 U	12 D	**300**	0.39 U	0.38 U	0.4 U	0.36 U	**130 D**	0.37 U	0.4 U	0.39 U	0.4 U	0.41 U
Phenanthrene	100	100	500	0.4 U	16 D	**440**	**0.16 J**	**0.1 J**	**0.19 J**	0.36 U	**130 D**	0.37 U	0.4 U	0.39 U	0.4 U	**0.042 J**
Pyrene	100	100	500	0.4 U	**4.1**	**380**	**0.081 J**	**0.057 J**	**0.11 J**	0.36 U	**64**	0.37 U	0.4 U	0.39 U	0.4 U	**1.4**

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-24 12 4/16/2002**	**SHSB-24 20 4/16/2002**	**SHSB-24 40 4/16/2002**	**SHSB-24 56 4/17/2002**	**SHSB-25 21 4/5/2002**	**SHSB-25 42 4/8/2002**	**SHSB-25 57 4/8/2002**	**SHSB-25 6 4/5/2002**	**SHSB-26 16 4/8/2002**	**SHSB-26 40 4/8/2002**	**SHSB-26 5 4/8/2002**	**SHSB-26 58 4/9/2002**	**SHSB-27 28 4/11/2002**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.004**	0.001 U	0.001 U
Toluene	0.7	100	500	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.017**	0.001 U	0.001 U
Ethylbenzene	1	41	390	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.002 U	0.001 U	0.001 U
Xylene, total	0.26	100	500	**0.003**	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.041**	0.001 U	0.001 U
PAHs (mg/kg)																
Acenaphthene	20	100	500	**0.09 J**	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.13 J**	**0.12 J**	0.4 U	*96*	0.39 U	0.38 U
Acenaphthylene	100	100	500	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	**76**	0.39 U	0.38 U
Anthracene	100	100	500	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.12 J**	**0.094 J**	0.4 U	**120**	0.39 U	0.38 U
Benz[a]anthracene	1	1	5.6	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	**0.07 J**	0.4 U	110	0.39 U	0.38 U
Benzo[a]pyrene	1	1	1	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	75	0.39 U	0.38 U
Benzo[b]fluoranthene	1	1	5.6	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	61	0.39 U	0.38 U
Benzo[g,h,i]perylene	100	100	500	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	**29**	0.39 U	0.38 U
Benzo[k]fluoranthene	0.8	3.9	56	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	**34**	0.39 U	0.38 U
Chrysene	1	3.9	56	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	**0.078 J**	0.4 U	110	0.39 U	0.38 U
Dibenz[a,h]anthracene	0.33	0.33	0.56	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	9.4 J	0.39 U	0.38 U
Dibenzofuran	7	59	350	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	22 U	0.39 U	0.38 U
Fluoranthene	100	100	500	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.15 J**	**0.16 J**	0.4 U	**190**	0.39 U	0.38 U
Fluorene	30	100	500	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.088 J**	**0.078 J**	0.4 U	**110**	0.39 U	0.38 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.4 U	26	0.39 U	0.38 U
Methylnaphthalene,2-	NE	NE	NE	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.051 J**	0.4 U	0.4 U	**22 J**	0.39 U	0.38 U
Naphthalene	12	100	500	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.14 J**	0.4 U	0.4 U	22 U	0.39 U	0.38 U
Phenanthrene	100	100	500	0.43 U	**0.14 J**	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.44**	**0.32 J**	0.4 U	**240**	0.39 U	0.38 U
Pyrene	100	100	500	0.43 U	0.4 U	0.42 U	0.4 U	0.4 U	0.42 U	0.4 U	**0.22 J**	**0.22 J**	0.4 U	**280**	0.39 U	0.38 U

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-27 5 4/11/2002**	**SHSB-28 10 4/2/2002**	**SHSB-28 20 4/2/2002**	**SHSB-28 38 4/2/2002**	**SHSB-28 58 4/2/2002**	**SHSB-29 12 4/11/2002**	**SHSB-29 30 4/11/2002**	**SHSB-29 5 4/11/2002**	**SHSB-29 58 4/11/2002**	**SHSB-30 28 4/1/2002**	**SHSB-30 5 4/1/2002**	**SHSB-31 16 3/28/2002**	**SHSB-31 28 3/28/2002**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	0.001 U	**0.001 J**	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.62 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U
Toluene	0.7	100	500	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.68**	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U
Ethylbenzene	1	41	390	0.001 U	0.001 U	**0.009**	0.001 U	0.001 U	0.001 U	0.001 U	*27*	0.001 U	0.001 U	0.002 U	0.001 U	0.001 U
Xylene, total	0.26	100	500	**0.006**	0.001 U	**0.005**	0.001 U	0.001 U	0.001 U	0.001 U	*32*	0.001 U	0.001 U	**0.008**	0.001 U	0.001 U
PAHs (mg/kg)																
Acenaphthene	20	100	500	**0.34 J**	**0.3 J**	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**440 D**	0.36 U	0.41 U	**0.5**	0.4 U	NA
Acenaphthylene	100	100	500	**0.64**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**45**	0.36 U	0.41 U	0.49 U	0.4 U	NA
Anthracene	100	100	500	**0.41**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**440 D**	0.36 U	0.41 U	0.49 U	0.4 U	NA
Benz[a]anthracene	1	1	5.6	**0.44**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	160 D	0.36 U	0.41 U	0.49 U	0.4 U	NA
Benzo[a]pyrene	1	1	1	**0.57**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	110 D	0.36 U	0.41 U	0.49 U	0.4 U	NA
Benzo[b]fluoranthene	1	1	5.6	**0.47**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	88 D	0.36 U	0.41 U	0.49 U	0.4 U	NA
Benzo[g,h,i]perylene	100	100	500	**0.43**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**54**	0.36 U	0.41 U	0.49 U	0.4 U	NA
Benzo[k]fluoranthene	0.8	3.9	56	**0.19 J**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**35**	0.36 U	0.41 U	0.49 U	0.4 U	NA
Chrysene	1	3.9	56	**0.49**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	150 D	0.36 U	0.41 U	0.49 U	0.4 U	NA
Dibenz[a,h]anthracene	0.33	0.33	0.56	**0.09 J**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	12	0.36 U	0.41 U	0.49 U	0.4 U	NA
Dibenzofuran	7	59	350	0.36 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	*13*	0.36 U	0.41 U	0.49 U	0.4 U	NA
Fluoranthene	100	100	500	**0.73**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**330 D**	**0.06 J**	0.41 U	0.49 U	**0.049 J**	NA
Fluorene	30	100	500	**0.22 J**	**0.088 J**	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**230 D**	0.36 U	0.41 U	0.49 U	0.4 U	NA
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	**0.35 J**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	46	0.36 U	0.41 U	0.49 U	0.4 U	NA
Methylnaphthalene,2-	NE	NE	NE	**0.1 J**	**0.1 J**	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	480 D	0.36 U	0.41 U	0.49 U	0.4 U	NA
Naphthalene	12	100	500	**0.18 J**	**1**	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	900 D	0.36 U	0.41 U	**2.3**	0.4 U	NA
Phenanthrene	100	100	500	**0.28 J**	**0.071 J**	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	840 D	**0.13 J**	0.41 U	0.49 U	**0.11 J**	NA
Pyrene	100	100	500	**1.4**	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.41 U	**430 D**	**0.096 J**	0.41 U	0.49 U	**0.058 J**	NA

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-31 4 3/28/2002**	**SHSB-32 16 4/15/2002**	**SHSB-32 5 4/15/2002**	**SHSB-33 12 4/15/2002**	**SHSB-33 5_5 4/15/2002**	**SHSB-34 28 4/9/2002**	**SHSB-34 8 4/9/2002**	**SHSB-35 28 4/10/2002**	**SHSB-35 8 4/10/2002**	**SHSB-36 14 3/29/2002**	**SHSB-36 8 3/29/2002**	**SHSB-37 10 4/12/2002**	**SHSB-37 14 4/12/2002**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	0.39 U	0.001 U	*0.57*	**0.034**	*1.1 J*	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.009**	*0.36*	0.001 U
Toluene	0.7	100	500	0.39 U	0.001 U	0.31 U	**0.002**	1.1 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U	0.001 U
Ethylbenzene	1	41	390	*16*	0.001 U	*23*	**0.001 J**	**65**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.005**	0.001 U
Xylene, total	0.26	100	500	*13*	0.001 U	*11*	**0.004**	*58*	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.009**	**0.006**
PAHs (mg/kg)																
Acenaphthene	20	100	500	**120 D**	0.4 U	*65 D*	0.41 U	620 D	0.4 U	0.46 U	0.41 U	**0.11 J**	0.4 U	0.42 U	1.6 U	0.4 U
Acenaphthylene	100	100	500	14	0.4 U	**5.7**	0.41 U	**45**	0.4 U	0.46 U	0.41 U	**0.16 J**	0.4 U	0.42 U	1.6 U	0.4 U
Anthracene	100	100	500	**57**	0.4 U	34 D	0.41 U	**280 D**	0.4 U	0.46 U	0.41 U	**0.41 J**	0.4 U	0.42 U	1.6 U	0.4 U
Benz[a]anthracene	1	1	5.6	40	0.4 U	21 D	0.41 U	180 D	0.4 U	0.46 U	0.41 U	**1.2**	0.4 U	0.42 U	1.6 U	0.4 U
Benzo[a]pyrene	1	1	1	27	0.4 U	16 D	0.41 U	120 DJ	0.4 U	0.46 U	0.41 U	1.1	0.4 U	0.42 U	1.6 U	0.4 U
Benzo[b]fluoranthene	1	1	5.6	24	0.4 U	13	0.41 U	110 DJ	0.4 U	0.46 U	0.41 U	**1.4**	0.4 U	0.42 U	1.6 U	0.4 U
Benzo[g,h,i]perylene	100	100	500	**9.3**	0.4 U	**8.3**	0.41 U	**50**	0.4 U	0.46 U	0.41 U	**0.75**	0.4 U	0.42 U	1.6 U	0.4 U
Benzo[k]fluoranthene	0.8	3.9	56	**10**	0.4 U	**5.7**	0.41 U	**33**	0.4 U	0.46 U	0.41 U	**0.56**	0.4 U	0.42 U	1.6 U	0.4 U
Chrysene	1	3.9	56	**41**	0.4 U	**22 D**	0.41 U	180 D	0.4 U	0.46 U	0.41 U	*1.3*	0.4 U	0.42 U	1.6 U	0.4 U
Dibenz[a,h]anthracene	0.33	0.33	0.56	2.5 J	0.4 U	1.9	0.41 U	11	0.4 U	0.46 U	0.41 U	**0.18 J**	0.4 U	0.42 U	1.6 U	0.4 U
Dibenzofuran	7	59	350	**5.4**	0.4 U	**2.5**	0.41 U	*18*	0.4 U	0.46 U	0.41 U	**0.064 J**	0.4 U	0.42 U	1.6 U	0.4 U
Fluoranthene	100	100	500	**68**	**0.052 J**	44 D	0.41 U	**380 D**	0.4 U	0.46 U	0.41 U	**2.9**	0.4 U	0.42 U	1.6 U	0.4 U
Fluorene	30	100	500	*48*	0.4 U	28 D	0.41 U	**280 D**	0.4 U	0.46 U	0.41 U	**0.14 J**	0.4 U	0.42 U	1.6 U	0.4 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	9.2	0.4 U	7.3	0.41 U	45	0.4 U	0.46 U	0.41 U	**0.72**	0.4 U	0.42 U	1.6 U	0.4 U
Methylnaphthalene,2-	NE	NE	NE	130 D	0.4 U	60 D	0.41 U	680 D	0.4 U	0.46 U	0.41 U	0.47 U	0.4 U	0.42 U	1.6 U	0.4 U
Naphthalene	12	100	500	**300 D**	**0.046 J**	**130 D**	0.41 U	1700 D	0.4 U	0.46 U	0.41 U	**0.09 J**	0.4 U	0.42 U	1.6 U	0.4 U
Phenanthrene	100	100	500	**190 D**	**0.12 J**	**110 D**	0.41 U	1000 D	0.4 U	0.46 U	0.41 U	**1.7**	0.4 U	0.42 U	1.6 U	0.4 U
Pyrene	100	100	500	**74**	**0.073 J**	57 D	0.41 U	**490 D**	0.4 U	0.063 J	0.41 U	**2.4**	0.4 U	0.42 U	1.6 U	0.4 U

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-37 6 4/12/2002**	**SHSB-38 12 4/8/2002**	**SHSB-38 22 4/8/2002**	**SHSB-38 8 4/8/2002**	**SHSB-39 16 3/27/2002**	**SHSB-39 8 3/27/2002**	**SHSB-40 13 4/9/2002**	**SHSB-40 8 4/9/2002**	**SHSB-41 16 4/11/2002**	**SHSB-41 9 4/11/2002**	**SHSB-42 20 4/15/2002**	**SHSB-42 8 4/15/2002**	**SHSB-43 16 4/16/2002**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	**0.002**	0.065 U	0.001 U	**14**	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.26 U	0.001 U
Toluene	0.7	100	500	0.001 U	**0.16**	0.001 U	*17*	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.26 U	0.001 U
Ethylbenzene	1	41	390	**0.003**	**0.75**	0.001 U	**140**	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	*16*	0.001 U
Xylene, total	0.26	100	500	**0.008**	*0.78*	0.001 U	**130**	0.001 U	0.003 U	**0.002**	0.001 U	0.001 U	**0.007**	0.001 U	*17*	**0.002**
PAHs (mg/kg)																
Acenaphthene	20	100	500	13 D	**1.2**	0.39 U	**330**	0.38 U	0.92 U	0.4 U	**0.053 J**	0.42 U	**0.4 J**	0.42 U	**110 D**	0.41 U
Acenaphthylene	100	100	500	**1.8**	**0.26 J**	0.39 U	**85 J**	0.38 U	0.92 U	0.4 U	**0.41 U**	0.42 U	0.43 U	0.42 U	**10**	0.41 U
Anthracene	100	100	500	11 D	**0.64**	0.39 U	**210**	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	58 D	0.41 U
Benz[a]anthracene	1	1	5.6	6.1	**0.45**	0.39 U	150	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	39 D	0.41 U
Benzo[a]pyrene	1	1	1	4	**0.35 J**	0.39 U	120	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	31 DJ	0.41 U
Benzo[b]fluoranthene	1	1	5.6	**3**	**0.22 J**	0.39 U	81 J	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	18	0.41 U
Benzo[g,h,i]perylene	100	100	500	**1.1**	**0.17 J**	0.39 U	**59 J**	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	**12**	0.41 U
Benzo[k]fluoranthene	0.8	3.9	56	*1.9*	**0.19 J**	0.39 U	60 J	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	**6.8**	0.41 U
Chrysene	1	3.9	56	**6.2 D**	**0.42 J**	0.39 U	150	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	**36 D**	0.41 U
Dibenz[a,h]anthracene	0.33	0.33	0.56	**0.39**	0.43 U	0.39 U	110 U	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	2.8	0.41 U
Dibenzofuran	7	59	350	**0.55**	0.43 U	0.39 U	110 U	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.14 J	0.42 U	**2.2**	0.41 U
Fluoranthene	100	100	500	**12 D**	**0.99**	0.39 U	**300**	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	82 D	0.41 U
Fluorene	30	100	500	8.3 D	**0.64**	0.39 U	**190**	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.12 J	0.42 U	*51 D*	0.41 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	**1.2**	**0.14 J**	0.39 U	47 J	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	10	0.41 U
Methylnaphthalene,2-	NE	NE	NE	6.3 D	**1.5**	0.39 U	**420**	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	**0.33 J**	0.42 U	160 D	0.41 U
Naphthalene	12	100	500	7.9 D	**5.3**	0.39 U	1400	0.38 U	0.92 U	**0.29 J**	0.41 U	0.42 U	**1.7**	**0.047 J**	**390 D**	0.41 U
Phenanthrene	100	100	500	32 D	**2.3**	0.39 U	690	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	**210 D**	0.41 U
Pyrene	100	100	500	14 D	**1.3**	0.39 U	**410**	0.38 U	0.92 U	0.4 U	0.41 U	0.42 U	0.43 U	0.42 U	**120 D**	0.41 U

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSB-43 8 4/16/2002**	**SHSB-44 28 4/17/2002**	**SHSB-44 6 4/17/2002**	**SHSB-45 0 5/14/2002**	**SHSB-46 1_25 5/14/2002**	**SHSS-01 0 3/29/2000**	**SHSS-02 0 3/29/2000**	**SHSS-03 0 3/29/2000**	**SHSS-04 0 3/29/2000**	**SHSS-05 0 3/29/2000**	**SHSS-06 0 3/29/2000**	**SHSS-07 0 3/29/2000**	**SHSS-08 0 3/31/2000**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	0.7	100	500	0.001 U	0.001 U	0.001 U	0.001 U	**0.001**	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	1	41	390	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA	NA	NA	NA	NA
Xylene, total	0.26	100	500	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA	NA	NA	NA	NA
PAHs (mg/kg)																
Acenaphthene	20	100	500	0.42 U	0.37 U	0.42 U	0.38 U	3.8 U	1.8 U	1.8 U	1.9 U	1.8 U	0.34 U	1.8 U	1.90 U	0.37 U
Acenaphthylene	100	100	500	0.42 U	0.37 U	0.42 U	**0.1 J**	**4**	**4.2**	**12**	**18**	**9.4**	0.34 U	**10**	**2.9**	**0.047 J**
Anthracene	100	100	500	0.42 U	0.37 U	0.42 U	**0.11 J**	**1.4 J**	**1.4 J**	**5**	**7.5**	**2.9**	**0.04 J**	**4.6**	**0.95 J**	0.37 U
Benz[a]anthracene	1	1	5.6	0.42 U	0.37 U	0.42 U	**0.33 J**	7.2	9.4	32 D	49 D	17	**0.17 J**	23	**4.2**	**0.09 J**
Benzo[a]pyrene	1	1	1	0.42 U	0.37 U	0.42 U	**0.32 J**	9.3	8.7	27	45 D	28	**0.19 J**	21	5.4	**0.13 J**
Benzo[b]fluoranthene	1	1	5.6	0.42 U	0.37 U	0.42 U	**0.52**	10	13	39 D	66 D	30 D	**0.28 J**	29	8.1	**0.18 J**
Benzo[g,h,i]perylene	100	100	500	0.42 U	0.37 U	0.42 U	**0.23 J**	**6.5**	**11**	**37 D**	54 D	30 D	**0.15 J**	**25**	7.3	**0.18 J**
Benzo[k]fluoranthene	0.8	3.9	56	0.42 U	0.37 U	0.42 U	**0.23 J**	**5.1**	**5.2**	**17**	**20**	**13**	**0.13 J**	**14**	*2.4*	**0.082 J**
Chrysene	1	3.9	56	0.42 U	0.37 U	0.42 U	**0.48**	**8.4**	**9.9**	**26**	**47 D**	**18**	**0.21 J**	**23**	**4.9**	**0.11 J**
Dibenz[a,h]anthracene	0.33	0.33	0.56	0.42 U	0.37 U	0.42 U	0.38 U	1.4 J	1.9	6.6	9.9	5.7	0.34 U	4.7	1.2 J	0.37 U
Dibenzofuran	7	59	350	0.42 U	0.37 U	0.42 U	0.38 U	3.8 U	1.8 U	**0.27 J**	**0.42 J**	1.8 U	0.34 U	**0.26 J**	1.90 U	0.37 U
Fluoranthene	100	100	500	0.42 U	0.37 U	0.42 U	**0.72**	**6.1**	**11**	40 D	66 D	**15**	**0.52**	**21**	**5.6**	**0.14 J**
Fluorene	30	100	500	0.42 U	0.37 U	0.42 U	0.38 U	3.8 U	**0.34 J**	**1.2 J**	**1.8 J**	**0.9 J**	0.34 U	**1.4 J**	**0.31 J**	0.37 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	0.42 U	0.37 U	0.42 U	**0.17 J**	**5**	9.4	33 D	49 D	27	**0.15 J**	22	5.9	**0.14 J**
Methylnaphthalene,2-	NE	NE	NE	0.42 U	0.37 U	0.42 U	0.38 U	3.8 U	**0.41 J**	**1.7 J**	**2.7**	**0.9 J**	0.34 U	**2.6**	**0.36 J**	0.37 U
Naphthalene	12	100	500	0.42 U	0.37 U	0.42 U	0.38 U	**0.58 J**	**0.83 J**	**3.6**	**6.1**	**1.5 J**	0.34 U	**5.7**	**0.75 J**	0.37 U
Phenanthrene	100	100	500	**0.045 J**	0.37 U	0.42 U	**0.46**	**1.8 J**	**2.5**	**10**	**15**	**3**	**0.3 J**	**12**	**2.0**	**0.044 J**
Pyrene	100	100	500	0.42 U	0.37 U	0.42 U	**0.88**	**13**	**17**	51 D	82 D	29 D	**0.34 J**	43 D	**10**	**0.25 J**

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSS-09 0 3/29/2000**	**SHSS-10 0 4/3/2000**	**SHSS-11 0 3/29/2000**	**SHSS-12 0 3/30/2000**	**SHSS-13 0 3/31/2000**	**SHSS-14 0 4/17/2002**	**SHSS-14 0 5/15/2002**	**SHSS-15 0 5/9/2002**	**SHSS-16 0 5/9/2002**	**SHSS-17 0 5/9/2002**	**SHSS-18 0 5/17/2002**	**SHMGP-01 0 2/21/2006**	**SHSS-101 0 6/1/2004**
BTEX (mg/kg)																
Benzene	0.06	4.8	44	NA	NA	NA	NA	NA	NA	0.006 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.012 U
Toluene	0.7	100	500	NA	NA	NA	NA	NA	NA	0.006 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.012 U
Ethylbenzene	1	41	390	NA	NA	NA	NA	NA	NA	0.006 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.012 U
Xylene, total	0.26	100	500	NA	NA	NA	NA	NA	NA	0.006 U	**0.001**	**0.003**	**0.004**	0.001 U	0.012 U	**0.003 J**
PAHs (mg/kg)																
Acenaphthene	20	100	500	1.90 U	3.8 U	2.1 U	**4.2**	**0.3 J**	4.1 U	3.9 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	0.39 U
Acenaphthylene	100	100	500	**7.6**	**21**	**8.6**	**20**	**4.5**	**1.6 J**	3.9 U	0.41 U	**0.16 J**	0.54 U	0.35 U	4.2	**0.28 J**
Anthracene	100	100	500	**2.4**	**10**	**2.5**	**12**	**2.5 J**	**0.69 J**	3.9 U	0.41 U	**0.061 J**	**0.061 J**	0.35 U	1.3	**0.17 J**
Benz[a]anthracene	1	1	5.6	12	26	8.4	82 D	13	**1.8 J**	3.9 U	0.41 U	**0.18 J**	**0.25 J**	**0.058 J**	8.4 D	**0.44**
Benzo[a]pyrene	1	1	1	19	36	15	100 D	14	2.1 J	3.9 U	0.41 U	**0.22 J**	**0.28 J**	**0.048 J**	16 D	**0.56**
Benzo[b]fluoranthene	1	1	5.6	22	44	18	97 D	21	**2.4 J**	3.9 U	0.41 U	**0.36 J**	**0.42 J**	**0.064 J**	14 D	**0.58**
Benzo[g,h,i]perylene	100	100	500	24	**44**	**20**	**110 D**	**11**	**2.6 J**	3.9 U	0.41 U	**0.16 J**	0.54 U	0.35 U	14 D	**0.38 J**
Benzo[k]fluoranthene	0.8	3.9	56	**9.4**	**14**	**8.4**	**50 D**	**6.8**	*1.3 J*	3.9 U	0.41 U	**0.19 J**	**0.28 J**	0.35 U	**6.5**	**0.43**
Chrysene	1	3.9	56	**12**	**33**	**9**	75 D	**12**	*2.5 J*	3.9 U	0.41 U	**0.32 J**	**0.4 J**	**0.067 J**	**9 D**	**0.51**
Dibenz[a,h]anthracene	0.33	0.33	0.56	3.6	7.3	3.2	15	2.5 J	4.1 U	3.9 U	0.41 U	0.4 U	0.54 U	0.35 U	1.8	0.39 U
Dibenzofuran	7	59	350	1.90 U	3.8 U	**0.25 J**	**0.29 J**	2.8 U	4.1 U	3.9 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	NA
Fluoranthene	100	100	500	**10**	**37**	**8.7**	**120 D**	**16**	2.3 J	3.9 U	**0.054 J**	**0.3 J**	**0.57**	**0.1 J**	8.2 D	**0.72**
Fluorene	30	100	500	**0.71 J**	3.8 U	**0.96 J**	**3.1**	**0.91 J**	4.1 U	3.9 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	0.39 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	20	34	16	97 D	11	**1.8 J**	3.9 U	0.41 U	**0.14 J**	**0.13 J**	0.35 U	6	**0.33 J**
Methylnaphthalene,2-	NE	NE	NE	**0.53 J**	**1.1 J**	**1.9**	**3.2**	**0.58 J**	4.1 U	3.9 U	0.41 U	0.4 U	0.54 U	0.35 U	0.64	0.39 U
Naphthalene	12	100	500	**1.4 J**	**3 J**	**2.7**	**8**	**0.92 J**	4.1 U	3.9 U	0.41 U	0.4 U	0.54 U	0.35 U	0.75	0.39 U
Phenanthrene	100	100	500	**2.1 J**	**6.6**	**4.0**	**14**	**8.6**	**0.65 J**	3.9 U	0.41 U	**0.11 J**	**0.24 J**	**0.054 J**	1.8	**0.25 J**
Pyrene	100	100	500	**21**	**61**	**15**	**140 D**	**21**	**4.3**	3.9 U	**0.073 J**	**0.42**	**0.64**	**0.12 J**	20 D	**0.91**

Table 2. Comparison of Pre-Remedial Action Soil Analytical Data to Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Chemical	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (bold)**	**6NYCRR Part 375 RESTRICTED USE COMMERCIAL**	**SHSS-102 0 6/1/2004**	**SHSS-103 0 6/1/2004**	**SHSS-104 0 6/1/2004**	**SHSS-105 0 6/1/2004**	**SHSS-106 0 6/1/2004**	**SHSS-107 0 6/1/2004**	**SHSS-108 0 6/1/2004**	**SHSS-109 0 6/1/2004**	**SHSS-110 0 6/2/2004**
BTEX (mg/kg)												
Benzene	0.06	4.8	44	0.017 U	0.011 U	0.012 U	0.011 U	0.012 U	0.011 U	0.011 U	0.01 UJ	0.015 U
Toluene	0.7	100	500	0.017 U	0.011 U	0.012 U	0.011 U	0.012 U	0.011 U	0.011 U	0.01 UJ	0.015 U
Ethylbenzene	1	41	390	0.017 U	0.011 U	0.012 U	0.011 U	0.012 U	0.011 U	0.011 U	**0.002 J**	0.015 U
Xylene, total	0.26	100	500	**0.006 J**	0.011 U	0.012 U	0.011 U	0.012 U	**0.002 J**	0.011 U	**0.01**	0.015 U
PAHs (mg/kg)												
Acenaphthene	20	100	500	0.56 U	**0.18 J**	**0.21 J**	**0.21 J**	0.39 U	**0.3 J**	0.36 U	0.34 U	**0.17 J**
Acenaphthylene	100	100	500	**0.61**	0.37 U	**0.69**	**0.54**	0.39 U	**0.11 J**	**0.073 J**	**0.12 J**	**0.79**
Anthracene	100	100	500	**0.27 J**	**0.38**	**0.95**	**0.88**	0.39 U	**0.72**	0.36 U	**0.089 J**	**0.48 J**
Benz[a]anthracene	1	1	5.6	**0.75**	**1.2**	**2**	**2.2**	**0.25 J**	**1.7**	**0.16 J**	**0.26 J**	**1.1**
Benzo[a]pyrene	1	1	1	1.2	1.1	2.5	2.3 J	**0.26 J**	1.5 J	**0.17 J**	**0.31 J**	1.5 J
Benzo[b]fluoranthene	1	1	5.6	**1.6**	**1.3**	**4.6**	**2.5 J**	**0.4**	**1.2 J**	**0.18 J**	**0.31 J**	**1.2 J**
Benzo[g,h,i]perylene	100	100	500	**0.93**	**0.36 J**	**0.86**	**0.83 J**	0.39 U	**0.25 J**	0.36 UJ	0.34 U	**0.54 J**
Benzo[k]fluoranthene	0.8	3.9	56	*1.3*	*1.5*	0.4 U	*3.8 J*	**0.37 J**	*2 J*	**0.35 J**	**0.74**	*2.1 J*
Chrysene	1	3.9	56	*1.2*	*1.5*	*2.8*	*2.9*	**0.42**	*1.5*	**0.21 J**	**0.46**	*1.2*
Dibenz[a,h]anthracene	0.33	0.33	0.56	0.56 U	0.37 U	0.4 U	0.36 UJ	0.39 U	0.37 UJ	0.36 UJ	0.34 U	0.49 UJ
Dibenzofuran	7	59	350	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	100	100	500	**0.95**	**3.1**	**4.2**	**4.2**	**0.7**	**2.9**	**0.27 J**	**0.57**	**1.4**
Fluorene	30	100	500	0.56 U	**0.24 J**	0.4 U	**0.28 J**	0.39 U	**0.29 J**	0.36 U	0.34 U	**0.23 J**
Indeno[1,2,3-cd]pyrene	0.5	0.5	5.6	**0.84**	**0.43**	**0.91**	**0.85 J**	0.39 U	**0.37 J**	**0.082 J**	**0.17 J**	**0.52 J**
Methylnaphthalene,2-	NE	NE	NE	**0.13 J**	0.37 U	**0.085 J**	**0.15 J**	0.39 U	**0.096 J**	0.36 U	0.34 U	**0.18 J**
Naphthalene	12	100	500	**0.2 J**	0.37 U	**0.12 J**	**0.26 J**	0.39 U	**0.13 J**	0.36 U	0.34 U	**0.5**
Phenanthrene	100	100	500	**0.42 J**	**2.2**	**2.9**	**2.8**	**0.45**	**2.3**	**0.13 J**	**0.3 J**	**1.1**
Pyrene	100	100	500	**1.5**	**2.7**	**5**	**4.5**	**0.73**	**4.4**	**0.42**	**0.72 J**	**3.1**

Notes:
NYCRR = New York Codes, Rules and Regulations
BTEX = Benzene, Toluene, Ethylbenzene and Xylene
PAHs = Polycyclic Aromatic Hydrocarbons
mg/kg = milligram per kilogram
U = Nondetected result. The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Indicates exceedance of 6NYCRR Part 375 Unrestricted Use SCOs
Indicates exceedance of 6NYCRR Part 375 Restricted Use Residencial SCOs
Indicates exceedance of 6NYCRR Part 375 Restricted Use Commercial Use SCOs

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name:	NYSDEC Class GA Groundwater Criteria	MW-01	MW-01	MW-01	MW-01	MW-01	MW-01	MW-01	MW-02	MW-02	MW-02	MW-02	MW-02	MW-02	MW-02	MW-03	MW-03	MW-03	MW-03	MW-03	MW-03	MW-04	MW-04	MW-04	MW-04	MW-04	MW-05	MW-05
Sample Date:		5/24/2004	8/30/2004	6/27/2005	12/14/2007	3/20/2008	6/20/2008	9/12/2008	5/20/2004	8/30/2004	6/21/2005	12/12/2007	3/20/2008	6/17/2008	9/8/2008	5/21/2004	6/22/2005	12/17/2007	3/17/2008	6/19/2008	9/9/2008	5/18/2004	6/21/2005	12/10/2007	6/18/2008	9/9/2008	5/20/2004	8/30/2004
BTEX (µg/L)																												
Benzene	1	**4 J**	10 U	**12**	**240**	**280**	**120**	**190**	**1700**	**460**	**1700**	**2 J**	**530**	**570**	**72**	**920**	**1100**	**780**	960 E	**760**	**930**	**94**	100 U	**37**	**11**	**40**	**5500**	**740**
Toluene	5	10 U	10 U	10 U	**6 J**	**10**	**5 J**	**5 J**	**87**	**60**	**110**	10 U	**25 J**	**45**	**8 J**	**63**	**57**	**51 J**	**62**	**51**	**45 J**	**5 J**	100 U	**1 J**	10 U	**2 J**	**1000**	**78**
Ethylbenzene	NE	10 U	10 U	10 U	**8 J**	**15**	**9 J**	**7 J**	**6900**	**1300**	**6100**	**58**	**860**	**2500**	**800**	**810**	**850**	**620**	710 E	**590**	**520**	**69**	100 U	**17**	**3 J**	**17**	**2300**	**240**
Xylene, total	5	10 U	10 U	10 U	**6 J**	**12**	**7 J**	**6 J**	**4600**	**1500**	**5100**	**38**	**830**	**2200**	**720**	**780**	**860**	**600 J**	650 E	**560**	**560**	**40**	100 U	**11**	**1 J**	**20**	**2800**	**320**
PAHs (µg/L)																												
Acenaphthene	20	**9 J**	**24**	**12**	**45 J**	**56**	**2 J**	**33**	**1700 J**	**140**	5000 U	**25**	**96**	**120**	**160**	**300 J**	**400**	**170**	150 E	**74**	**190**	**16**	**11**	**2 J**	10 U	**14**	**31000**	**200**
Acenaphthylene	NE	**1 J**	10 U	10 U	**2 J**	**2 J**	10 U	**2 J**	**120**	10 U	10 U	10 U	**3 J**	**3 J**	**2 J**	**5 J**	10 U	**5**	**6**	**5 J**	**7.0 J**	**2 J**	10 U	10 U	10 U	**1 J**	**6500**	200 U
Anthracene	50	10 U	10 U	10 U	**1 J**	**2 J**	10 U	10 U	**680**	**28**	**34**	**8**	**6**	**15**	**18**	**15 J**	**17**	**11**	**10**	10 U	**20**	**6 J**	10 U	10 U	10 U	10 U	**17000**	200 U
Benz[a]anthracene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**750**	**17**	**15**	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	**1 J**	**3 J**	**2 J**	10 U	10 U	10 U	10 U	**15000**	200 U
Benzo[a]pyrene	0	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**470**	**11**	**11**	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	**1 J**	**2 J**	**1 J**	10 U	10 U	10 U	10 U	**11000**	200 U
Benzo[b]fluoranthene	0.002	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	**390 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	**8300 J**	200 U
Benzo[g,h,i]perylene	NE	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	**150 J**	10 U	10 U	10 UJ	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**3400 J**	200 U
Benzo[k]fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**180 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**3500 J**	200 U
Chrysene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**580**	**14**	**12**	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	**3 J**	**2 J**	10 U	10 U	10 U	10 U	**12000**	200 U
Fluorene	50	**2 J**	10 U	10 U	**11**	**14**	10 U	10 U	**560**	**50**	**58**	**10**	**22**	**43**	**52**	**50 J**	**44**	**48**	**47**	10 U	**72**	**6 J**	10 U	10 U	10 U	**2 J**	**16000**	200 U
Indeno[1,2,3-cd]pyrene	0.002	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	**140**	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2800 J**	200 U
Methyl tert-butyl ether	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	100 U	10 U	10 U	10 U	100 U	10 U
Methylnaphthalene,2-	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2400**	**420**	**700**	**18**	**46**	**380**	**370**	**470 J**	**500**	**350**	**65**	10 U	**180**	10 U	10 U	10 U	10 U	10 U	**61000**	**230**
Naphthalene	10	**18**	10 U	**49**	**33 J**	**63**	10 U	10 U	**11000**	**1500**	**9600**	**61**	**120**	**1100**	**1500**	**2600**	**3500**	**1300**	**53**	10 U	**170**	**25**	**11**	10 U	10 U	10 U	**110000**	**820**
Phenanthrene	50	10 U	10 U	10 U	**5 J**	**8**	10 U	10 U	**2900 J**	**97**	5000 U	**28**	**13**	**57**	**85 J**	**64 J**	**73**	**58**	**43**	10 U	**99**	**16**	10 U	10 U	10 U	10 U	**79000**	**250**
Pyrene	50	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1800 J**	**42**	**40**	**8**	**5**	**9**	**11**	**9 J**	**12**	**6**	**7**	**8**	**18**	**7 J**	10 U	**2 J**	10 U	**3 J**	**34000**	**200**

Notes:
µg/L = Microgram per Liter
U = Non Detect
J = Result is Estimated
NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name: **Sample Date:**	NYSDEC Class GA Groundwater Criteria	MW-05 6/27/2005	MW-06 5/19/2004	MW-06 6/22/2005	MW-06 12/17/2007	MW-06 3/20/2008	MW-06 6/18/2008	MW-06 9/10/2008	SHMW-01S 5/21/2004	SHMW-01S 6/21/2005	SHMW-01S 12/17/2007	SHMW-01S 3/17/2008	SHMW-01S 6/19/2008	SHMW-01S 9/9/2008	SHMW-01I 5/21/2004	SHMW-02D 5/24/2004	SHMW-02D 12/17/2007	SHMW-02I 5/24/2004	SHMW-02I 8/30/2004	SHMW-02I 6/27/2005	SHMW-02I 12/14/2007	SHMW-02I 3/21/2008	SHMW-02I 6/20/2008	SHMW-02I 9/12/2008	SHMW-03S 5/20/2004	SHMW-03S 6/22/2005	SHMW-03S 12/13/2007	SHMW-03S 3/20/2008
BTEX (µg/L)																												
Benzene	1	**9700**	**2 J**	10 U	10 U	10 U	**2 J**	10 U	**760**	**650**	**520**	**570**	**150**	**140**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	**12**	10 U	**7 J**	10 U
Toluene	5	**1800**	**1 J**	10 U	10 U	10 U	**1 J**	10 U	**52**	100 U	**24**	**35**	**5 J**	**4 J**	10 U	10 U	10 U	**29**	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	NE	**3200**	**21**	**26**	10 U	**1 J**	**14**	**3 J**	**700**	**630**	**360**	**410**	**77**	**49**	10 U	10 U	10 U	**300**	10 U	10 U	10 U	**2 J**	**4 J**	**2 J**	**59**	**31**	**25**	**2 J**
Xylene, total	5	**4200**	**25**	**29**	10 UJ	10 U	**16**	**4 J**	**590**	**530**	**290 J**	**350**	**74**	**50**	10 U	10 U	10 UJ	**850**	**16**	**20**	**15**	**16**	**34**	**27**	**39**	**22**	**18**	**1 J**
PAHs (µg/L)																												
Acenaphthene	20	**12000**	**28**	**66**	10 U	10 U	10 U	**10**	**77**	**57**	**31**	10 U	10 U	10 U	10 U	**6 J**	**2 J**	**9000 J**	10 U	10 U	**3 J**	**3 J**	**3 J**	**5 J**	**28**	**20**	**20**	10 U
Acenaphthylene	NE	**2700**	**2 J**	10 U	10 U	10 U	10 U	10 U	**6 J**	10 U	**1 J**	10 U	10 U	10 U	10 U	**2 J**	10 U	**48000**	**12**	**15**	**12**	**2 J**	**21**	**32**	**1 J**	10 U	10 U	10 U
Anthracene	50	**6700**	10 U	10 U	10 U	10 U	10 U	10 U	**5 J**	10 U	**1 J**	10 U	10 U	10 U	10 U	**4 J**	10 U	**29000**	10 U	10 U	**2 J**	10 U	**2 J**	**3 J**	**3 J**	10 U	10 U	10 U
Benz[a]anthracene	0.002	**4100**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**5 J**	10 U	**22000 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[a]pyrene	0	**3100**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**5 J**	10 U	**17000 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[b]fluoranthene	0.002	2000 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 UJ	**4 J**	10 U	**12000 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[g,h,i]perylene	NE	**2200**	10 UJ	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ	10 U	10 U	10 U	10 UJ	**3 J**	10 UJ	**8600 J**	10 U	10 U	10 UJ	10 U	10 U	10 U	10 UJ	10 U	10 UJ	10 U
Benzo[k]fluoranthene	0.002	2000 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	**5800 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	0.002	**3300**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**4 J**	10 U	**18000 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	50	**6300**	**2 J**	**13**	10 U	10 U	10 U	10 U	**21**	**13**	**5**	10 U	10 U	10 U	10 U	**3 J**	10 U	**28000**	10 U	10 U	**5 J**	10 U	**5**	**8**	**9 J**	10 U	**5 J**	10 U
Indeno[1,2,3-cd]pyrene	0.002	2000 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	**5800 J**	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U
Methyl tert-butyl ether	NE	1000 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**3 J**	**2 J**	**2 J**	10 U	10 U	10 U	10 U
Methylnaphthalene,2-	NE	**27000**	10 U	10 U	10 U	10 U	10 U	10 U	**190 J**	2000 U	10 U	10 U	10 U	10 U	10 U	**6 J**	**2 J**	**67000**	10 U	**14**	10 U	10 U	**7**	**33**	**18**	10 U	**6**	10 U
Naphthalene	10	**68000**	10 U	10 U	10 U	10 U	10 U	10 U	**2100**	**2100**	10 U	10 U	10 U	10 U	10 U	**12**	**11**	**120000**	**29**	**95**	10 U	**2 J**	10 U	**92**	**220**	**110**	**92**	10 U
Phenanthrene	50	**35000**	10 U	10 U	10 U	10 U	10 U	10 U	**21**	**15**	10 U	10 U	10 U	10 U	10 U	**13**	10 U	**99000**	10 U	10 U	**4 J**	10 U	10 U	**14**	**14**	10 U	**3 J**	10 U
Pyrene	50	**10000**	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	**2 J**	10 U	10 U	10 U	10 U	**11**	10 U	**51000**	10 U	10 U	**3 J**	10 U	**2 J**	**2 J**	**1 J**	10 U	10 U	10 U

Notes:
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NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name: **Sample Date:**	NYSDEC Class GA Groundwater Criteria	SHMW-03S 6/17/2008	SHMW-03S 9/10/2008	SHMW-03S 12/15/2008	SHMW-03S 3/17/2009	SHMW-03I 5/20/2004	SHMW-03I 12/13/2007	SHMW-03I 12/15/2008	SHMW-04S 5/20/2004	SHMW-04S 6/21/2005	SHMW-04S 12/12/2007	SHMW-04S 3/20/2008	SHMW-04S 6/19/2008	SHMW-04S 9/9/2008	SHMW-04I 5/20/2004	SHMW-04I 12/12/2007	SHMW-05S 5/21/2004	SHMW-05S 6/22/2005	SHMW-05S 12/13/2007	SHMW-05S 3/20/2008	SHMW-05S 6/18/2008	SHMW-05S 9/10/2008	SHMW-05I 5/21/2004	SHMW-05I 12/13/2007	SHMW-06S 5/18/2004	SHMW-06S 6/27/2005	SHMW-06S 12/11/2007	SHMW-06S 3/20/2008
BTEX (μg/L)																												
Benzene	1	10 U	10 U	**1 J**	**13**	10 U	10 U	10 U	**6500**	**9900**	**3000**	**520**	**1700**	**1400**	10 U	10 U	**21**	**240**	**60**	**21**	**35**	**24**	10 U	10 U	**410**	**310**	**460**	**290**
Toluene	5	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	**80**	**130**	**78**	**67 J**	**59**	**61**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**47**	100 U	**15**	**26**
Ethylbenzene	NE	10 U	**3 J**	**9 J**	**52**	10 U	10 U	10 U	**2900**	**4000**	**2400**	**1100**	**1100**	**650**	10 U	10 U	**36**	**19**	**17**	**31**	**26**	**22**	10 U	10 U	**1400**	**970**	**700**	**520**
Xylene, total	5	10 U	**2 J**	**3 J**	**44**	10 U	10 U	10 U	**2700**	**3700**	**2100**	**1200**	**1100**	**800**	10 U	10 U	**26**	**23**	**21**	**25**	**22**	**18**	10 U	10 U	**1200**	**670**	**360**	**340**
PAHs (μg/L)																												
Acenaphthene	20	10 U	**6**	**16**	10 U	10 U	10 U	10 U	**360 J**	5000 U	**130 J**	10 U	**110**	**140**	10 U	10 U	**20**	**18**	**6**	**2 J**	10 U	**13**	10 U	10 U	**180**	**200**	**70**	10 U
Acenaphthylene	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**11**	10 U	**5**	10 U	**7**	**6**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**7 J**	10 U	10 U	10 U
Anthracene	50	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**54**	10 U	**9**	10 U	**8**	**11**	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	**10**	10 U	**3 J**	10 U
Benz[a]anthracene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**35**	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[a]pyrene	0	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**26**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U
Benzo[b]fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**24**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ	10 U	10 U	10 U
Benzo[g,h,i]perylene	NE	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	**6 J**	10 U	10 UJ	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10 UJ	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U
Benzo[k]fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**8 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U
Chrysene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**26**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U
Fluorene	50	10 U	**1 J**	**4 J**	10 U	10 U	10 U	10 U	**65**	**28**	**34**	10 U	**28**	**43**	10 U	10 U	**6 J**	10 U	**2 J**	10 U	10 U	**5**	10 U	10 U	**34 J**	**29**	**10**	10 U
Indeno[1,2,3-cd]pyrene	0.002	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	**5 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 U	10 U
Methyl tert-butyl ether	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	100 U	10 U	10 U
Methylnaphthalene,2-	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**600 J**	5000 U	**440**	10 U	**78**	**350**	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**240**	**200**	10 U	10 U
Naphthalene	10	10 U	**9**	**6**	10 U	10 U	10 U	10 U	**4300**	**6600**	**3100**	10 U	**390**	**1100**	10 U	10 U	**55**	**73**	10 U	10 U	10 U	10 U	10 U	10 U	**2500**	**1900**	**180**	10 U
Phenanthrene	50	10 U	**1 J**	**3 J**	10 U	10 U	10 U	10 U	**320 J**	**41**	**46**	10 U	**18**	**66**	10 U	10 U	**8 J**	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	**41**	**37**	10 U	10 U
Pyrene	50	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**75**	10 U	**6**	10 U	**5**	**7**	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	**6**	10 U	**4 J**	10 U

Notes:
μg/L = Microgram per Liter
U = Non Detect
J = Result is Estimated
NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name: **Sample Date:**	NYSDEC Class GA Groundwater Criteria	SHMW-06S 6/18/2008	SHMW-06S 9/8/2008	SHMW-06I 5/18/2004	SHMW-06I 12/11/2007	SHMW-07S 5/18/2004	SHMW-07S 6/22/2005	SHMW-07S 12/17/2007	SHMW-07S 6/19/2008	SHMW-07S 9/8/2008	SHMW-07I 5/18/2004	SHMW-07I 12/17/2007	SHMW-08S 5/21/2004	SHMW-08S 6/21/2005	SHMW-08S 12/10/2007	SHMW-08S 3/17/2008	SHMW-08S 6/17/2008	SHMW-08S 9/8/2008	SHMW-08I 5/21/2004	SHMW-08I 12/10/2007	SHMW-09S 5/18/2004	SHMW-09S 6/27/2005	SHMW-09S 12/13/2007	SHMW-09S 3/20/2008	SHMW-09S 6/19/2008	SHMW-09S 9/10/2008	SHMW-09S 12/16/2008	SHMW-09I 5/18/2004
BTEX (µg/L)																												
Benzene	1	**260**	**380**	10 U	10 U	**79**	**740**	**140**	**280**	**290**	10 U	10 U	**9 J**	**14**	**12**	**8 J**	**9 J**	**5 J**	10 U	10 U	**320**	**370**	**240**	**290**	**390**	**250**	**180**	10 U
Toluene	5	**23**	**8 J**	10 U	10 U	**5 J**	100 U	**6 J**	**15**	**14**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**10**	10 U	10 U	**9 J**	**18**	**1 J**	**1 J**	10 U
Ethylbenzene	NE	**640**	**350**	10 U	10 U	**190**	**1500**	**300**	**410**	**370**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	**530**	**440**	**240**	**420**	**510**	**260**	230 E	10 U
Xylene, total	5	**370**	**170**	10 U	10 U	**140**	**1100**	**200 J**	**290**	**280**	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	**240**	**190**	**110 J**	**200**	**260**	**110**	**92**	10 U
PAHs (µg/L)																												
Acenaphthene	20	**34**	**290**	10 U	10 U	**200 J**	**200**	10 U	**41**	**150**	10 U	10 U	**19**	**16**	**9**	**10**	**11 J**	**15**	10 U	10 U	**71**	**69**	**77**	10 U	**67**	**120**	96 E	10 U
Acenaphthylene	NE	**3 J**	**19**	10 U	10 U	**4 J**	10 U	**4 J**	**2 J**	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U
Anthracene	50	10 U	**110**	10 U	10 U	**16**	**12**	10 U	10 U	**12**	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	**2 J**	10 U	**2 J**	10 U	**2 J**	**4 J**	**3 J**	10 U
Benz[a]anthracene	0.002	10 U	**81**	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[a]pyrene	0	10 U	**49**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[b]fluoranthene	0.002	10 U	**37**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[g,h,i]perylene	NE	10 U	**12**	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U
Benzo[k]fluoranthene	0.002	10 U	**16**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	0.002	10 U	**59**	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	50	10 U	**120**	10 U	10 U	**46**	**39**	10 U	**4 J**	**43**	10 U	10 U	**10**	10 U	10 U	10 U	**1 J**	**10**	10 U	10 U	**16**	**17**	**19**	10 U	**16**	**28**	**23**	10 U
Indeno[1,2,3-cd]pyrene	0.002	10 U	**11**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U
Methyl tert-butyl ether	NE	10 U	10 U	10 U	10 U	10 U	100 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	**3 J**	10 U	**1 J**	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylnaphthalene,2-	NE	10 U	**520**	10 U	10 U	**360 J**	**500**	10 U	10 U	**340**	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**95 J**	**100**	**13**	10 U	10 U	**100**	85 E	10 U
Naphthalene	10	10 U	**1900**	10 U	10 U	**2000**	**3800**	10 U	10 U	**1600**	10 U	10 U	**35**	**33**	10 U	10 U	**3 J**	10 UJ	10 U	10 U	**1500**	**1400**	**3 J**	10 U	10 U	**180**	210 E	10 U
Phenanthrene	50	10 U	**350**	10 U	10 U	**63**	**53**	10 U	10 U	**50**	10 U	10 U	**18**	**21**	10 U	10 U	10 U	**20**	10 U	10 U	**13**	**14**	**15**	10 U	**7**	**23**	**17**	10 U
Pyrene	50	**4 J**	**170**	10 U	10 U	**9**	10 U	10 U	**4 J**	**7**	10 U	10 U	**4 J**	10 U	**2 J**	**2 J**	**3 J**	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Notes:
µg/L = Microgram per Liter
U = Non Detect
J = Result is Estimated
NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name: **Sample Date:**	NYSDEC Class GA Groundwater Criteria	SHMW-09I 12/13/2007	SHMW-09I 12/16/2008	SHMW-10S 5/19/2004	SHMW-10S 6/22/2005	SHMW-10S 12/11/2007	SHMW-10S 3/20/2008	SHMW-10S 6/18/2008	SHMW-10S 9/10/2008	SHMW-10S 12/16/2008	SHMW-10S 3/17/2009	SHMW-10I 5/19/2004	SHMW-10I 12/11/2007	SHMW-10I 12/16/2008	SHMW-11S 5/19/2004	SHMW-11S 6/21/2005	SHMW-11S 12/11/2007	SHMW-11S 3/20/2008	SHMW-11S 6/17/2008	SHMW-11S 9/10/2008	SHMW-11S 12/16/2008	SHMW-11S 3/17/2009	SHMW-11I 5/19/2004	SHMW-11I 12/11/2007	SHMW-11I 12/16/2008	SHMW-12S 5/19/2004	SHMW-12S 6/21/2005
BTEX (µg/L)																											
Benzene	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**270**	**930**
Toluene	5	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	100 U
Ethylbenzene	NE	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**35**	100 U
Xylene, total	5	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**38**	100 U
PAHs (µg/L)																											
Acenaphthene	20	10 U	10 U	**6 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	**4 J**	10 U
Acenaphthylene	NE	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Anthracene	50	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Benz[a]anthracene	0.002	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Benzo[a]pyrene	0	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Benzo[b]fluoranthene	0.002	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Benzo[g,h,i]perylene	NE	10 UJ	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Benzo[k]fluoranthene	0.002	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Chrysene	0.002	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Fluorene	50	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Indeno[1,2,3-cd]pyrene	0.002	10 UJ	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Methyl tert-butyl ether	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	100 U
Methylnaphthalene,2-	NE	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	**4 J**	10 U
Naphthalene	10	10 U	10 U	10 UJ	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	**4 J**	10 U	**210 J**	**600**
Phenanthrene	50	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U
Pyrene	50	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U

Notes:
µg/L = Microgram per Liter
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Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name: **Sample Date:**	NYSDEC Class GA Groundwater Criteria	SHMW-12S 12/12/2007	SHMW-12S 3/17/2008	SHMW-12S 6/18/2008	SHMW-12S 9/9/2008	SHMW-12S 12/15/2008	SHMW-12S 3/17/2009	SHMW-12I 5/19/2004	SHMW-12I 12/12/2007	SHMW-12I 12/15/2008	SHMW-13S 5/20/2004	SHMW-13S 6/21/2005	SHMW-13S 12/10/2007	SHMW-13S 3/17/2008	SHMW-13S 6/17/2008	SHMW-13S 9/8/2008	SHMW-13S 12/15/2008	SHMW-13S 3/17/2009	SHMW-13I 5/20/2004	SHMW-13I 12/10/2007	SHMW-13I 12/15/2008	SHGP-01 1 3/14/2000	SHGP-01 32 3/14/2000	SHGP-02 1 3/14/2000	SHGP-02 32 3/14/2000	SHGP-02 48 4/20/2000	SHGP-02 58 4/20/2000	SHGP-03 2 3/14/2000
BTEX (µg/L)																												
Benzene	1	10 U	**140**	**360**	**75**	250 E	**28**	10 U	**13**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**710**	**22**	**4800**	**8700**	**4**	**1**	100 U
Toluene	5	10 U	10 U	**2 J**	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	200 U	**3**	1000 U	**7900**	**10**	**4**	100 U
Ethylbenzene	NE	10 U	**8 J**	**30**	**8 J**	**11**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**540**	**34**	**1200**	**3300**	**9**	**5**	**150**
Xylene, total	5	10 U	**18**	**50**	**27**	**38**	10 U	10 U	**10**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**740**	**45**	**1400**	**4000**	**14**	**8**	**160**
PAHs (µg/L)																												
Acenaphthene	20	**3 J**	**3 J**	**4 J**	50 DU	**5 J**	10 U	10 UJ	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1700**	**31**	**160**	**830**	**4 J**	**2 J**	**57**
Acenaphthylene	NE	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**180 J**	10 U	**32 J**	**350 J**	**7 J**	**2 J**	**13 J**
Anthracene	50	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**790**	**9 J**	**62**	**410 J**	**4 J**	**2 J**	**17 J**
Benz[a]anthracene	0.002	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**500**	**3 J**	**33 J**	**230 J**	10 U	10 U	**18 J**
Benzo[a]pyrene	0	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**340 J**	**2 J**	**29 J**	**190 J**	10 U	10 U	**29 J**
Benzo[b]fluoranthene	0.002	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**250 J**	**1 J**	**20 J**	**140 J**	10 U	10 U	**26 J**
Benzo[g,h,i]perylene	NE	10 UJ	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	**140 J**	10 U	**18 J**	**98 J**	10 U	10 U	**42 J**
Benzo[k]fluoranthene	0.002	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**94 J**	10 U	**6 J**	500 U	10 U	10 U	**9 J**
Chrysene	0.002	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**430**	**2 J**	**32 J**	**200 J**	**1 J**	10 U	**15 J**
Fluorene	50	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**730**	**13**	**70**	**400 J**	**5 J**	**2 J**	**20 J**
Indeno[1,2,3-cd]pyrene	0.002	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**130 J**	10 U	**13 J**	**65 J**	10 U	10 U	**26 J**
Methyl tert-butyl ether	NE	10 U	**2 J**	**2 J**	**2 J**	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Methylnaphthalene,2-	NE	**2 J**	10 U	**3 J**	50 DU	**5**	10 U	10 UJ	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2000**	**38**	**430**	**1400**	**13**	**4 J**	**48 J**
Naphthalene	10	**110**	**6**	**96**	**250**	220 E	10 U	10 UJ	**17**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**5600**	**160**	**2600 D**	**5000**	**44**	**19**	**1200 D**
Phenanthrene	50	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2700**	**38**	**240**	**1600**	**22**	**7 J**	**51**
Pyrene	50	10 U	10 U	10 U	50 DU	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1400**	**12**	**95**	**750**	**7 J**	**3 J**	**48 J**

Notes:
µg/L = Microgram per Liter
U = Non Detect
J = Result is Estimated
NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name:	NYSDEC Class GA	SHGP-03 33	SHGP-03 33	SHGP-04 0	SHGP-04 30	SHGP-05 0	SHGP-05 30	SHGP-05 48	SHGP-05 60	SHGP-06 0_5	SHGP-06 31	SHGP-07 0	SHGP-07 30	SHGP-08 0	SHGP-08 30	SHGP-09 0	SHGP-09 30	SHGP-10 0	SHGP-10 32	SHGP-10 48	SHGP-10 58	SHGP-11 0	SHGP-11 30	SHGP-12 0	SHGP-12 30	SHGP-13 0	SHGP-13 30	SHGP-14 3	SHGP-14 33
Sample Date:	Groundwater Criteria	3/14/2000	3/20/2000	3/15/2000	3/15/2000	3/15/2000	3/15/2000	3/22/2000	3/22/2000	3/15/2000	3/15/2000	3/15/2000	3/15/2000	3/14/2000	3/14/2000	3/14/2000	3/14/2000	3/14/2000	3/14/2000	4/20/2000	4/20/2000	3/15/2000	3/15/2000	3/15/2000	3/15/2000	3/15/2000	3/15/2000	3/10/2000	3/10/2000
BTEX (µg/L)																													
Benzene	1	**19**	NA	**66**	1 U	**78**	**310**	**17**	1 U	**170**	**3**	1 U	**4**	**100**	**2**	**5500**	**10**	**4500**	**170**	1 U	**2**	**12**	**16**	**85**	1 U	**49**	**2**	**40**	1 U
Toluene	5	**4**	NA	50 U	1 U	**25**	**950**	**12**	1 U	**390**	1 U	1 U	1 U	**15**	1 U	100 U	1 U	**570**	**28**	1 U	**1**	5 U	1 U	**11**	1 U	1 U	1 U	10 U	1 U
Ethylbenzene	NE	**24**	NA	50 U	1 U	**360**	**1200**	**40**	**4**	**1800**	**5**	1 U	**2**	**230**	**4**	**670**	**8**	**920**	**270**	**2**	**3**	**410**	**23**	**120**	**1**	**13**	**3**	**320**	**4**
Xylene, total	5	**30**	NA	50 U	1 U	**540**	**1800**	**82**	**9**	**4600**	**4**	1 U	1 U	**270**	**4**	**690**	**8**	**1100**	**330**	**1**	**5**	**370**	**18**	**130**	1 U	**13**	**2**	**250**	**3 B**
PAHs (µg/L)																													
Acenaphthene	20	NA	**36**	**3300 D**	**38 J**	**810**	80000 U	**100 J**	**13**	**190 J**	**4 J**	50 U	**1 J**	**170**	**18**	**460**	**10**	**510**	**330**	**5 J**	**20**	**400**	**70**	**440**	**46**	10 U	**2 J**	**580 D**	**89**
Acenaphthylene	NE	NA	**6 J**	**300**	**13 J**	**280**	**220000**	**330**	**57**	400 U	10 U	**11 J**	10 U	**20 J**	**2 J**	**27 J**	10 U	**65 J**	**78 J**	10 U	**2 J**	**50**	**4 J**	**120**	**9 J**	**2 J**	**6 J**	**40**	**7 J**
Anthracene	50	NA	**10**	**2300 D**	**36 J**	**590**	**110000**	**120 J**	**15**	**56 J**	**3 J**	50 U	10 U	**55 J**	**6 J**	**170**	**5 J**	**200 J**	**110 J**	**2 J**	**11**	**200**	**19 J**	**220**	**22**	10 U	**3 J**	**120**	**24**
Benz[a]anthracene	0.002	NA	**2 J**	**1100 D**	**25 J**	**570**	**72000 J**	**78 J**	**5 J**	400 U	10 U	**11 J**	10 U	**35 J**	10 U	**96**	10 U	**99 J**	**50 J**	**1 J**	**6 J**	**160**	**10 J**	**130**	**14**	**3 J**	**1 J**	**89**	**7 J**
Benzo[a]pyrene	0	NA	**2 J**	**560**	**17 J**	**500**	**56000 J**	**63 J**	**4 J**	400 U	10 U	**16 J**	10 U	**21 J**	10 U	**62**	10 U	**72 J**	**35 J**	10 U	**3 J**	**130**	**8 J**	**160**	**15**	**2 J**	10 U	**60**	**6 J**
Benzo[b]fluoranthene	0.002	NA	**2 J**	**450**	**15 J**	**430**	**44000 J**	**46 J**	**3 J**	400 U	10 U	**17 J**	10 U	**22 J**	10 U	**46 J**	10 U	**57 J**	**29 J**	10 U	**3 J**	**100**	**7 J**	**140**	**13**	**4 J**	**1 J**	**52**	**5 J**
Benzo[g,h,i]perylene	NE	NA	**1 J**	**240**	**9 J**	**290**	**25000 J**	**33 J**	**2 J**	400 U	10 U	**21 J**	10 U	**12 J**	10 U	**26 J**	10 U	400 U	**30 J**	10 U	10 U	**63**	**4 J**	**160**	**11**	**3 J**	10 U	**30**	**3 J**
Benzo[k]fluoranthene	0.002	NA	10 U	**170**	**5 J**	**170**	**14000 J**	200 U	**1 J**	400 U	10 U	**6 J**	10 U	80 U	10 U	**18 J**	10 U	400 U	250 U	10 U	10 U	**30 J**	**2 J**	**37 J**	**4 J**	**1 J**	10 U	**21**	**2 J**
Chrysene	0.002	NA	**2 J**	**1100 D**	**24 J**	**580**	**63000 J**	**69 J**	**4 J**	400 U	10 U	**12 J**	10 U	**39 J**	10 U	**86**	10 U	**98 J**	**45 J**	**1 J**	**6 J**	**130**	**9 J**	**140**	**14**	**3 J**	**1 J**	**75**	**7 J**
Fluorene	50	NA	**17**	**1800 D**	**25 J**	**550**	**100000**	**150 J**	**24**	**67 J**	**3 J**	50 U	10 U	**87**	10 U	**170**	**5 J**	**230 J**	**130 J**	**2 J**	**11**	**170**	**30**	**210**	**22**	10 U	**4 J**	**140**	**43**
Indeno[1,2,3-cd]pyrene	0.002	NA	10 U	**220**	**7 J**	**230**	**23000 J**	**29 J**	**2 J**	400 U	10 U	**13 J**	10 U	80 U	10 U	**23 J**	10 U	400 U	250 U	10 U	10 U	**52**	**4 J**	**130**	**9 J**	**3 J**	10 U	**27**	**3 J**
Methyl tert-butyl ether	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	120 U	5 U	NA	NA	NA	NA
Methylnaphthalene,2-	NE	NA	**41**	**3000 D**	**10 J**	**600**	**270000**	**460**	**77**	**400**	**3 J**	50 U	10 U	**200**	**10**	**580**	**8 J**	**810**	**580**	**6 J**	**22**	**450**	**70**	**620**	**43**	10 U	**8 J**	**800 D**	**100**
Naphthalene	10	NA	**120**	**6500 D**	**12 J**	**1500**	**790000**	**1800**	**320 D**	**4100**	**12**	**8 J**	**4 J**	**890**	**24**	**2800 D**	**20**	**3900**	**3000**	**19**	**60**	**1500 D**	**270**	**2500**	**55**	**12**	**31**	**2700 D**	**180 D**
Phenanthrene	50	NA	**42**	**6300 D**	**94**	**1600**	**380000**	**480**	**64**	**210 J**	**13**	**6 J**	**3 J**	**180**	**29**	**510**	**19**	**680**	**380**	**8 J**	**40**	**580**	**91**	**640**	**72**	**1 J**	**12**	**700 D**	**82**
Pyrene	50	NA	**9 J**	**2900 D**	**62**	**1500**	**200000**	**230**	**19**	**100 J**	**5 J**	**23 J**	**1 J**	**110**	**5 J**	**240**	**4 J**	**320 J**	**160 J**	**4 J**	**18**	**400**	**34**	**340**	**39**	**6 J**	**5 J**	**280 D**	**22**

Notes:
µg/L = Microgram per Liter
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J = Result is Estimated
NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name:	NYSDEC Class GA Groundwater Criteria	SHGP-15 26	SHGP-15 3	SHGP-15 33	SHGP-16 26	SHGP-16 3	SHGP-16 33	SHGP-17 3	SHGP-17 33	SHGP-18 3	SHGP-18 30	SHGP-19 3	SHGP-19 33	SHGP-20 2	SHGP-20 33	SHGP-21 2	SHGP-21 31	SHGP-22 1	SHGP-22 30	SHGP-23 2	SHGP-23 32	SHGP-24 1	SHGP-24 33	SHGP-25 2	SHGP-25 32	SHGP-26 0	SHGP-26 0	SHGP-26 30	SHGP-26 30
Sample Date:		3/9/2000	3/9/2000	3/9/2000	3/9/2000	3/9/2000	3/9/2000	3/10/2000	3/10/2000	3/7/2000	3/7/2000	3/9/2000	3/9/2000	3/7/2000	3/8/2000	3/10/2000	3/10/2000	3/10/2000	3/10/2000	3/8/2000	3/8/2000	3/9/2000	3/8/2000	3/16/2000	3/16/2000	3/16/2000	3/20/2000	3/16/2000	3/20/2000
BTEX (µg/L)																													
Benzene	1	**500**	**50**	**5**	**14**	**140**	1 U	**66**	1 U	**370**	**17**	**1200**	**42**	**2000**	**30**	**50**	1 U	**800**	1 U	**680 D**	5 U	1 U	5 U	**230**	**1**	1 U	NA	1 U	NA
Toluene	5	10 U	2 U	1 U	**79**	2 U	**1**	1 U	1 U	**30**	**1**	44 U	**2**	100 U	1 U	2 U	1 U	**48**	1 U	**36**	5 U	1 U	5 U	**25**	1 U	1 U	NA	1 U	NA
Ethylbenzene	NE	**220**	**120**	**2**	**370**	**48**	**5**	**48**	1 U	**300**	**9**	**640**	**49**	**680**	**8**	**110**	1 U	**820**	**11**	**620 D**	5 U	1 U	5 U	**820**	**2**	**3**	NA	**1**	NA
Xylene, total	5	**170**	**53**	**2**	**260**	**24**	**4**	**36**	1 U	**250**	**7**	**740**	**60**	**570**	**7**	**68**	1 U	**400**	**4 B**	**530**	5 U	1 U	5 U	**810**	**2**	**2**	NA	1 U	NA
PAHs (µg/L)																													
Acenaphthene	20	**36**	**59**	10 U	**69 J**	**35**	**10**	**44**	**2 J**	**230**	**15**	**550**	**220**	**170 J**	**12**	**58**	**2 J**	**110**	**49**	**140**	**2 J**	10 U	10 U	**750**	**7 J**	NA	**3 J**	NA	**12**
Acenaphthylene	NE	20 U	40 U	10 U	**12 J**	10 U	**8 J**	10 U	10 U	**11 J**	**1 J**	100 U	**18 J**	200 U	**2 J**	**2 J**	10 U	**3 J**	**2 J**	**9 J**	10 U	10 U	10 U	**62 J**	10 U	NA	**2 J**	NA	10 U
Anthracene	50	20 U	**5 J**	10 U	80 U	**2 J**	10 U	**3 J**	10 U	**44 J**	**4 J**	**210**	**48 J**	**58 J**	**6 J**	**2 J**	10 U	**7 J**	**18**	**44**	**1 J**	10 U	10 U	**250 J**	**2 J**	NA	**2 J**	NA	**5 J**
Benz[a]anthracene	0.002	20 U	40 U	10 U	80 U	10 U	10 U	10 U	10 U	**25 J**	**2 J**	**130**	**24 J**	**42 J**	**3 J**	10 U	10 U	10 U	**5 J**	**25**	10 U	10 U	10 U	**180 J**	10 U	NA	**2 J**	NA	**2 J**
Benzo[a]pyrene	0	20 U	40 U	10 U	80 U	10 U	10 U	10 U	10 U	**16 J**	**1 J**	**91 J**	**16 J**	**32 J**	**2 J**	10 U	10 U	10 U	**4 J**	**18**	10 U	10 U	10 U	**120 J**	10 U	NA	**2 J**	NA	10 U
Benzo[b]fluoranthene	0.002	20 U	40 U	10 U	80 U	10 U	10 U	10 U	10 U	**12 J**	10 U	**72 J**	**12 J**	**22 J**	**2 J**	10 U	10 U	10 U	**3 J**	**14**	10 U	10 U	10 U	**98 J**	10 U	NA	**3 J**	NA	10 U
Benzo[g,h,i]perylene	NE	20 U	40 U	10 U	80 U	10 U	10 U	10 U	10 U	**7 J**	10 U	**44 J**	100 U	200 U	**2 J**	10 U	10 U	10 U	**2 J**	**8 J**	10 U	10 U	10 U	**56 J**	10 U	NA	**3 J**	NA	10 U
Benzo[k]fluoranthene	0.002	20 U	40 U	10 U	80 U	10 U	10 U	10 U	10 U	50 U	10 U	**18 J**	100 U	200 U	10 U	10 U	10 U	10 U	**2 J**	**6 J**	10 U	10 U	10 U	**45 J**	10 U	NA	**1 J**	NA	10 U
Chrysene	0.002	20 U	40 U	10 U	80 U	10 U	10 U	10 U	10 U	**23 J**	**2 J**	**110**	**20 J**	**36 J**	**3 J**	10 U	10 U	10 U	**5 J**	**23**	10 U	10 U	10 U	**160 J**	10 U	NA	**2 J**	NA	**1 J**
Fluorene	50	**6 J**	**13 J**	10 U	**12 J**	**9 J**	10 U	**13**	10 U	**77**	**7 J**	**230**	**76 J**	**64 J**	**7 J**	**14**	10 U	**33**	**26**	**64**	**2 J**	10 U	10 U	**310 J**	**3 J**	NA	**2 J**	NA	**6 J**
Indeno[1,2,3-cd]pyrene	0.002	20 U	40 U	10 U	80 U	10 U	10 U	10 U	10 U	**6 J**	10 U	**31 J**	100 U	200 U	**1 J**	10 U	10 U	10 U	**2 J**	**9 J**	10 U	10 U	10 U	**46 J**	10 U	NA	**2 J**	NA	10 U
Methyl tert-butyl ether	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**93**	5 U	NA	5 U	NA	NA	NA	NA	NA	NA
Methylnaphthalene,2-	NE	**17 J**	**18 J**	10 U	**55 J**	**18**	**2 J**	**47**	**1 J**	**180**	**3 J**	**660**	**360**	**320**	**18**	**73**	**1 J**	**340 D**	**25**	**300 D**	10 U	10 U	10 U	**930**	**6 J**	NA	10 U	NA	**7 J**
Naphthalene	10	**290**	**430**	**4 J**	**930**	**160**	**26**	**260 D**	**9 J**	**770**	**25**	**1600**	**1000**	**1900**	**40**	**450 D**	**10**	**2800 D**	**130**	**2300 D**	**8 J**	10 U	10 U	**4500**	**12**	NA	10 U	NA	**16**
Phenanthrene	50	**7 J**	**27 J**	10 U	**14 J**	**13**	**2 J**	**17**	**1 J**	**160**	**18**	**790**	**200**	**230**	**26**	**10**	**2 J**	**37**	**62**	**130**	**8 J**	10 U	10 U	**1000**	**11**	NA	**6 J**	NA	**22**
Pyrene	50	20 U	**5 J**	10 U	80 U	**1 J**	10 U	10 U	10 U	**62**	**7 J**	**350**	**68 J**	**120 J**	**9 J**	**1 J**	10 U	**3 J**	**17**	**56**	**2 J**	10 U	10 U	**470**	**3 J**	NA	**4 J**	NA	**7 J**

Notes:
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NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name:	NYSDEC Class GA Groundwater Criteria	SHGP-27 0	SHGP-27 30	SHGP-28 34	SHGP-28 4	SHGP-29 30	SHGP-29 7	SHGP-30 30	SHGP-30 46	SHGP-30 6	SHGP-31 30	SHGP-31 4	SHGP-32 30	SHGP-32 6_5	SHGP-33 30	SHGP-33 4	SHGP-34 30	SHGP-34 4	SHGP-34 41	SHGP-34 56	SHGP-34 71	SHGP-35 30	SHGP-35 6	SHGP-36 30	SHGP-36 4	SHGP-37 2	SHGP-37 30	SHGP-38 2	SHGP-38 30
Sample Date:		3/24/2000	3/24/2000	5/22/2000	5/22/2000	4/10/2000	4/10/2000	4/23/2001	4/23/2001	4/23/2001	4/5/2002	4/5/2002	4/17/2002	4/17/2002	4/12/2002	4/12/2002	4/3/2002	4/3/2002	4/24/2002	4/24/2002	4/24/2002	4/3/2002	4/3/2002	4/10/2002	4/10/2002	3/29/2002	3/29/2002	4/9/2002	4/9/2002
BTEX (µg/L)																													
Benzene	1	**96**	**1**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**2**	1 U	1 U	1 U	**3**	**24**	1 U	1 U	1 U	**52**	**28**	1 U	1 U	**510**	1 U	**3**	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**17**	1 U	1 U	1 U
Ethylbenzene	NE	**4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**140**	**37**	1 U	1 U	1 U	**89**	**4**	1 U	1 U	**800**	1 U	1 U	1 U
Xylene, total	5	**12**	1 U*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**1**	1 U	1 U	**2**	**49**	**14**	1 U	1 U	1 U	**20**	**6**	1 U	1 U	**500**	1 U	1 U	1 U
PAHs (µg/L)																													
Acenaphthene	20	**30**	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	**7 J**	**5 J**	10 U	10 U	**33**	**58**	**30**	10 U	10 U	10 U	**76**	**14**	10 U	10 U	**360 DJ**	**11**	10 U	10 U
Acenaphthylene	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**3 J**	**45**	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	10 U	**9 J**	10 U	10 U	10 U
Anthracene	50	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**5 J**	**1 J**	**2 J**	10 U	10 U	10 U	**5 J**	10 U	10 U	10 U	**54**	**5 J**	10 U	10 U
Benz[a]anthracene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**23**	**2 J**	**1 J**	10 U
Benzo[a]pyrene	0	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**15**	**1 J**	10 U	10 U
Benzo[b]fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**13**	10 U	**1 J**	10 U
Benzo[g,h,i]perylene	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**8 J**	10 U	**1 J**	10 U
Benzo[k]fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**6 J**	10 U	10 U	10 U
Chrysene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**29**	**2 J**	**1 J**	10 U
Fluorene	50	**7 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**8 J**	**19**	**8 J**	10 U	10 U	10 U	**20**	**2 J**	10 U	10 U	**80**	**5 J**	10 U	10 U
Indeno[1,2,3-cd]pyrene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**7 J**	10 U	10 U	10 U
Methyl tert-butyl ether	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylnaphthalene,2-	NE	**6 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**20**	**1 J**	10 U	10 U	10 U	**10**	**28**	10 U	10 U	**670 D**	**12**	10 U	10 U
Naphthalene	10	**140**	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	**370 D**	**40**	10 U	10 U	10 U	**390 D**	**390 D**	10 U	10 U	**5200 D**	**32**	**4 J**	10 U
Phenanthrene	50	**4 J**	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	**13**	**29**	**3 J**	10 U	10 U	10 U	**20**	10 U	10 U	10 U	**150**	**19**	10 U	10 U
Pyrene	50	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**3 J**	10 U	**14**	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**57**	**7 J**	**4 J**	10 U

Notes:
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J = Result is Estimated
NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name: **Sample Date:**	NYSDEC Class GA Groundwater Criteria	SHGP-39 30 4/10/2002	SHGP-39 4 4/10/2002	SHGP-40 30 4/12/2002	SHGP-40 5 4/12/2002	SHGP-41 30 4/9/2002	SHGP-41 6 4/9/2002	SHGP-42 2 4/1/2002	SHGP-42 30 4/1/2002	SHGP-43 2 3/28/2002	SHGP-43 30 3/28/2002	SHGP-44 30 4/11/2002	SHGP-44 4 4/11/2002	SHGP-45 2 4/16/2002	SHGP-45 30 4/16/2002	SHGP-46 2 4/17/2002	SHGP-46 30 4/2/2002	SHGP-47 30 4/25/2002	SHGP-47 4 4/25/2002	SHGP-48 30 4/24/2002	SHGP-48 7_5 4/24/2002	SHGP-49 2 4/26/2002	SHGP-49 30 4/26/2002	SHGP-50 30 4/30/2002	SHGP-50 4 4/30/2002	SHGP-51 30 4/25/2002	SHGP-51 4 4/25/2002	SHGP-52 41 4/26/2002	SHGP-52 56 4/26/2002
BTEX (µg/L)																													
Benzene	1	1 U	**30**	1 U	**84**	1 U	**560**	1 U	1 U	1 U	1 U	1 U	**3**	**1**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	5	1 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	NE	1 U	1 U	1 U	**27**	1 U	**1100**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	5	1 U	**3**	1 U	**37**	1 U	**550**	**1**	1 U	1 U	1 U	1 U	**2**	1 U	1 U	**2**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
PAHs (µg/L)																													
Acenaphthene	20	10 U	**4 J**	10 U	**6 J**	**1 J**	**100**	10 U	10 U	10 U	10 U	10 U	**19**	**1 J**	10 U	10 U	10 U	10 U	**25**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	NE	10 U	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	**23**	10 U	10 U	10 U	10 U	**24**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	50	10 U	10 U	10 U	10 U	**4 J**	**6 J**	10 U	10 U	10 U	10 U	10 U	10 U	**9 J**	10 U	10 U	10 U	10 U	**7 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benz[a]anthracene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**13**	10 U	**2 J**	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[a]pyrene	0	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**22**	10 U	**2 J**	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[b]fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**22**	10 U	**2 J**	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[g,h,i]perylene	NE	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**24**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[k]fluoranthene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**16**	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**18**	10 U	**2 J**	10 U	10 U	**4 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	50	10 U	10 U	10 U	10 U	10 U	**26**	10 U	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	**13**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno[1,2,3-cd]pyrene	0.002	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**20**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methyl tert-butyl ether	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylnaphthalene,2-	NE	10 U	10 U	10 U	**5 J**	10 U	**180 DJ**	10 U	10 U	10 U	10 U	10 U	**6 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10	10 U	**38**	10 U	**790 D**	**2 J**	**2500 D**	**1 J**	10 U	10 U	10 U	10 U	**70**	**8 J**	10 U	10 U	10 U	10 U	**22**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Phenanthrene	50	10 U	10 U	10 U	10 U	**4 J**	**36**	10 U	10 U	10 U	10 U	10 U	**2 J**	**5 J**	10 U	**2 J**	10 U	**5 J**	**38**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	50	10 U	10 U	10 U	10 U	**1 J**	**4 J**	10 U	10 U	10 U	10 U	10 U	10 U	**28**	10 U	**3 J**	10 U	**2 J**	**14**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Notes:
µg/L = Microgram per Liter
U = Non Detect
J = Result is Estimated
NA = Not Analyzed

Table 3. Comparison of Pre-Remedial Action Groundwater Analytical Data to Aquatic Water Quality Standards and Guidance Values
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name:	NYSDEC Class GA Groundwater Criteria	SHGP-52 71	SHGP-53 30	SHGP-53 46	SHGP-53 6	SHGP-54 30	SHGP-54 4	SHGP-55 30	SHGP-55 6	SHGP-56 2_5	SHGP-56 30	SHGP-57 30	SHGP-57 5	SHGP-58 30	SHGP-58 46	SHGP-58 8	SHGP-59 11	SHGP-59 34	SHGP-59 50
Sample Date:		4/26/2002	5/3/2002	5/23/2002	5/3/2002	5/9/2002	5/9/2002	5/3/2002	5/3/2002	5/1/2002	5/1/2002	5/9/2002	5/9/2002	5/31/2002	5/31/2002	5/31/2002	5/30/2002	5/30/2002	5/30/2002
BTEX (µg/L)																			
Benzene	1	1 U	**62**	1 U	1 U	1 U	1 U	1 U	**1**	1 U	1 U	1 U	1 U	**20**	1 U	1 U	1 U	1 U	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**1**	**2**	1 U	1 U	1 U
Ethylbenzene	NE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**1**	1 U	1 U	1 U	1 U	1 U
Xylene, total	5	1 U	**5**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
PAHs (µg/L)																			
Acenaphthene	20	10 U	**13 J**	10 U	**4 J**	10 U	10 U	10 U	**5 J**	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	NE	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**4 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	50	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benz[a]anthracene	0.002	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[a]pyrene	0	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[b]fluoranthene	0.002	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[g,h,i]perylene	NE	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo[k]fluoranthene	0.002	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	0.002	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	50	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno[1,2,3-cd]pyrene	0.002	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methyl tert-butyl ether	NE	NA	1 U	1 U	1 U	**1**	**8**	1 U	1 U	NA	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	1 U
Methylnaphthalene,2-	NE	10 U	**4 J**	10 U	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10	10 U	**310**	10 U	10 U	10 U	10 U	10 U	**80**	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Phenanthrene	50	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**6 J**	**2 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	50	10 U	30 U	10 U	10 U	10 U	10 U	10 U	10 U	**4 J**	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Notes:
µg/L = Microgram per Liter
U = Non Detect
J = Result is Estimated
NA = Not Analyzed

Table 4. Remedial Action Waste Removal Summary
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Material Type	Weight	Volume
C&D Debris	505 tons	253 cubic yards
Total MGP Soils	36,584 tons	18,292 cubic yards
Hazardous Lead Soils	734 tons	367 cubic yards
Totals Soils Removed	**37,824** tons	**18,912** cubic yards
Total Water Removed	--	**15,654,508** gallons

Table 5. Comparison of Remaining Soil Analytical Data to Unrestricted Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name Sample Depth Date Collected	6NYCRR Part 375 UNRESTRICTED USE (italics)	SHSB-01 26-28' 3/20/2000	SHSB-01* 8-10' 10/25/2010	SHSB-01* 74-75' 10/25/2010	SHSB-02 16-18' 3/20/2000	SHSB-02 52-54' 3/22/2000	SHSB-02* 4-5' 10/26/2010	SHSB-02* 11-11.5' 10/26/2010	SHSB-02* 20-22' 10/26/2010	SHSB-02* 30-30.5' 10/26/2010	SHSB-02* 70-72' 10/26/2010	Duplicate of: SHSB-02* 70-72' 10/26/2010	SHSB-03 34-36' 3/20/2000	SHSB-04 24-26' 3/15/2000	SHSB-04* 6-8' 10/26/2010	SHSB-04* 13-15' 10/26/2010	SHSB-04A* 5-5.5' 11/1/2010	SHSB-04A* 6-9' 11/1/2010	SHSB-04A* 10.5-13.5' 11/1/2010
Location		**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**
BTEX (mg/kg)																			
Benzene	0.06	0.001	0.011 U	0.011 UJ	***92***	0.001 U	0.011 U	***0.086***	0.013 U	0.057 UJ	0.012 U	0.008	0.001	0.001 U	0.002 J	0.012 U	***0.067***	0.056 U	***4.9***
Toluene	0.7	0.001 U	0.011 U	0.011 UJ	***270***	0.001	0.011 U	0.15	0.013 U	0.68	0.012 U	0.004 J	0.003	0.001 U	0.004 J	0.012 U	0.037	0.022 J	0.005 J
Ethylbenzene	1	0.001	0.011 U	0.011 UJ	***240***	0.003	0.011 U	0.86	0.013 U	***17***	0.006	0.02	0.004	0.001 U	0.77	0.012 U	***1.1***	***17***	***25***
Xylene, total	0.26	0.002	0.011 U	0.011 UJ	***380***	0.005	0.011 U	***2.4***	0.013 U	***32***	0.013 J	0.044 J	0.005	0.001 U	***1.4***	0.012 U	***1.1***	***15***	0.22
PAHs (mg/kg)																			
Acenaphthene	20	0.38 U	0.37 U	0.37 U	***38***	0.12 J	0.36 U	***22***	0.41 U	***87 J***	0.4 U	0.38 U	0.41 U	0.4 U	18	18	***59***	***240***	***31***
Acenaphthylene	100	0.38 U	0.37 U	0.37 U	54	0.21 J	0.36 U	3	0.41 U	***390***	0.4 U	0.38 U	0.41 U	0.4 U	1.3	1.3	12	14	2
Anthracene	100	0.38 U	0.37 U	0.37 U	31	0.21 J	0.36 U	11	0.41 U	***220***	0.4 U	0.38 U	0.41 U	0.4 U	7.3	7.6	84	90	12
Benz[a]anthracene	1	0.38 U	0.37 U	0.37 U	***16 J***	0.15 J	0.36 U	***11***	0.41 U	***150***	0.4 U	0.38 U	0.41 U	0.4 U	***5.3***	***5.8***	***60***	***54***	***7.6***
Benzo[a]pyrene	1	0.38 U	0.37 U	0.37 U	***12 J***	0.13 J	0.36 U	***10***	0.41 U	***130***	0.4 U	0.38 U	0.41 U	0.4 U	***4.1***	***4.4***	***24***	***46***	***5.4***
Benzo[b]fluoranthene	1	0.38 U	0.37 U	0.37 U	***9.4 J***	0.11 J	0.36 U	***7.8***	0.41 U	***82 J***	0.4 U	0.38 U	0.41 U	0.4 U	***3.3***	***4***	***37***	***28***	***6.1 J***
Benzo[g,h,i]perylene	100	0.38 U	0.37 U	0.37 U	6.3 J	0.064 J	0.36 U	5.4	0.41 U	35	0.4 U	0.38 U	0.41 U	0.4 U	1.9	2	13	14	1.8 J
Benzo[k]fluoranthene	0.8	0.38 U	0.37 U	0.37 U	***4 J***	0.39 U	0.36 U	***2.5***	0.41 U	***32***	0.4 U	0.38 U	0.41 U	0.4 U	***1.5***	***1.2***	***12 J***	***18***	***1.8 J***
Chrysene	1	0.38 U	0.37 U	0.37 U	***14 J***	0.14 J	0.36 U	***10***	0.41 U	***140***	0.4 U	0.38 U	0.41 U	0.4 U	***4.3***	***4.3***	***56***	***46***	***6.7***
Dibenz[a,h]anthracene	0.33	0.38 U	0.37 U	0.37 U	29 U	0.39 U	0.36 U	***1.2***	0.41 U	***8.7 J***	0.4 U	0.38 U	0.41 U	0.4 U	***0.5***	***0.6***	***3.5 J***	***4.3 J***	***0.48 J***
Dibenzofuran	7	0.38 U	0.37 U	0.37 U	29 U	0.39 U	0.36 U	0.81	0.41 U	***15***	0.4 U	0.38 U	0.41 U	0.4 U	0.42	0.43	3.6 J	6.8	0.97
Fluoranthene	100	0.38 U	0.37 U	0.37 U	36	0.3 J	0.36 U	22	0.41 U	***320***	0.4 U	0.14 J	0.41 U	0.4 U	9.6	10	98	***120***	16
Fluorene	30	0.38 U	0.37 U	0.37 U	29 U	0.18 J	0.36 U	10	0.41 U	***210***	0.4 U	0.38 U	0.41 U	0.4 U	6.3	7	***58***	***90***	***12***
Indeno[1,2,3-cd]pyrene	0.5	0.38 U	0.37 U	0.37 U	***5 J***	0.053 J	0.36 U	***3.7***	0.41 U	***27***	0.4 U	0.38 U	0.41 U	0.4 U	***1.3***	***1.3***	***9.7***	***11***	***1.3 J***
Methylnaphthalene,2-	0.41^{+}	0.38 U	0.37 U	0.37 U	***120***	0.27 J	0.36 U	***20***	0.41 U	***590***	0.4 U	0.38 U	0.41 U	0.4 U	***20***	***20***	3.8 U	***270***	***31***
Naphthalene	12	0.38 U	0.37 U	0.37 U	***270***	0.31 J	0.36 U	***37***	0.41 U	***1600***	0.4 U	0.38 U	0.045 J	0.4 U	***31***	***31***	10	***760***	***85***
Phenanthrene	100	0.38 U	0.37 U	0.37 U	***160***	0.83	0.36 U	51	0.41 U	***970***	0.14 J	0.29	0.094 J	0.064 J	35	37	***320***	***400***	53
Pyrene	100	0.38 U	0.37 U	0.37 U	49	0.42	0.36 U	31	0.41 U	***440***	0.092 J	0.18 J	0.056 J	0.4 U	13	14	***130***	***160***	22

Notes:

92 Result exceeds Unrestructed

NYCRR = New York Codes, Rules and Regulations
BTEX = Benzene, Toluene, Ethylbenzene and Xylene
PAHs = Polycyclic Aromatic Hydrocarbons
mg/kg = milligram per kilogram
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.
J = The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
NS = Not Sampled
* samples collected from borings completed in 2010.
\+ Value adapted from Residential Use SCO
MGP = Former Sag Harbor Manufactured Gas Plant Site
SHROW = Village of Sag Harbor Right of Way Areas

Table 5. Comparison of Remaining Soil Analytical Data to Unrestricted Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name Sample Depth Date Collected	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**SHSB-05 22-24' 3/13/2000**	**SHSB-05 88-90' 5/22/2000**	**SHSB-05* 5-7' 10/27/2010**	**SHSB-05* 10-10.5' 10/27/2010**	**SHSB-05* 15-16' 10/27/2010**	**SHSB-05 * 40-42' 10/28/2010**	**SHSB-06 50-52' 3/13/2000**	**SHSB-07 26-28' 3/17/2000**	**SHSB-07* 4-5' 11/1/2010**	**SHSB-07* 6.5-8.5' 11/1/2010**	**SHSB-07* 16-18' 11/1/2010**	**SHSB-08 50-52' 3/20/2000**	**SHSB-09 26-28' 3/23/2000**	**SHSB-10 24-26' 3/16/2000**	**SHSB-11 30-32' 3/23/2000**	**SHSB-12 34-36' 3/24/2000**	**SHSB-13 18-20' 3/27/2000**	**SHSB-13 34-36' 3/27/2000**
Location		**MGP**	**MGP**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**MGP**	**MGP**	**SHROW**	**SHROW**	**SHROW**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**
BTEX (mg/kg)																			
Benzene	0.06	0.001 U	0.001 U	0.012 U	0.005 J	0.012 U	0.012 U	0.001 U	0.001	0.012 U	***0.45***	0.012 U	0.001 U	0.001 U	0.001 U	0.002	0.001 U	0.005 U	0.001 U
Toluene	0.7	0.001 U	0.001 U	0.012 U	0.012 U	0.012 U	0.012 U	0.001 U	0.001 U	0.012 U	**0.61**	0.012 U	0.001 U	0.001	0.001 U	0.001 U	0.001 U	0.022	0.002
Ethylbenzene	1	0.001 U	0.001 U	0.012 U	0.026	0.012 U	0.012 U	0.001 U	0.001 U	0.012 U	***23***	0.012 U	0.001 U	0.001 U	0.002	0.018	0.001 U	0.11	0.002
Xylene, total	0.26	0.001 U	0.001 U	0.012 U	0.023	0.012 U	0.012 U	0.001 U	0.002	0.012 U	***16***	0.012 U	0.001 U	0.001	0.002	0.011	0.001 U	0.14	0.002
PAHs (mg/kg)																			
Acenaphthene	20	0.38 U	0.38 U	0.38 U	0.37	0.39 U	0.39 U	0.39 U	0.4 U	0.18 J	***410***	0.15 J	0.38 U	0.4 U	0.41 U	2.6	0.4 U	0.39 U	0.4 U
Acenaphthylene	100	0.38 U	0.081 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	6	30	0.38 U	0.38 U	0.4 U	0.41 U	0.41	0.4 U	3.4	0.4 U
Anthracene	100	0.38 U	0.12 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	32	***180***	0.085 J	0.38 U	0.4 U	0.41 U	1.3	0.4 U	2.6	0.4 U
Benz[a]anthracene	1	0.38 U	0.1 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***20***	***120***	0.38 U	0.38 U	0.4 U	0.41 U	***1.2***	0.4 U	***2***	0.4 U
Benzo[a]pyrene	1	0.38 U	0.076 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***26***	***91 J***	0.38 U	0.38 U	0.4 U	0.41 U	***1.1***	0.4 U	***1.6***	0.4 U
Benzo[b]fluoranthene	1	0.38 U	0.06 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***25***	***59 J***	0.38 U	0.38 U	0.4 U	0.41 U	0.84	0.4 U	***1.2***	0.4 U
Benzo[g,h,i]perylene	100	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	16	26	0.38 U	0.38 U	0.4 U	0.41 U	0.66	0.4 U	0.79	0.4 U
Benzo[k]fluoranthene	0.8	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***15***	***37***	0.38 U	0.38 U	0.4 U	0.41 U	0.26 J	0.4 U	0.42	0.4 U
Chrysene	1	0.38 U	0.11 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***24***	***100***	0.38 U	0.38 U	0.4 U	0.41 U	***1***	0.4 U	***1.6***	0.4 U
Dibenz[a,h]anthracene	0.33	*0.38 U*	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***3.7 J***	***7.9 J***	0.38 U	0.38 U	0.4 U	0.41 U	0.1 J	0.4 U	0.14 J	0.4 U
Dibenzofuran	7	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	0.4 U	***19***	0.38 U	0.38 U	0.4 U	0.41 U	0.046 J	0.4 U	0.1 J	0.4 U
Fluoranthene	100	0.38 U	0.2 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	29	***220***	0.11 J	0.38 U	0.4 U	0.41 U	2.6	0.4 U	4.2	0.058 J
Fluorene	30	0.38 U	0.084 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	0.63	***170***	0.078 J	0.38 U	0.4 U	0.41 U	1.3	0.4 U	2.2	0.4 U
Indeno[1,2,3-cd]pyrene	0.5	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***12***	***22***	0.38 U	0.38 U	0.4 U	0.41 U	**0.52**	0.4 U	***0.66***	0.4 U
Methylnaphthalene,2-	0.41^{+}	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	***0.83***	***460***	0.1 J	0.38 U	0.4 U	0.41 U	***2.4***	0.4 U	***3.3***	0.4 U
Naphthalene	12	0.38 U	0.38 U	0.38 U	0.57	0.39 U	0.39 U	0.39 U	0.4 U	1.9	***1400***	0.13 J	0.38 U	0.4 U	0.41 U	5.7	0.4 U	5.9	0.4 U
Phenanthrene	100	0.072 J	0.51	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	9.2	***690***	0.35	0.38 U	0.4 U	0.049 J	5.7	0.4 U	10 D	0.1 J
Pyrene	100	0.38 U	0.29 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U	0.4 U	46	***310***	0.17 J	0.38 U	0.4 U	0.41 U	3.5	0.4 U	5.4	0.079 J

Notes:

92 Result exceeds Unrestructed

NYCRR = New York Codes, Rules and Regulations
BTEX = Benzene, Toluene, Ethylbenzene and Xylene
PAHs = Polycyclic Aromatic Hydrocarbons
mg/kg = milligram per kilogram
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.
J = The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
NS = Not Sampled
* samples collected from borings completed in 2010.
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Table 5. Comparison of Remaining Soil Analytical Data to Unrestricted Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name Sample Depth Date Collected	6NYCRR Part 375 UNRESTRICTED USE (italics)	SHSB-14 48-52' 3/6/2000	SHSB-15 16-18' 3/6/2000	SHSB-15 26-28' 3/6/2000	SHSB-15 48-50' 3/7/2000	SHSB-16 50-52' 3/8/2000	SHSB-16 6-8' 3/7/2000	SHSB-17 14-16' 3/8/2000	SHSB-18 30-32' 3/27/2000	SHSB-19 50-52' 3/20/2000	SHSB-20 31-33' 3/22/2002	SHSB-20 79-81' 3/25/2002	SHSB-20 9-11' 3/21/2002	SHSB-20 99-101' 3/25/2002	SHSB-21 15-17' 3/27/2002	SHSB-21 71-73' 3/28/2002	SHSB-21 95-97' 3/29/2002	SHSB-22 20-22' 4/1/2002	SHSB-22 52-54' 4/2/2002
Location		**31 Long Island Avenue**	**31 Long Island Avenue**	**31 Long Island Avenue**	**31 Long Island Avenue**	**SHROW**	**SHROW**	**SHROW**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**
BTEX (mg/kg)																			
Benzene	0.06	0.001 U	0.001 U	0.012 U	0.001 U	0.001 U	1.2 U	0.001 U	0.001 U	0.001	0.003	0.001 U	***0.55***	0.001 U	***11***	0.001 U	0.001 U	0.001 U	0.001 U
Toluene	0.7	0.001 U	0.001 U	0.012 U	0.001 U	0.001 U	1.2 U	0.001 U	0.001 U	0.002	0.001 U	0.001 U	0.23	0.001 U	***16***	0.001 U	0.001 U	0.001 U	0.001 U
Ethylbenzene	1	0.001 U	0.001 U	0.086	0.001 U	0.001 U	***17***	0.001 U	0.001 U	0.001 U	0.002	0.001 U	***6.6***	0.001 U	***28***	0.001 U	0.001 U	0.001 U	0.001 U
Xylene, total	0.26	0.001 U	0.001 U	0.1	0.001 U	0.001 U	***8.6***	0.001 U	0.001 U	0.002	0.004	0.002	***11***	0.001 U	***37***	0.001 U	0.001 U	0.001 U	0.001 U
PAHs (mg/kg)																			
Acenaphthene	20	0.39 U	0.38 U	1.8	0.39 U	0.41 U	19	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***30 D***	0.4 U	5.7	0.39 U	0.38 U	0.048 J	0.36 U
Acenaphthylene	100	0.39 U	0.38 U	13	0.39 U	0.41 U	1.2 J	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	2.6	0.4 U	2.2	0.39 U	0.38 U	0.4 U	0.36 U
Anthracene	100	0.39 U	0.38 U	7.5	0.39 U	0.41 U	5.9	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	17 D	0.4 U	2.8	0.39 U	0.38 U	0.05 J	0.36 U
Benz[a]anthracene	1	0.39 U	0.38 U	***5***	0.39 U	0.41 U	***5***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***12 D***	0.4 U	***1.4***	0.39 U	0.38 U	0.058 J	0.36 U
Benzo[a]pyrene	1	0.39 U	0.38 U	***3.8***	0.39 U	0.41 U	***3.8***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***6.3***	0.4 U	***1.2***	0.39 U	0.38 U	0.4 U	0.36 U
Benzo[b]fluoranthene	1	0.39 U	0.38 U	***3.1***	0.39 U	0.41 U	***3***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***4.9***	0.4 U	0.89	0.39 U	0.38 U	0.4 U	0.36 U
Benzo[g,h,i]perylene	100	0.39 U	0.38 U	1.7	0.39 U	0.41 U	1.6	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	2.5	0.4 U	0.5	0.39 U	0.38 U	0.4 U	0.36 U
Benzo[k]fluoranthene	0.8	0.39 U	0.38 U	***0.92 J***	0.39 U	0.41 U	***0.98 J***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***2.1***	0.4 U	0.31 J	0.39 U	0.38 U	0.4 U	0.36 U
Chrysene	1	0.39 U	0.38 U	***4.5***	0.39 U	0.41 U	***4.6***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***12 D***	0.4 U	***1.4***	0.39 U	0.38 U	0.051 J	0.36 U
Dibenz[a,h]anthracene	0.33	0.39 U	0.38 U	***0.36 J***	*0.39 U*	0.41 U	***0.41 J***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***0.82***	0.4 U	0.14 J	0.39 U	0.38 U	0.4 U	0.36 U
Dibenzofuran	7	0.39 U	0.38 U	0.71 J	0.39 U	0.41 U	0.53 J	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	0.36 J	0.4 U	0.4 U	0.39 U	0.38 U	0.4 U	0.36 U
Fluoranthene	100	0.39 U	0.38 U	10	0.39 U	0.41 U	9.9	0.37 U	0.39 U	0.39 U	0.046 J	0.39 U	20 D	0.4 U	2.4	0.063 J	0.044 J	0.095 J	0.36 U
Fluorene	30	0.39 U	0.38 U	7.2	0.39 U	0.41 U	5.7	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	15 D	0.4 U	2.9	0.39 U	0.38 U	0.4 U	0.36 U
Indeno[1,2,3-cd]pyrene	0.5	0.39 U	0.38 U	***1.5 J***	0.39 U	0.41 U	***1.4***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***1.9***	0.4 U	0.41	0.39 U	0.38 U	0.4 U	0.36 U
Methylnaphthalene,2-	0.41^{+}	0.39 U	0.38 U	***14***	0.39 U	0.41 U	***17***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***39 D***	0.4 U	***9.3 D***	0.39 U	0.38 U	0.4 U	0.36 U
Naphthalene	12	0.39 U	0.22 J	***22***	0.39 U	0.41 U	***83 D***	0.37 U	0.39 U	0.39 U	0.4 U	0.39 U	***60 D***	0.4 U	***12 D***	0.39 U	0.38 U	0.4 U	0.36 U
Phenanthrene	100	0.39 U	0.38 U	23	0.08 J	0.41 U	23 D	0.37 U	0.39 U	0.39 U	0.12 J	0.39 U	60 D	0.4 U	16 D	0.16 J	0.1 J	0.19 J	0.36 U
Pyrene	100	0.39 U	0.38 U	14	0.052 J	0.41 U	14	0.37 U	0.39 U	0.39 U	0.072 J	0.39 U	34 D	0.4 U	4.1	0.081 J	0.057 J	0.11 J	0.36 U

Notes:

92 Result exceeds Unrestructed

NYCRR = New York Codes, Rules and Regulations
BTEX = Benzene, Toluene, Ethylbenzene and Xylene
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Table 5. Comparison of Remaining Soil Analytical Data to Unrestricted Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name Sample Depth Date Collected	6NYCRR Part 375 UNRESTRICTED USE (italics)	SHSB-22 98-100' 4/2/2002	SHSB-23 8-10' 4/4/2002	SHSB-23 17-19' 4/4/2002	SHSB-23 37-39' 4/4/2002	SHSB-23 58-60' 4/4/2002	SHSB-24 12-14' 4/16/2002	SHSB-24 20-22' 4/16/2002	SHSB-24 40-42' 4/16/2002	SHSB-24 56-58' 4/17/2002	SHSB-25 6-8 4/5/2002	SHSB-25 21-23' 4/5/2002	SHSB-25 42-44' 4/8/2002	SHSB-25 57-59' 4/8/2002	SHSB-26 5-6' 4/8/2002	SHSB-26 16-18' 4/8/2002	SHSB-26 40-42' 4/8/2002	SHSB-26 58-60' 4/9/2002	SHSB-27 5-7' 4/11/2002
Location		**MGP**	**8 West Water Street**	**8 West Water Street**	**8 West Water Street**	**8 West Water Street**	**2 West Water Street**	**2 West Water Street**	**2 West Water Street**	**2 West Water Street**	**4 West Water Street**	**4 West Water Street**	**4 West Water Street**	**4 West Water Street**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**
BTEX (mg/kg)																			
Benzene	0.06	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.004	0.001 U	0.001 U	0.001 U	0.001 U
Toluene	0.7	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.017	0.001 U	0.001 U	0.001 U	0.002
Ethylbenzene	1	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U	0.002	0.001 U	0.001 U	0.001 U
Xylene, total	0.26	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.003	0.002	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.041	0.001 U	0.001 U	0.001 U	0.006
PAHs (mg/kg)																			
Acenaphthene	20	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.09 J	0.4 U	0.42 U	0.4 U	0.13 J	0.4 U	0.42 U	0.4 U	***96***	0.12 J	0.4 U	0.39 U	0.34 J
Acenaphthylene	100	0.37 U	0.33 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	76	0.4 U	0.4 U	0.39 U	0.64
Anthracene	100	0.37 U	0.12 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.12 J	0.4 U	0.42 U	0.4 U	***120***	0.094 J	0.4 U	0.39 U	0.41
Benz[a]anthracene	1	0.37 U	0.8	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	***110***	0.07 J	0.4 U	0.39 U	0.44
Benzo[a]pyrene	1	0.37 U	0.91	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	***75***	0.4 U	0.4 U	0.39 U	0.57
Benzo[b]fluoranthene	1	0.37 U	0.89	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	***61***	0.4 U	0.4 U	0.39 U	0.47
Benzo[g,h,i]perylene	100	0.37 U	0.5	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	29	0.4 U	0.4 U	0.39 U	0.43
Benzo[k]fluoranthene	0.8	0.37 U	0.32 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	***34***	0.4 U	0.4 U	0.39 U	0.19 J
Chrysene	1	0.37 U	0.93	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	***110***	0.078 J	0.4 U	0.39 U	0.49
Dibenz[a,h]anthracene	0.33	0.37 U	0.1 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	***9.4 J***	0.4 U	0.4 U	0.39 U	0.09 J
Dibenzofuran	7	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	22 U	0.4 U	0.4 U	0.39 U	0.36 U
Fluoranthene	100	0.37 U	0.86	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.15 J	0.4 U	0.42 U	0.4 U	***190***	0.16 J	0.4 U	0.39 U	0.73
Fluorene	30	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.088 J	0.4 U	0.42 U	0.4 U	***110***	0.078 J	0.4 U	0.39 U	0.22 J
Indeno[1,2,3-cd]pyrene	0.5	0.37 U	0.39 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	***26***	0.4 U	0.4 U	0.39 U	0.35 J
Methylnaphthalene,2-	0.41+	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.051 J	0.4 U	0.42 U	0.4 U	***22 J***	0.4 U	0.4 U	0.39 U	0.1 J
Naphthalene	12	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.14 J	0.4 U	0.42 U	0.4 U	22 U	0.4 U	0.4 U	0.39 U	0.18 J
Phenanthrene	100	0.37 U	0.042 J	0.4 U	0.39 U	0.4 U	0.43 U	0.14 J	0.42 U	0.4 U	0.44	0.4 U	0.42 U	0.4 U	***240***	0.32 J	0.4 U	0.39 U	0.28 J
Pyrene	100	0.37 U	1.4	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.22 J	0.4 U	0.42 U	0.4 U	***280***	0.22 J	0.4 U	0.39 U	1.4

Notes:
92 Result exceeds Unrestructed
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National Grid

Sample Name Sample Depth Date Collected	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**SHSB-27 28-30' 4/11/2002**	**SHSB-28 10-12' 4/2/2002**	**SHSB-28 20-22' 4/2/2002**	**SHSB-28 38-40' 4/2/2002**	**SHSB-28 58-60' 4/2/2002**	**SHSB-29 30-32' 4/11/2002**	**SHSB-29 58-60' 4/11/2002**	**SHSB-30 5-6' 4/1/2002**	**SHSB-30 28-30' 4/1/2002**	**SHSB-31 4-6' 3/28/2002**	**SHSB-31 16-18' 3/28/2002**	**SHSB-31 28-30' 3/28/2002**	**SHSB-32 16-20' 4/15/2002**	**SHSB-34 8-10' 4/9/2002**	**SHSB-34 28-30' 4/9/2002**	**SHSB-35 8-10 4/10/2002**	**SHSB-35 28-30 4/10/2002**	**SHSB-36 8-10' 3/29/2002**
Location		**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**18 Bridge Street**	**18 Bridge Street**	**SHROW**	**SHROW**	**SHROW**	**11 Bridge Street**	**SHROW**	**SHROW**	**18 Bridge Street**	**18 Bridge Street**	**SHROW**
BTEX (mg/kg)																			
Benzene	0.06	0.001 U	0.001 J	0.002	0.001 U	0.001 U	0.001 U	0.001 U	0.002	0.001 U	0.39 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.009
Toluene	0.7	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	0.39 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethylbenzene	1	0.001 U	0.001 U	0.009	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	***16***	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Xylene, total	0.26	0.001 U	0.001 U	0.005	0.001 U	0.001 U	0.001 U	0.001 U	0.008	0.001 U	***13***	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
PAHs (mg/kg)																			
Acenaphthene	20	0.38 U	0.3 J	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.5	0.41 U	***120 D***	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.11 J	0.41 U	0.42 U
Acenaphthylene	100	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	14	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.16 J	0.41 U	0.42 U
Anthracene	100	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	57	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.41 J	0.41 U	0.42 U
Benz[a]anthracene	1	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	***40***	0.4 U	NS	0.4 U	0.46 U	0.4 U	***1.2***	0.41 U	0.42 U
Benzo[a]pyrene	1	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	***27***	0.4 U	NS	0.4 U	0.46 U	0.4 U	***1.1***	0.41 U	0.42 U
Benzo[b]fluoranthene	1	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	***24***	0.4 U	NS	0.4 U	0.46 U	0.4 U	***1.4***	0.41 U	0.42 U
Benzo[g,h,i]perylene	100	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	9.3	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.75	0.41 U	0.42 U
Benzo[k]fluoranthene	0.8	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	***10***	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.56	0.41 U	0.42 U
Chrysene	1	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	***41***	0.4 U	NS	0.4 U	0.46 U	0.4 U	***1.3***	0.41 U	0.42 U
Dibenz[a,h]anthracene	0.33	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	***2.5 J***	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.18 J	0.41 U	0.42 U
Dibenzofuran	7	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	5.4	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.064 J	0.41 U	0.42 U
Fluoranthene	100	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.06 J	0.49 U	0.41 U	68	0.049 J	NS	0.052 J	0.46 U	0.4 U	2.9	0.41 U	0.42 U
Fluorene	30	0.38 U	0.088 J	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	***48***	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.14 J	0.41 U	0.42 U
Indeno[1,2,3-cd]pyrene	0.5	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	**9.2**	0.4 U	NS	0.4 U	0.46 U	0.4 U	***0.72***	0.41 U	0.42 U
Methylnaphthalene,2-	0.41^{+}	0.38 U	0.1 J	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	0.49 U	0.41 U	**130 D**	0.4 U	NS	0.4 U	0.46 U	0.4 U	0.47 U	0.41 U	0.42 U
Naphthalene	12	0.38 U	1	0.41 U	0.41 U	0.4 U	0.41 U	0.36 U	2.3	0.41 U	**300 D**	0.4 U	NS	0.046 J	0.46 U	0.4 U	0.09 J	0.41 U	0.42 U
Phenanthrene	100	0.38 U	0.071 J	0.41 U	0.41 U	0.4 U	0.41 U	0.13 J	0.49 U	0.41 U	**190 D**	0.11 J	NS	0.12 J	0.46 U	0.4 U	1.7	0.41 U	0.42 U
Pyrene	100	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U	0.096 J	0.49 U	0.41 U	74	0.058 J	NS	0.073 J	0.063 J	0.4 U	2.4	0.41 U	0.42 U

Notes:

92 Result exceeds Unrestructed

NYCRR = New York Codes, Rules and Regulations

BTEX = Benzene, Toluene, Ethylbenzene and Xylene

PAHs = Polycyclic Aromatic Hydrocarbons

mg/kg = milligram per kilogram

U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

J = The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

NS = Not Sampled

* samples collected from borings completed in 2010.

\+ Value adapted from Residential Use SCO

MGP = Former Sag Harbor Manufactured Gas Plant Site

SHROW = Village of Sag Harbor Right of Way Areas

Table 5. Comparison of Remaining Soil Analytical Data to Unrestricted Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name Sample Depth Date Collected	**6NYCRR Part 375 UNRESTRICTED USE (italics)**	**SHSB-36 14-16' 3/29/2002**	**SHSB-37 6-8' 4/12/2002**	**SHSB-37 10-12' 4/12/2002**	**SHSB-37 14-16' 4/12/2002**	**SHSB-38 8-10' 4/8/2002**	**SHSB-38 12-14' 4/8/2002**	**SHSB-38 22-24' 4/8/2002**	**SHSB-39 8-10' 3/27/2002**	**SHSB-39 16-18' 3/27/2002**	**SHSB-40 8-10' 4/9/2002**	**SHSB-40 13-15' 4/9/2002**	**SHSB-41 9-11' 4/11/2002**	**SHSB-41 16-18' 4/11/2002**	**SHSB-42 8-10' 4/15/2002**	**SHSB-42 20-22' 4/15/2002**	**SHSB-43 8-10' 4/16/2002**	**SHSB-43 16-18' 4/16/2002**	**SHSB-44 6-8' 4/17/2002**
Location		**SHROW**	**11 Bridge Street**	**11 Bridge Street**	**11 Bridge Street**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**USPS**	**USPS**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**11 Bridge Street**	**11 Bridge Street**	**SHROW**
BTEX (mg/kg)																			
Benzene	0.06	0.001 U	0.002	***0.36***	0.001 U	***14***	0.065 U	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.26 U	0.001 U	0.001 U	0.001 U	0.001 U
Toluene	0.7	0.001 U	0.001 U	0.005 U	0.001 U	***17***	**0.16**	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.26 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethylbenzene	1	0.001 U	0.003	0.005	0.001 U	***140***	0.75	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	***16***	0.001 U	0.001 U	0.001 U	0.001 U
Xylene, total	0.26	0.001 U	0.008	0.009	0.006	***130***	***0.78***	0.001 U	0.003 U	0.001 U	0.001 U	0.002	0.007	0.001 U	***17***	0.001 U	0.001 U	0.002	0.001 U
PAHs (mg/kg)																			
Acenaphthene	20	0.4 U	13 D	1.6 U	0.4 U	***330***	1.2	0.39 U	0.92 U	0.38 U	0.053 J	0.4 U	0.4 J	0.42 U	***110 D***	0.42 U	0.42 U	0.41 U	0.42 U
Acenaphthylene	100	0.4 U	1.8	1.6 U	0.4 U	85 J	0.26 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	10	0.42 U	0.42 U	0.41 U	0.42 U
Anthracene	100	0.4 U	11 D	1.6 U	0.4 U	***210***	0.64	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	58 D	0.42 U	0.42 U	0.41 U	0.42 U
Benz[a]anthracene	1	0.4 U	***6.1***	1.6 U	0.4 U	***150***	0.45	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***39 D***	0.42 U	0.42 U	0.41 U	0.42 U
Benzo[a]pyrene	1	0.4 U	***4***	1.6 U	0.4 U	***120***	0.35 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***31 DJ***	0.42 U	0.42 U	0.41 U	0.42 U
Benzo[b]fluoranthene	1	0.4 U	***3***	1.6 U	0.4 U	***81 J***	0.22 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***18***	0.42 U	0.42 U	0.41 U	0.42 U
Benzo[g,h,i]perylene	100	0.4 U	1.1	1.6 U	0.4 U	59 J	0.17 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	12	0.42 U	0.42 U	0.41 U	0.42 U
Benzo[k]fluoranthene	0.8	0.4 U	***1.9***	1.6 U	0.4 U	***60 J***	0.19 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***6.8***	0.42 U	0.42 U	0.41 U	0.42 U
Chrysene	1	0.4 U	***6.2 D***	1.6 U	0.4 U	***150***	0.42 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***36 D***	0.42 U	0.42 U	0.41 U	0.42 U
Dibenz[a,h]anthracene	0.33	0.4 U	***0.39***	1.6 U	0.4 U	110 U	0.43 U	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***2.8***	0.42 U	0.42 U	0.41 U	0.42 U
Dibenzofuran	7	0.4 U	0.55	1.6 U	0.4 U	110 U	0.43 U	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.14 J	0.42 U	2.2	0.42 U	0.42 U	0.41 U	0.42 U
Fluoranthene	100	0.4 U	12 D	1.6 U	0.4 U	***300***	0.99	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	82 D	0.42 U	0.42 U	0.41 U	0.42 U
Fluorene	30	0.4 U	8.3 D	1.6 U	0.4 U	***190***	0.64	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.12 J	0.42 U	***51 D***	0.42 U	0.42 U	0.41 U	0.42 U
Indeno[1,2,3-cd]pyrene	0.5	0.4 U	***1.2***	1.6 U	0.4 U	***47 J***	0.14 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***10***	0.42 U	0.42 U	0.41 U	0.42 U
Methylnaphthalene,2-	0.41^+	0.4 U	***6.3 D***	1.6 U	0.4 U	***420***	***1.5***	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.33 J	0.42 U	***160 D***	0.42 U	0.42 U	0.41 U	0.42 U
Naphthalene	12	0.4 U	7.9 D	1.6 U	0.4 U	***1400***	5.3	0.39 U	0.92 U	0.38 U	0.41 U	0.29 J	1.7	0.42 U	***390 D***	0.047 J	0.42 U	0.41 U	0.42 U
Phenanthrene	100	0.4 U	32 D	1.6 U	0.4 U	***690***	2.3	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***210 D***	0.42 U	0.045 J	0.41 U	0.42 U
Pyrene	100	0.4 U	14 D	1.6 U	0.4 U	***410***	1.3	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	***120 D***	0.42 U	0.42 U	0.41 U	0.42 U

Notes:

92 Result exceeds Unrestructed

NYCRR = New York Codes, Rules and Regulations
BTEX = Benzene, Toluene, Ethylbenzene and Xylene
PAHs = Polycyclic Aromatic Hydrocarbons
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Table 5. Comparison of Remaining Soil Analytical Data to Unrestricted Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name Sample Depth Date Collected	6NYCRR Part 375 UNRESTRICTED USE (italics)	SHSB-44 28-30' 4/17/2002	SHSS-15 0-2" 5/9/2002	SHSS-16 0-2" 5/9/2002	SHSS-17 0-2" 5/9/2002	SHSS-18 0-2" 5/17/2002	SHMGP-01 0 2/21/2006	SHSS-102 0-2" 6/1/2004	SHSS-103 0-2" 6/1/2004	SHSS-106 0-2" 6/1/2004	SHSS-107 0-2" 6/1/2004	SHSS-108 0-2" 6/1/2004	SHSS-110 0-2" 6/2/2004	SB-204 4-10' 4/26/2007	SB-204 16-18' 4/26/2007	SB-219 2-8' 4/26/2007	SB-220 4-9' 5/1/2007	SB-221 5-8' 5/1/2007	SB-222 5-9' 5/1/2007
Location		**SHROW**	**SHROW**	**SHROW**	**SHROW**	**2 West Water Street**	**SHROW**	**SHROW**	**Schiavoni**	**2 West Water Street**	**2 West Water Street**	**4 West Water Street**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**
BTEX (mg/kg)																			
Benzene	0.06	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.017 U	0.011 U	0.012 U	0.011 U	0.011 U	0.015 U	0.0058 U	0.0059 U	0.0062	0.097 J	***0.35 J***	***1.9***
Toluene	0.7	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.017 U	0.011 U	0.012 U	0.011 U	0.011 U	0.015 U	0.0058 U	0.0059 U	0.0062	***7.4***	***7.2***	***27***
Ethylbenzene	1	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.017 U	0.011 U	0.012 U	0.011 U	0.011 U	0.015 U	0.0058 U	0.0059 U	0.0062	0.39 U	0.2 J	0.91 J
Xylene, total	0.26	0.001 U	0.001	0.003	0.004	0.001 U	0.012 U	0.006 J	0.011 U	0.012 U	0.002 J	0.011 U	0.015 U	0.017 U	0.018 U	0.019 U	***7.4***	***5.9***	***24***
PAHs (mg/kg)																			
Acenaphthene	20	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	0.56 U	0.18 J	0.39 U	0.3 J	0.36 U	0.17 J	0.38 U	15 J	0.22 J	***58***	***270***	***43***
Acenaphthylene	100	0.37 U	0.41 U	0.16 J	0.54 U	0.35 U	4.2	0.61	0.37 U	0.39 U	0.11 J	0.073 J	0.79	0.38 U	0.39 U	0.41 U	11 J	35 J	5.8
Anthracene	100	0.37 U	0.41 U	0.061 J	0.061 J	0.35 U	1.3	0.27 J	0.38	0.39 U	0.72	0.36 U	0.48 J	0.38 U	0.39 U	0.41 U	40	***130***	24 J
Benz[a]anthracene	1	0.37 U	0.41 U	0.18 J	0.25 J	0.058 J	***8.4 D***	0.75	***1.2***	0.25 J	***1.7***	0.16 J	***1.1***	0.38 U	0.39 U	0.41 U	***30 J***	***95***	***21 J***
Benzo[a]pyrene	1	0.37 U	0.41 U	0.22 J	0.28 J	0.048 J	***16 D***	***1.2***	***1.1***	0.26 J	***1.5 J***	0.17 J	***1.5 J***	0.38 U	0.39 U	0.41 U	***25 J***	***64***	***15 J***
Benzo[b]fluoranthene	1	0.37 U	0.41 U	0.36 J	0.42 J	0.064 J	***14 D***	***1.6***	***1.3***	0.4	***1.2 J***	0.18 J	***1.2 J***	0.38 U	0.39 U	0.41 U	***16 J***	***44 J***	***12***
Benzo[g,h,i]perylene	100	0.37 U	0.41 U	0.16 J	0.54 U	0.35 U	14 D	0.93	0.36 J	0.39 U	0.25 J	0.36 UJ	0.54 J	0.38 U	0.39 U	0.41 U	15 J	33 J	10
Benzo[k]fluoranthene	0.8	0.37 U	0.41 U	0.19 J	0.28 J	0.35 U	***6.5***	***1.3***	***1.5***	0.37 J	***2 J***	0.35 J	***2.1 J***	0.38 U	0.39 U	0.41 U	39 U	***17 J***	***4.3***
Chrysene	1	0.37 U	0.41 U	0.32 J	0.4 J	0.067 J	***9 D***	***1.2***	***1.5***	0.42	***1.5***	0.21 J	***1.2***	0.38 U	0.39 U	0.41 U	***24 J***	***82***	***17 J***
Dibenz[a,h]anthracene	0.33	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	***1.8***	0.56 U	0.37 U	0.39 U	0.37 UJ	0.36 UJ	0.49 UJ	0.38 U	0.39 U	0.41 U	39 U	***4 J***	***1.7 J***
Dibenzofuran	7	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	NA	NA	NA	NA	NA	NA	0.38 U	0.39 U	0.41 U	39 U	***11 J***	2 U
Fluoranthene	100	0.37 U	0.054 J	0.3 J	0.57	0.1 J	8.2 D	0.95	3.1	0.7	2.9	0.27 J	1.4	0.38 U	0.39 U	0.41 U	35 J	***170***	34
Fluorene	30	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	0.56 U	0.24 J	0.39 U	0.29 J	0.36 U	0.23 J	0.38 U	0.39 U	0.41 U	***30 J***	***100***	18 J
Indeno[1,2,3-cd]pyrene	0.5	0.37 U	0.41 U	0.14 J	0.13 J	0.35 U	***6***	***0.84***	0.43	0.39 U	0.37 J	0.082 J	***0.52 J***	0.38 U	0.39 U	0.41 U	***8 J***	***23 J***	***7***
Methylnaphthalene,2-	0.41^{+}	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	***0.64***	0.13 J	0.37 U	0.39 U	0.096 J	0.36 U	0.18 J	0.38 U	0.39 U	0.41 U	***140***	***310***	***40***
Naphthalene	12	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.75	0.2 J	0.37 U	0.39 U	0.13 J	0.36 U	0.5	0.38 U	0.048 J	0.41 U	***160***	***790***	***110***
Phenanthrene	100	0.37 U	0.41 U	0.11 J	0.24 J	0.054 J	1.8	0.42 J	2.2	0.45	2.3	0.13 J	1.1	0.025 J	0.39 U	0.049	***160***	***450***	89
Pyrene	100	0.37 U	0.073 J	0.42	0.64	0.12 J	20 D	1.5	2.7	0.73	4.4	0.42	3.1	0.016 J	0.39 U	0.021 J	91	***250***	52

Notes:

92 Result exceeds Unrestructed

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mg/kg = milligram per kilogram
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.
J = The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
NS = Not Sampled
* samples collected from borings completed in 2010.
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Table 5. Comparison of Remaining Soil Analytical Data to Unrestricted Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Sample Name Sample Depth Date Collected	6NYCRR Part 375 UNRESTRICTED USE (italics)	SB-223 4-8' 5/1/2007	SB-224 8-10' 5/8/2007	SB-230 5-6' 7/11/2007	SB-230 7.5-10' 7/11/2007	SB-231 5-6' 7/11/2007	SB-231 8-10' 7/11/2007	SB-234 5-6' 7/17/2007	SB-234 10-12' 7/17/2007	SB-235 6.5-7.5' 7/17/2007	SB-235 10-12' 7/17/2007	SB-236 6-7' 7/17/2007	SB-236 10-12' 7/17/2007	SB-237 2-3' 7/17/2007	SB-237 7-8' 7/17/2007	SHHC-E1 1.5' 7/28/2010	SHHC-N1 1.5' 7/28/2010
Location		**SHROW**	**SHROW**	**18 Bridge Street**	**18 Bridge Street**	**18 Bridge Street**	**18 Bridge Street**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**18 Bridge Street**	**18 Bridge Street**
BTEX (mg/kg)																	
Benzene	0.06	0.0059 U	0.0057 U	0.0059 U	0.0061 U	0.0059 U	0.0061 U	0.0061 U	0.0058 U	0.006 U	0.006 U	0.0078 U	0.0058 U	0.0061 U	0.0074 U	0.0063 U	0.0063 U
Toluene	0.7	0.0059 U	0.0057 U	0.0059 U	0.0061 U	0.0059 U	0.0061 U	0.0061 U	0.0058 U	0.006 U	0.006 U	0.0078 U	0.0058 U	0.0061 U	0.0074 U	0.0063 U	0.0063 U
Ethylbenzene	1	0.0059 U	0.0057 U	0.0059 U	0.0061 U	0.0059 U	0.0061 U	0.0061 U	0.0058 U	0.006 U	0.006 U	0.0078 U	0.0058 U	0.0061 U	0.0074 U	0.0063 U	0.0063 U
Xylene, total	0.26	0.018 U	0.017 U	0.018 U	0.018 U	0.018 U	0.013 J	0.018 U	0.017 U	0.018 U	0.018 U	0.023 U	0.017 U	0.018 U	0.022 U	0.0063 U	0.0063 U
PAHs (mg/kg)																	
Acenaphthene	20	0.07 J	0.086 J	0.39 U	0.023 J	0.35 J	0.4 U	0.4 U	0.38 U	0.09 J	0.063 J	1.8 J	0.052 J	0.4 U	0.49 U	5.6 D	0.38 U
Acenaphthylene	100	0.89 J	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	2.2	0.38 U
Anthracene	100	0.4 J	0.039 J	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	0.15 J	0.38 U	0.4 U	0.49 U	2.9	0.38 U
Benz[a]anthracene	1	***2.5***	0.38 U	0.034 J	0.4 U	0.071 J	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	0.16 J	0.38 U	0.4 U	0.49 U	***6.8 D***	0.38 U
Benzo[a]pyrene	1	***2.2***	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.014 J	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	***7.5 D***	0.38 U
Benzo[b]fluoranthene	1	***2.7***	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.024 J	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	***5.0***	0.38 U
Benzo[g,h,i]perylene	100	2.9	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	3.2	0.38 U
Benzo[k]fluoranthene	0.8	***1 J***	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	***6.0***	0.38 U
Chrysene	1	***2.4***	0.38 UJ	0.037 J	0.4 U	0.39 U	0.4 U	0.24 J	0.38 U	0.39 U	0.39 U	0.12 J	0.38 U	0.4 U	0.49 U	***6.5 D***	0.38 U
Dibenz[a,h]anthracene	0.33	***0.43 J***	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	***0.8***	0.38 U
Dibenzofuran	7	1.6 U	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	NA	NA
Fluoranthene	100	3.7	0.017 J	0.042 J	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.041 J	0.021 J	0.4 J	0.033 J	0.4 U	0.49 U	13.0 D	0.38 U
Fluorene	30	1.6 U	0.041 J	0.39 U	0.4 U	0.14 J	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	1.7	0.38 U
Indeno[1,2,3-cd]pyrene	0.5	***2.1 J***	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.56	0.47	***2.3 J***	0.38 U	0.4 U	0.49 U	***2.6***	0.38 U
Methylnaphthalene,2-	0.41$^+$	***0.88 J***	***0.42 J***	0.54 J	0.4 U	0.32 J	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	***1.4 J***	0.38 U	0.4 U	0.49 U	0.42 U	0.38 U
Naphthalene	12	0.14 J	0.1 J	0.39	0.059 J	0.86	0.43	0.4 U	0.38 U	0.56	0.47	2.3 J	0.38 U	0.4 U	0.49 U	0.42 U	0.38 U
Phenanthrene	100	0.61 J	0.18 J	0.39 U	0.4 U	0.36 J	0.4 U	0.019 J	0.38 U	0.39 U	0.39 U	0.68 J	0.035 J	0.4 U	0.49 U	6.4	0.38 U
Pyrene	100	6.4	0.027 J	0.073 J	0.4 U	0.39 U	0.4 U	0.4 U	0.38 U	0.39 U	0.39 U	0.25 J	0.38 U	0.4 U	0.49 U	22.0 D	0.38 U

Notes:

92 Result exceeds Unrestructed

NYCRR = New York Codes, Rules and Regulations

BTEX = Benzene, Toluene, Ethylbenzene and Xylene

PAHs = Polycyclic Aromatic Hydrocarbons

mg/kg = milligram per kilogram

U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

J = The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

NS = Not Sampled

* samples collected from borings completed in 2010.

\+ Value adapted from Residential Use SCO

MGP = Former Sag Harbor Manufactured Gas Plant Site

SHROW = Village of Sag Harbor Right of Way Areas

Table 6. Comparison of Remaining Soil Analytical Data to Restricted Residential Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

	6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (Bold)	**SHSB-01 26-28' 3/20/2000**	**SHSB-01* 8-10' 10/25/2010**	**SHSB-01* 74-75' 10/25/2010**	**SHSB-02 16-18' 3/20/2000**	**SHSB-02 52-54' 3/22/2000**	**SHSB-02* 4-5' 10/26/2010**	**SHSB-02* 11-11.5' 10/26/2010**	**SHSB-02* 20-22' 10/26/2010**	**SHSB-02* 30-30.5' 10/26/2010**	**SHSB-02 70-72' 10/26/2010**	**Duplicate of: SHSB-02* 70-72' 10/26/2010**	**SHSB-03 34-36' 3/20/2000**	**SHSB-04 24-26' 3/15/2000**	**SHSB-04* 6-8' 10/26/2010**	**SHSB-04* 13-15' 10/26/2010**	**SHSB-04A* 5-5.5' 11/1/2010**	**SHSB-04A* 6-9' 11/1/2010**	**SHSB-04A* 10.5-13.5' 11/1/2010**	**SHSB-05 22-24' 3/13/2000**	**SHSB-05 88-90' 5/22/2000**	**SHSB-05* 5-7' 10/27/2010**	**SHSB-05* 10-10.5' 10/27/2010**	**SHSB-05* 15-16' 10/27/2010**	**SHSB-05* 40-42' 10/28/2010**	**SHSB-06 50-52' 3/13/2000**
Location		**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**MGP**	**MGP**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**MGP**
BTEX (mg/kg)																										
Benzene	4.8	0.001	0.011 U	0.011 UJ	**92**	0.001 U	0.011 U	0.086	0.013 U	0.057 UJ	0.012 U	0.008	0.001	0.001 U	0.002 J	0.012 U	0.067	0.056 U	**4.9**	0.001 U	0.001 U	0.012 U	0.005 J	0.012 U	0.012 U	0.001 U
Toluene	100	0.001 U	0.011 U	0.011 UJ	**270**	0.001	0.011 U	0.15	0.013 U	0.68	0.012 U	0.004 J	0.003	0.001 U	0.004 J	0.012 U	0.037	0.022 J	0.005 J	0.001 U	0.001 U	0.012 U	0.012 U	0.012 U	0.012 U	0.001 U
Ethylbenzene	41	0.001	0.011 U	0.011 UJ	**240**	0.003	0.011 U	0.86	0.013 U	17	0.006	0.02	0.004	0.001 U	0.77	0.012 U	1.1	17	25	0.001 U	0.001 U	0.012 U	0.026	0.012 U	0.012 U	0.001 U
Xylene, total	100	0.002	0.011 U	0.011 UJ	**380**	0.005	0.011 U	2.4	0.013 U	32	0.013 J	0.044 J	0.005	0.001 U	1.4	0.012 U	1.1	15	0.22	0.001 U	0.001 U	0.012 U	0.023	0.012 U	0.012 U	0.001 U
PAHs (mg/kg)																										
Acenaphthene	100	0.38 U	0.37 U	0.37 U	38	0.12 J	0.36 U	22	0.41 U	87 J	0.4 U	0.38 U	0.41 U	0.4 U	18	18	59	**240**	31	0.38 U	0.38 U	0.38 U	0.37	0.39 U	0.39 U	0.39 U
Acenaphthylene	100	0.38 U	0.37 U	0.37 U	54	0.21 J	0.36 U	3	0.41 U	**390**	0.4 U	0.38 U	0.41 U	0.4 U	1.3	1.3	12	14	2	0.38 U	0.081 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Anthracene	100	0.38 U	0.37 U	0.37 U	31	0.21 J	0.36 U	11	0.41 U	**220**	0.4 U	0.38 U	0.41 U	0.4 U	7.3	7.6	84	90	12	0.38 U	0.12 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Benz[a]anthracene	1	0.38 U	0.37 U	0.37 U	**16 J**	0.15 J	0.36 U	**11**	0.41 U	**150**	0.4 U	0.38 U	0.41 U	0.4 U	**5.3**	**5.8**	**60**	**54**	**7.6**	0.38 U	0.1 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Benzo[a]pyrene	1	0.38 U	0.37 U	0.37 U	**12 J**	0.13 J	0.36 U	**10**	0.41 U	**130**	0.4 U	0.38 U	0.41 U	0.4 U	**4.1**	**4.4**	**24**	**46**	**5.4**	0.38 U	0.076 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Benzo[b]fluoranthen	1	0.38 U	0.37 U	0.37 U	**9.4 J**	0.11 J	0.36 U	**7.8**	0.41 U	**82 J**	0.4 U	0.38 U	0.41 U	0.4 U	**3.3**	**4**	**37**	**28**	**6.1 J**	0.38 U	0.06 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Benzo[g,h,i]perylene	100	0.38 U	0.37 U	0.37 U	6.3 J	0.064 J	0.36 U	5.4	0.41 U	**35**	0.4 U	0.38 U	0.41 U	0.4 U	1.9	2	13	14	1.8 J	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Benzo[k]fluoranthen	3.9	0.38 U	0.37 U	0.37 U	**4 J**	0.39 U	0.36 U	2.5	0.41 U	**32**	0.4 U	0.38 U	0.41 U	0.4 U	1.5	1.2	**12 J**	**18**	1.8 J	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Chrysene	3.9	0.38 U	0.37 U	0.37 U	**14 J**	0.14 J	0.36 U	**10**	0.41 U	**140**	0.4 U	0.38 U	0.41 U	0.4 U	**4.3**	**4.3**	**56**	**46**	**6.7**	0.38 U	0.11 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Dibenz[a,h]anthracen	0.33	0.38 U	0.37 U	0.37 U	29 U	0.39 U	0.36 U	**1.2**	0.41 U	**8.7 J**	0.4 U	0.38 U	0.41 U	0.4 U	**0.5**	**0.6**	**3.5 J**	**4.3 J**	**0.48 J**	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Dibenzofuran	59	0.38 U	0.37 U	0.37 U	29 U	0.39 U	0.36 U	0.81	0.41 U	15	0.4 U	0.38 U	0.41 U	0.4 U	0.42	0.43	3.6 J	6.8	0.97	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Fluoranthene	100	0.38 U	0.37 U	0.37 U	36	0.3 J	0.36 U	22	0.41 U	**320**	0.4 U	0.14 J	0.41 U	0.4 U	9.6	10	98	**120**	16	0.38 U	0.2 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Fluorene	100	0.38 U	0.37 U	0.37 U	29 U	0.18 J	0.36 U	10	0.41 U	**210**	0.4 U	0.38 U	0.41 U	0.4 U	6.3	7	58	90	12	0.38 U	0.084 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Indeno[1,2,3-cd]pyre	0.5	0.38 U	0.37 U	0.37 U	**5 J**	0.053 J	0.36 U	**3.7**	0.41 U	**27**	0.4 U	0.38 U	0.41 U	0.4 U	**1.3**	**1.3**	**9.7**	**11**	**1.3 J**	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Methylnaphthalene,2	0.41^{+}	0.38 U	0.37 U	0.37 U	**120**	0.27 J	0.36 U	**20**	0.41 U	**590**	0.4 U	0.38 U	0.41 U	0.4 U	**20**	**20**	3.8 U	**270**	**31**	0.38 U	0.38 U	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Naphthalene	100	0.38 U	0.37 U	0.37 U	**270**	0.31 J	0.36 U	37	0.41 U	**1600**	0.4 U	0.38 U	0.045 J	0.4 U	31	31	10	**760**	85	0.38 U	0.38 U	0.38 U	0.57	0.39 U	0.39 U	0.39 U
Phenanthrene	100	0.38 U	0.37 U	0.37 U	**160**	0.83	0.36 U	51	0.41 U	**970**	0.14 J	0.29	0.094 J	0.064 J	35	37	**320**	**400**	53	0.072 J	0.51	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U
Pyrene	100	0.38 U	0.37 U	0.37 U	49	0.42	0.36 U	31	0.41 U	**440**	0.092 J	0.18 J	0.056 J	0.4 U	13	14	**130**	**160**	22	0.38 U	0.29 J	0.38 U	0.41 U	0.39 U	0.39 U	0.39 U

Table 6. Comparison of Remaining Soil Analytical Data to Restricted Residential Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

	6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (Bold)	**SHSB-07 26-28' 3/17/2000**	**SHSB-07* 4-5' 11/1/2010**	**SHSB-07* 6.5-8.5' 11/1/2010**	**SHSB-07* 16-18' 11/1/2010**	**SHSB-08 50-52' 3/20/2000**	**SHSB-09 26-28' 3/23/2000**	**SHSB-10 24-26' 3/16/2000**	**SHSB-11 30-32' 3/23/2000**	**SHSB-12 34-36' 3/24/2000**	**SHSB-13 18-20' 3/27/2000**	**SHSB-13 34-36' 3/27/2000**	**SHSB-14 48-52' 3/6/2000**	**SHSB-15 16-18' 3/6/2000**	**SHSB-15 26-28 3/6/2000**	**SHSB-15 48-50' 3/7/2000**	**SHSB-16 6-8' 3/7/2000**	**SHSB-16 50-52' 3/8/2000**	**SHSB-17 14-16' 3/8/2000**	**SHSB-18 30-32 3/27/2000**	**SHSB-19 50-52' 3/20/2000**	**SHSB-20 9-11' 3/21/2002**	**SHSB-20 31-33' 3/22/2002**	**SHSB-20 79-81' 3/25/2002**	**SHSB-20 99-101' 3/25/2002**	**SHSB-21 15-17' 3/27/2002**	**SHSB-21 71-73' 3/28/2002**
Location		**MGP**	**SHROW**	**SHROW**	**SHROW**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**31 Long Island Avenue**	**31 Long Island Avenue**	**31 Long Island Avenue**	**31 Long Island Avenue**	**SHROW**	**SHROW**	**SHROW**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**	**MGP**
BTEX (mg/kg)																											
Benzene	4.8	0.001	0.012 U	0.45	0.012 U	0.001 U	0.001 U	0.001 U	0.002	0.001 U	0.005 U	0.001 U	0.001 U	0.001 U	0.012 U	0.001 U	1.2 U	0.001 U	0.001 U	0.001 U	0.001	0.55	0.003	0.001 U	0.001 U	**11**	0.001 U
Toluene	100	0.001 U	0.012 U	0.61	0.012 U	0.001 U	0.001	0.001 U	0.001 U	0.001 U	0.022	0.002	0.001 U	0.001 U	0.012 U	0.001 U	1.2 U	0.001 U	0.001 U	0.001 U	0.002	0.23	0.001 U	0.001 U	0.001 U	16	0.001 U
Ethylbenzene	41	0.001 U	0.012 U	23	0.012 U	0.001 U	0.001 U	0.002	0.018	0.001 U	0.11	0.002	0.001 U	0.001 U	0.086	0.001 U	17	0.001 U	0.001 U	0.001 U	0.001 U	6.6	0.002	0.001 U	0.001 U	28	0.001 U
Xylene, total	100	0.002	0.012 U	16	0.012 U	0.001 U	0.001	0.002	0.011	0.001 U	0.14	0.002	0.001 U	0.001 U	0.1	0.001 U	8.6	0.001 U	0.001 U	0.001 U	0.002	11	0.004	0.002	0.001 U	37	0.001 U
PAHs (mg/kg)																											
Acenaphthene	100	0.4 U	0.18 J	**410**	0.15 J	0.38 U	0.4 U	0.41 U	2.6	0.4 U	0.39 U	0.4 U	0.39 U	0.38 U	1.8	0.39 U	19	0.41 U	0.37 U	0.39 U	0.39 U	30 D	0.4 U	0.39 U	0.4 U	5.7	0.39 U
Acenaphthylene	100	0.4 U	6	30	0.38 U	0.38 U	0.4 U	0.41 U	0.41	0.4 U	3.4	0.4 U	0.39 U	0.38 U	13	0.39 U	1.2 J	0.41 U	0.37 U	0.39 U	0.39 U	2.6	0.4 U	0.39 U	0.4 U	2.2	0.39 U
Anthracene	100	0.4 U	32	**180**	0.085 J	0.38 U	0.4 U	0.41 U	1.3	0.4 U	2.6	0.4 U	0.39 U	0.38 U	7.5	0.39 U	5.9	0.41 U	0.37 U	0.39 U	0.39 U	17 D	0.4 U	0.39 U	0.4 U	2.8	0.39 U
Benz[a]anthracene	1	0.4 U	**20**	**120**	0.38 U	0.38 U	0.4 U	0.41 U	**1.2**	0.4 U	**2**	0.4 U	0.39 U	0.38 U	**5**	0.39 U	**5**	0.41 U	0.37 U	0.39 U	0.39 U	**12 D**	0.4 U	0.39 U	0.4 U	**1.4**	0.39 U
Benzo[a]pyrene	1	0.4 U	**26**	**91 J**	0.38 U	0.38 U	0.4 U	0.41 U	**1.1**	0.4 U	**1.6**	0.4 U	0.39 U	0.38 U	**3.8**	0.39 U	**3.8**	0.41 U	0.37 U	0.39 U	0.39 U	**6.3**	0.4 U	0.39 U	0.4 U	**1.2**	0.39 U
Benzo[b]fluoranthen	1	0.4 U	**25**	**59 J**	0.38 U	0.38 U	0.4 U	0.41 U	0.84	0.4 U	**1.2**	0.4 U	0.39 U	0.38 U	**3.1**	0.39 U	**3**	0.41 U	0.37 U	0.39 U	0.39 U	**4.9**	0.4 U	0.39 U	0.4 U	0.89	0.39 U
Benzo[g,h,i]perylene	100	0.4 U	16	26	0.38 U	0.38 U	0.4 U	0.41 U	0.66	0.4 U	0.79	0.4 U	0.39 U	0.38 U	1.7	0.39 U	1.6	0.41 U	0.37 U	0.39 U	0.39 U	2.5	0.4 U	0.39 U	0.4 U	0.5	0.39 U
Benzo[k]fluoranthen	3.9	0.4 U	**15**	**37**	0.38 U	0.38 U	0.4 U	0.41 U	0.26 J	0.4 U	0.42	0.4 U	0.39 U	0.38 U	0.92 J	0.39 U	0.98 J	0.41 U	0.37 U	0.39 U	0.39 U	2.1	0.4 U	0.39 U	0.4 U	0.31 J	0.39 U
Chrysene	3.9	0.4 U	**24**	**100**	0.38 U	0.38 U	0.4 U	0.41 U	1	0.4 U	1.6	0.4 U	0.39 U	0.38 U	**4.5**	0.39 U	**4.6**	0.41 U	0.37 U	0.39 U	0.39 U	**12 D**	0.4 U	0.39 U	0.4 U	1.4	0.39 U
Dibenz[a,h]anthracen	0.33	0.4 U	**3.7 J**	**7.9 J**	0.38 U	0.38 U	0.4 U	0.41 U	0.1 J	0.4 U	0.14 J	0.4 U	0.39 U	0.38 U	**0.36 J**	0.39 U	**0.41 J**	0.41 U	0.37 U	0.39 U	0.39 U	**0.82**	0.4 U	0.39 U	0.4 U	0.14 J	0.39 U
Dibenzofuran	59	0.4 U	0.4 U	19	0.38 U	0.38 U	0.4 U	0.41 U	0.046 J	0.4 U	0.1 J	0.4 U	0.39 U	0.38 U	0.71 J	0.39 U	0.53 J	0.41 U	0.37 U	0.39 U	0.39 U	0.36 J	0.4 U	0.39 U	0.4 U	0.4 U	0.39 U
Fluoranthene	100	0.4 U	29	**220**	0.11 J	0.38 U	0.4 U	0.41 U	2.6	0.4 U	4.2	0.058 J	0.39 U	0.38 U	10	0.39 U	9.9	0.41 U	0.37 U	0.39 U	0.39 U	20 D	0.046 J	0.39 U	0.4 U	2.4	0.063 J
Fluorene	100	0.4 U	0.63	**170**	0.078 J	0.38 U	0.4 U	0.41 U	1.3	0.4 U	2.2	0.4 U	0.39 U	0.38 U	7.2	0.39 U	5.7	0.41 U	0.37 U	0.39 U	0.39 U	15 D	0.4 U	0.39 U	0.4 U	2.9	0.39 U
Indeno[1,2,3-cd]pyre	0.5	0.4 U	**12**	**22**	0.38 U	0.38 U	0.4 U	0.41 U	**0.52**	0.4 U	**0.66**	0.4 U	0.39 U	0.38 U	**1.5 J**	0.39 U	**1.4**	0.41 U	0.37 U	0.39 U	0.39 U	**1.9**	0.4 U	0.39 U	0.4 U	0.41	0.39 U
Methylnaphthalene,2	0.41^{+}	0.4 U	**0.83**	**460**	0.1 J	0.38 U	0.4 U	0.41 U	**2.4**	0.4 U	**3.3**	0.4 U	0.39 U	0.38 U	**14**	0.39 U	**17**	0.41 U	0.37 U	0.39 U	0.39 U	**39 D**	0.4 U	0.39 U	0.4 U	**9.3 D**	0.39 U
Naphthalene	100	0.4 U	1.9	**1400**	0.13 J	0.38 U	0.4 U	0.41 U	5.7	0.4 U	5.9	0.4 U	0.39 U	0.22 J	22	0.39 U	83 D	0.41 U	0.37 U	0.39 U	0.39 U	60 D	0.4 U	0.39 U	0.4 U	12 D	0.39 U
Phenanthrene	100	0.4 U	9.2	**690**	0.35	0.38 U	0.4 U	0.049 J	5.7	0.4 U	10 D	0.1 J	0.39 U	0.38 U	23	0.08 J	23 D	0.41 U	0.37 U	0.39 U	0.39 U	60 D	0.12 J	0.39 U	0.4 U	16 D	0.16 J
Pyrene	100	0.4 U	46	**310**	0.17 J	0.38 U	0.4 U	0.41 U	3.5	0.4 U	5.4	0.079 J	0.39 U	0.38 U	14	0.052 J	14	0.41 U	0.37 U	0.39 U	0.39 U	34 D	0.072 J	0.39 U	0.4 U	4.1	0.081 J

Table 6. Comparison of Remaining Soil Analytical Data to Restricted Residential Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

	6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (Bold)	**SHSB-21 95-97' 3/29/2002**	**SHSB-22 20-22' 4/1/2002**	**SHSB-22 52-54' 4/2/2002**	**SHSB-22 98-100' 4/2/2002**	**SHSB-23 8-10' 4/4/2002**	**SHSB-23 17-19' 4/4/2002**	**SHSB-23 37-39' 4/4/2002**	**SHSB-23 58-60' 4/4/2002**	**SHSB-24 12-14' 4/16/2002**	**SHSB-24 20-22' 4/16/2002**	**SHSB-24 40-42' 4/16/2002**	**SHSB-24 56-58' 4/17/2002**	**SHSB-25 6-8' 4/5/2002**	**SHSB-25 21-23' 4/5/2002**	**SHSB-25 42-44' 4/8/2002**	**SHSB-25 57-59' 4/8/2002**	**SHSB-26 5-6' 4/8/2002**	**SHSB-26 16-18' 4/8/2002**	**SHSB-26 40-42' 4/8/2002**	**SHSB-26 58-60' 4/9/2002**	**SHSB-27 5-7' 4/11/2002**	**SHSB-27 28-30' 4/11/2002**	**SHSB-28 10-12' 4/2/2002**	**SHSB-28 20-22' 4/2/2002**	**SHSB-28 38-40' 4/2/2002**	**SHSB-28 58-60' 4/2/2002**	**SHSB-29 30-32' 4/11/2002**
Location		**MGP**	**MGP**	**MGP**	**MGP**	**8 West Water Street**	**8 West Water Street**	**8 West Water Street**	**8 West Water Street**	**2 West Water Street**	**2 West Water Street**	**2 West Water Street**	**2 West Water Street**	**4 West Water Street**	**4 West Water Street**	**4 West Water Street**	**4 West Water Street**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**
BTEX (mg/kg)																												
Benzene	4.8	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.004	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 J	0.002	0.001 U	0.001 U	0.001 U
Toluene	100	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.017	0.001 U	0.001 U	0.001 U	0.002	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethylbenzene	41	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U	0.002	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.009	0.001 U	0.001 U	0.001 U
Xylene, total	100	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.003	0.002	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.041	0.001 U	0.001 U	0.001 U	0.006	0.001 U	0.001 U	0.005	0.001 U	0.001 U	0.001 U
PAHs (mg/kg)																												
Acenaphthene	100	0.38 U	0.048 J	0.36 U	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.09 J	0.4 U	0.42 U	0.4 U	0.13 J	0.4 U	0.42 U	0.4 U	96	0.12 J	0.4 U	0.39 U	0.34 J	0.38 U	0.3 J	0.41 U	0.41 U	0.4 U	0.41 U
Acenaphthylene	100	0.38 U	0.4 U	0.36 U	0.37 U	0.33 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	76	0.4 U	0.4 U	0.39 U	0.64	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Anthracene	100	0.38 U	0.05 J	0.36 U	0.37 U	0.12 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.12 J	0.4 U	0.42 U	0.4 U	**120**	0.094 J	0.4 U	0.39 U	0.41	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Benz[a]anthracene	1	0.38 U	0.058 J	0.36 U	0.37 U	0.8	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	**110**	0.07 J	0.4 U	0.39 U	0.44	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Benzo[a]pyrene	1	0.38 U	0.4 U	0.36 U	0.37 U	0.91	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	**75**	0.4 U	0.4 U	0.39 U	0.57	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Benzo[b]fluoranthen	1	0.38 U	0.4 U	0.36 U	0.37 U	0.89	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	**61**	0.4 U	0.4 U	0.39 U	0.47	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Benzo[g,h,i]perylene	100	0.38 U	0.4 U	0.36 U	0.37 U	0.5	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	29	0.4 U	0.4 U	0.39 U	0.43	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Benzo[k]fluoranthen	3.9	0.38 U	0.4 U	0.36 U	0.37 U	0.32 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	**34**	0.4 U	0.4 U	0.39 U	0.19 J	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Chrysene	3.9	0.38 U	0.051 J	0.36 U	0.37 U	0.93	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	**110**	0.078 J	0.4 U	0.39 U	0.49	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Dibenz[a,h]anthracen	0.33	0.38 U	0.4 U	0.36 U	0.37 U	0.1 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	**9.4 J**	0.4 U	0.4 U	0.39 U	0.09 J	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Dibenzofuran	59	0.38 U	0.4 U	0.36 U	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	22 U	0.4 U	0.4 U	0.39 U	0.36 U	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Fluoranthene	100	0.044 J	0.095 J	0.36 U	0.37 U	0.86	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.15 J	0.4 U	0.42 U	0.4 U	**190**	0.16 J	0.4 U	0.39 U	0.73	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Fluorene	100	0.38 U	0.4 U	0.36 U	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.088 J	0.4 U	0.42 U	0.4 U	**110**	0.078 J	0.4 U	0.39 U	0.22 J	0.38 U	0.088 J	0.41 U	0.41 U	0.4 U	0.41 U
Indeno[1,2,3-cd]pyre	0.5	0.38 U	0.4 U	0.36 U	0.37 U	0.39 J	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.38 U	0.4 U	0.42 U	0.4 U	**26**	0.4 U	0.4 U	0.39 U	0.35 J	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U
Methylnaphthalene,2	0.41^{+}	0.38 U	0.4 U	0.36 U	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.051 J	0.4 U	0.42 U	0.4 U	**22 J**	0.4 U	0.4 U	0.39 U	0.1 J	0.38 U	0.1 J	0.41 U	0.41 U	0.4 U	0.41 U
Naphthalene	100	0.38 U	0.4 U	0.36 U	0.37 U	0.41 U	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.14 J	0.4 U	0.42 U	0.4 U	22 U	0.4 U	0.4 U	0.39 U	0.18 J	0.38 U	1	0.41 U	0.41 U	0.4 U	0.41 U
Phenanthrene	100	0.1 J	0.19 J	0.36 U	0.37 U	0.042 J	0.4 U	0.39 U	0.4 U	0.43 U	0.14 J	0.42 U	0.4 U	0.44	0.4 U	0.42 U	0.4 U	**240**	0.32 J	0.4 U	0.39 U	0.28 J	0.38 U	0.071 J	0.41 U	0.41 U	0.4 U	0.41 U
Pyrene	100	0.057 J	0.11 J	0.36 U	0.37 U	1.4	0.4 U	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.22 J	0.4 U	0.42 U	0.4 U	**280**	0.22 J	0.4 U	0.39 U	1.4	0.38 U	0.39 U	0.41 U	0.41 U	0.4 U	0.41 U

Table 6. Comparison of Remaining Soil Analytical Data to Restricted Residential Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
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	6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (Bold)	**SHSB-29 58-60' 4/11/2002**	**SHSB-30 5-6' 4/1/2002**	**SHSB-30 28-30' 4/1/2002**	**SHSB-31 16-18' 3/28/2002**	**SHSB-31 28-30' 3/28/2002**	**SHSB-32 16-20' 4/15/2002**	**SHSB-34 8-10' 4/9/2002**	**SHSB-34 28-30' 4/9/2002**	**SHSB-35 8-10' 4/10/2002**	**SHSB-35 28-30' 4/10/2002**	**SHSB-36 8-10' 3/29/2002**	**SHSB-36 14-16' 3/29/2002**	**SHSB-37 6-8' 4/12/2002**	**SHSB-37 10-12' 4/12/2002**	**SHSB-38 8-10' 4/8/2002**	**SHSB-38 12-14' 4/8/2002**	**SHSB-38 22-24' 4/8/2002**	**SHSB-39 8-10' 3/27/2002**	**SHSB-39 16-18' 3/27/2002**	**SHSB-40 8-9' 4/9/2002**	**SHSB-40 13-15' 4/9/2002**	**SHSB-41 9-11' 4/11/2002**	**SHSB-41 16-18' 4/11/2002**	**SHSB-42 8-10' 4/15/2002**	**SHSB-42 20-22' 4/15/2002**	**SHSB-43 8-10' 4/16/2002**	**SHSB-43 16-18' 4/16/2002**
Location		**SHROW**	**18 Bridge Street**	**18 Bridge Street**	**SHROW**	**SHROW**	**11 Bridge Street**	**SHROW**	**SHROW**	**18 Bridge Street**	**18 Bridge Street**	**SHROW**	**SHROW**	**11 Bridge Street**	**11 Bridge Street**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**USPS**	**USPS**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**11 Bridge Street**	**11 Bridge Street**
BTEX (mg/kg)																												
Benzene	4.8	0.001 U	0.002	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.009	0.001 U	0.002	0.36	**14**	0.065 U	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.26 U	0.001 U	0.001 U	0.001 U
Toluene	100	0.001 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U	17	0.16	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.26 U	0.001 U	0.001 U	0.001 U
Ethylbenzene	41	0.001 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.003	0.005	**140**	0.75	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	16	0.001 U	0.001 U	0.001 U
Xylene, total	100	0.001 U	0.008	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.008	0.009	**130**	0.78	0.001 U	0.003 U	0.001 U	0.001 U	0.002	0.007	0.001 U	17	0.001 U	0.001 U	0.002
PAHs (mg/kg)																												
Acenaphthene	100	0.36 U	0.5	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.11 J	0.41 U	0.42 U	0.4 U	13 D	1.6 U	**330**	1.2	0.39 U	0.92 U	0.38 U	0.053 J	0.4 U	0.4 J	0.42 U	**110 D**	0.42 U	0.42 U	0.41 U
Acenaphthylene	100	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.16 J	0.41 U	0.42 U	0.4 U	1.8	1.6 U	85 J	0.26 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	10	0.42 U	0.42 U	0.41 U
Anthracene	100	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.41 J	0.41 U	0.42 U	0.4 U	11 D	1.6 U	**210**	0.64	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	58 D	0.42 U	0.42 U	0.41 U
Benz[a]anthracene	1	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	**1.2**	0.41 U	0.42 U	0.4 U	**6.1**	1.6 U	**150**	0.45	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**39 D**	0.42 U	0.42 U	0.41 U
Benzo[a]pyrene	1	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	**1.1**	0.41 U	0.42 U	0.4 U	**4**	1.6 U	**120**	0.35 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**31 DJ**	0.42 U	0.42 U	0.41 U
Benzo[b]fluoranthene	1	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	**1.4**	0.41 U	0.42 U	0.4 U	**3**	1.6 U	**81 J**	0.22 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**18**	0.42 U	0.42 U	0.41 U
Benzo[g,h,i]perylene	100	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.75	0.41 U	0.42 U	0.4 U	1.1	1.6 U	59 J	0.17 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	12	0.42 U	0.42 U	0.41 U
Benzo[k]fluoranthene	3.9	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.56	0.41 U	0.42 U	0.4 U	1.9	1.6 U	**60 J**	0.19 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**6.8**	0.42 U	0.42 U	0.41 U
Chrysene	3.9	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	1.3	0.41 U	0.42 U	0.4 U	**6.2 D**	1.6 U	**150**	0.42 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**36 D**	0.42 U	0.42 U	0.41 U
Dibenz[a,h]anthracene	0.33	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.18 J	0.41 U	0.42 U	0.4 U	**0.39**	1.6 U	110 U	0.43 U	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**2.8**	0.42 U	0.42 U	0.41 U
Dibenzofuran	59	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.064 J	0.41 U	0.42 U	0.4 U	0.55	1.6 U	110 U	0.43 U	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.14 J	0.42 U	2.2	0.42 U	0.42 U	0.41 U
Fluoranthene	100	0.06 J	0.49 U	0.41 U	0.049 J	NA	0.052 J	0.46 U	0.4 U	2.9	0.41 U	0.42 U	0.4 U	12 D	1.6 U	**300**	0.99	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	82 D	0.42 U	0.42 U	0.41 U
Fluorene	100	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.14 J	0.41 U	0.42 U	0.4 U	8.3 D	1.6 U	**190**	0.64	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.12 J	0.42 U	51 D	0.42 U	0.42 U	0.41 U
Indeno[1,2,3-cd]pyrene	0.5	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	**0.72**	0.41 U	0.42 U	0.4 U	**1.2**	1.6 U	**47 J**	0.14 J	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**10**	0.42 U	0.42 U	0.41 U
Methylnaphthalene,2	0.41^{+}	0.36 U	0.49 U	0.41 U	0.4 U	NA	0.4 U	0.46 U	0.4 U	0.47 U	0.41 U	0.42 U	0.4 U	**6.3 D**	1.6 U	**420**	**1.5**	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.33 J	0.42 U	**160 D**	0.42 U	0.42 U	0.41 U
Naphthalene	100	0.36 U	2.3	0.41 U	0.4 U	NA	0.046 J	0.46 U	0.4 U	0.09 J	0.41 U	0.42 U	0.4 U	7.9 D	1.6 U	**1400**	5.3	0.39 U	0.92 U	0.38 U	0.41 U	0.29 J	1.7	0.42 U	**390 D**	0.047 J	0.42 U	0.41 U
Phenanthrene	100	0.13 J	0.49 U	0.41 U	0.11 J	NA	0.12 J	0.46 U	0.4 U	1.7	0.41 U	0.42 U	0.4 U	32 D	1.6 U	**690**	2.3	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**210 D**	0.42 U	0.045 J	0.41 U
Pyrene	100	0.096 J	0.49 U	0.41 U	0.058 J	NA	0.073 J	0.063 J	0.4 U	2.4	0.41 U	0.42 U	0.4 U	14 D	1.6 U	**410**	1.3	0.39 U	0.92 U	0.38 U	0.41 U	0.4 U	0.43 U	0.42 U	**120 D**	0.42 U	0.42 U	0.41 U

Table 6. Comparison of Remaining Soil Analytical Data to Restricted Residential Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Location	6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (Bold)	SHSB-44 6-8' 4/17/2002	SHSB-44 28-30' 4/17/2002	SHSS-15 0-6" 5/9/2002	SHSS-16 0 5/9/2002	SHSS-17 0 5/9/2002	SHSS-18 0-2" 5/17/2002	SHMGP-01 0 2/21/2006	SHSS-102 0-2" 6/1/2004	SHSS-103 0-2" 6/1/2004	SHSS-106 0-2" 6/1/2004	SHSS-107 0-2" 6/1/2004	SHSS-108 0-2" 6/1/2004	SHSS-110 0-2" 6/2/2004	SB-204 4-10' 4/26/2007	SB-204 16-18' 4/26/2007	SB-219 2-8' 4/26/2007	SB-220 4-9' 5/1/2007	SB-221 5-8' 5/1/2007	SB-222 5-9' 5/1/2007	SB-223 4-8' 5/1/2007	SB-224 8-10' 5/8/2007	SB-230 5-6' 7/11/2007	SB-230 7.5-10' 7/11/2007	SB-231 5-6' 7/11/2007	SB-231 8-10' 7/11/2007	SB-232 5-6' 7/17/2007	SB-232 10-12' 7/17/2007
		SHROW	SHROW	SHROW	SHROW	SHROW	2 West Water Street	SHROW	SHROW	SHROW	2 West Water Street	2 West Water Street	4 West Water Street	SHROW	SHROW	SHROW	SHROW	SHROW	SHROW	SHROW	SHROW	SHROW	18 Bridge Street	18 Bridge Street	18 Bridge Street	18 Bridge Street	SHROW	SHROW
BTEX (mg/kg)																												
Benzene	4.8	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.017 U	0.011 U	0.012 U	0.011 U	0.011 U	0.015 U	0.0058 U	0.0059 U	0.0062 U	0.097 J	0.35 J	1.90	0.0059 U	0.0057 U	0.0059 U	0.0061 U	0.0059 U	0.0061 U	0.006 U	0.0059 U
Toluene	100	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.017 U	0.011 U	0.012 U	0.011 U	0.011 U	0.015 U	0.0058 U	0.0059 U	0.0062 U	7.4	7.2	27	0.0059 U	0.0057 U	0.0059 U	0.0061 U	0.0059 U	0.0061 U	0.006 U	0.0059 U
Ethylbenzene	41	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U	0.001 U	0.012 U	0.017 U	0.011 U	0.012 U	0.011 U	0.011 U	0.015 U	0.0058 U	0.0059 U	0.0062 U	0.39 U	0.2 J	0.91 J	0.0059 U	0.0057 U	0.0059 U	0.0061 U	0.0059 U	0.0061 U	0.006 U	0.0059 U
Xylene, total	100	0.001 U	0.001 U	0.001	0.003	0.004	0.001 U	0.012 U	0.006 J	0.011 U	0.012 U	0.002 J	0.011 U	0.015 U	0.017 U	0.018 U	0.019 U	7.4	5.9	24	0.018 U	0.017 U	0.018 U	0.018 U	0.018 U	0.013 J	0.018 U	0.018 U
PAHs (mg/kg)																												
Acenaphthene	100	0.42 U	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	0.56 U	0.18 J	0.39 U	0.3 J	0.36 U	0.17 J	0.38 U	0.015 J	0.022 J	58	**270**	43	0.07 J	0.086 J	0.39 U	0.023 J	0.35 J	0.4 U	0.48	0.37 U
Acenaphthylene	100	0.42 U	0.37 U	0.41 U	0.16 J	0.54 U	0.35 U	4.2	0.61	0.37 U	0.39 U	0.11 J	0.073 J	0.79	0.38 U	0.39 U	0.41 U	11 J	35 J	5.8	0.89 J	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.17 J	0.37 U
Anthracene	100	0.42 U	0.37 U	0.41 U	0.061 J	0.061 J	0.35 U	1.3	0.27 J	0.38	0.39 U	0.72	0.36 U	0.48 J	0.38 U	0.39 U	0.41 U	40	**130**	24 J	0.4 J	0.39 J	0.39 U	0.4 U	0.39 U	0.4 U	0.23 J	0.37 U
Benz[a]anthracene	1	0.42 U	0.37 U	0.41 U	0.18 J	0.25 J	0.058 J	**8.4 D**	0.75	**1.2**	0.25 J	**1.7**	0.16 J	**1.1**	0.38 U	0.39 U	0.41 U	**30 J**	**95**	**21 J**	**2.5**	0.38 U	0.034 J	0.4 U	0.071 J	0.4 U	0.22 J	0.37 U
Benzo[a]pyrene	1	0.42 U	0.37 U	0.41 U	0.22 J	0.28 J	0.048 J	**16 D**	**1.2**	**1.1**	0.26 J	**1.5 J**	0.17 J	**1.5 J**	0.38 U	0.39 U	0.41 U	**25 J**	**64**	**15 J**	**2.2**	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.22 J	0.37 U
Benzo[b]fluoranthene	1	0.42 U	0.37 U	0.41 U	0.36 J	0.42 J	0.064 J	**14 D**	**1.6**	**1.3**	0.4	**1.2 J**	0.18 J	**1.2 J**	0.38 U	0.39 U	0.41 U	**16 J**	**44 J**	**12**	**2.7**	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.19 J	0.37 U
Benzo[g,h,i]perylene	100	0.42 U	0.37 U	0.41 U	0.16 J	0.54 U	0.35 U	14 D	0.93	0.36 J	0.39 U	0.25 J	0.36 UJ	0.54 J	0.38 U	0.39 U	0.41 U	15 J	33 J	10	2.9	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.18 J	0.37 U
Benzo[k]fluoranthene	3.9	0.42 U	0.37 U	0.41 U	0.19 J	0.28 J	0.35 U	**6.5**	1.3	1.5	0.37 J	2 J	0.35 J	2.1 J	0.38 U	0.39 U	0.41 U	39 U	**17 J**	**4.3**	**1 J**	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.063 J	0.37 U
Chrysene	3.9	0.42 U	0.37 U	0.41 U	0.32 J	0.4 J	0.067 J	**9 D**	1.2	1.5	0.42	1.5	0.21 J	1.2	0.38 U	0.39 U	0.41 U	**24 J**	**82**	**17 J**	**2.4**	0.38 UJ	0.037 J	0.4 U	0.037 J	0.4 U	0.23 J	0.37 U
Dibenz[a,h]anthracene	0.33	0.42 U	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	**1.8**	0.56 U	0.37 U	0.39 U	0.37 UJ	0.36 UJ	0.49 UJ	0.38 U	0.39 U	0.41 U	39 U	**4 J**	**1.7 J**	**0.43 J**	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.37 U
Dibenzofuran	59	0.42 U	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	NA	NA	NA	NA	NA	NA	0.38 U	0.39 U	0.41 U	39 U	11 J	2 U	1.6 U	0.38 U	0.39 U	0.4 U	0.39 U	0.4 U	0.4 U	0.37 U
Fluoranthene	100	0.42 U	0.37 U	0.054 J	0.3 J	0.57	0.1 J	8.2 D	0.95	3.1	0.7	2.9	0.27 J	1.4	0.38 U	0.39 U	0.41 U	35 J	**170**	34	3.7	0.017 J	0.042 J	0.4 U	0.042 J	0.4 U	0.34 J	0.37 U
Fluorene	100	0.42 U	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.41 U	0.56 U	0.24 J	0.39 U	0.29 J	0.36 U	0.23 J	0.38 U	0.39 U	0.41 U	30 J	**100**	18 J	1.6 U	0.041 J	0.39 U	0.4 U	0.14 J	0.4 U	0.34 J	0.37 U
Indeno[1,2,3-cd]pyrene	0.5	0.42 U	0.37 U	0.41 U	0.14 J	0.13 J	0.35 U	**6**	**0.84**	0.43	0.39 U	0.37 J	0.082 J	**0.52 J**	0.38 U	0.39 U	0.41 U	**8 J**	**23 J**	**7**	**2.1 J**	0.38 UJ	0.39 U	0.4 U	0.39 U	0.4 U	0.11 J	0.37 U
Methylnaphthalene,2	0.41^{+}	0.42 U	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	**0.64**	0.13 J	0.37 U	0.39 U	0.096 J	0.36 U	0.18 J	0.38 U	0.39 U	0.41 U	**140**	**310**	**40**	0.088 J	0.042 J	0.054 J	0.4 U	0.32 J	0.4 U	0.1 J	0.37 U
Naphthalene	100	0.42 U	0.37 U	0.41 U	0.4 U	0.54 U	0.35 U	0.75	0.2 J	0.37 U	0.39 U	0.13 J	0.36 U	0.5	0.38 U	0.048 J	0.41 U	**160**	**790**	**110**	0.14 J	0.1 J	0.39	0.059 J	0.86	0.43	0.46	0.37 U
Phenanthrene	100	0.42 U	0.37 U	0.41 U	0.11 J	0.24 J	0.054 J	1.8	0.42 J	2.2	0.45	2.3	0.13 J	1.1	0.025 J	0.39 U	0.049	**160**	**450**	89	0.61 J	0.18 J	0.39 U	0.4 U	0.36 J	0.4 U	0.4	0.37 U
Pyrene	100	0.42 U	0.37 U	0.073 J	0.42	0.64	0.12 J	20 D	1.5	2.7	0.73	4.4	0.42	3.1	0.016 J	0.39 U	0.021 J	91	**250**	52	6.4	0.027 J	0.073 J	0.4 U	0.39 U	0.4 U	0.51	0.37 U

Table 6. Comparison of Remaining Soil Analytical Data to Restricted Residential Soil Cleanup Objectives
Site Management Plan
Sag Harbor Former MGP Site
National Grid

	6NYCRR Part 375 RESTRICTED USE RESIDENTIAL (Bold)	**SB-234 5-6' 7/17/2007**	**SB-234 10-12' 7/17/2007**	**SB-235 6.5-7.5' 7/17/2007**	**SB-235 10-12' 7/17/2007**	**SB-236 6-7' 7/17/2007**	**SB-236 10-12' 7/17/2007**	**SB-237 2-3' 7/17/2007**	**SB-237 7-8' 7/17/2007**	**SHHC-E1 1.5' 7/28/2010**	**SHHC-N1 1.5' 7/28/2010**
Location		**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**SHROW**	**18 Bridge Street**	**18 Bridge Street**
BTEX (mg/kg)											
Benzene	4.8	0.0061 U	0.0058 U	0.006 U	0.006 U	0.0078 U	0.0058 U	0.0061 U	0.0074 U	0.006 U	0.006 U
Toluene	100	0.0061 U	0.0058 U	0.006 U	0.006 U	0.0078 U	0.0058 U	0.0061 U	0.0074 U	0.006 U	0.006 U
Ethylbenzene	41	0.0061 U	0.0058 U	0.006 U	0.006 U	0.0078 U	0.0058 U	0.0061 U	0.0074 U	0.006 U	0.006 U
Xylene, total	100	0.018 U	0.017 U	0.018 U	0.018 U	0.023 U	0.017 U	0.018 U	0.022 U	0.006 U	0.006 U
PAHs (mg/kg)											
Acenaphthene	100	0.4 U	0.38 U	0.09 J	0.063 J	1.8 J	0.052 J	0.4 U	0.49 U	**5.6 D**	0.38 U
Acenaphthylene	100	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	**2.2**	0.38 U
Anthracene	100	0.4 U	0.38 U	0.39 U	0.39 U	0.15 J	0.38 U	0.4 U	0.49 U	**2.9**	0.38 U
Benz[a]anthracene	1	0.4 U	0.38 U	0.39 U	0.39 U	0.16 J	0.38 U	0.4 U	0.49 U	**6.8 D**	0.38 U
Benzo[a]pyrene	1	0.014 J	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	**7.5 D**	0.38 U
Benzo[b]fluoranthene	1	0.024 J	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	**5.0**	0.38 U
Benzo[g,h,i]perylene	100	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	**3.2**	0.38 U
Benzo[k]fluoranthene	3.9	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	**6.0**	0.38 U
Chrysene	3.9	0.24 J	0.38 U	0.39 U	0.39 U	0.12 J	0.38 U	0.4 U	0.49 U	**6.5 D**	0.38 U
Dibenz[a,h]anthracene	0.33	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	**0.8**	0.38 U
Dibenzofuran	59	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	NA	NA
Fluoranthene	100	0.4 U	0.38 U	0.041 J	0.021 J	0.19 J	0.38 U	0.4 U	0.49 U	**13.0 D**	0.38 U
Fluorene	100	0.4 U	0.38 U	0.39 U	0.39 U	0.4 J	0.033 J	0.4 U	0.49 U	**1.7**	0.38 U
Indeno[1,2,3-cd]pyrene	0.5	0.4 U	0.38 U	0.39 U	0.39 U	2.6 U	0.38 U	0.4 U	0.49 U	**2.6**	0.38 U
Methylnaphthalene,2	0.41^{+}	0.4 U	0.38 U	0.39 U	390 U	**1.4 J**	0.38 U	0.4 U	0.49 U	**0.42 U**	0.38 U
Naphthalene	100	0.4 U	0.38 U	0.56	0.47	2.3 J	0.38 U	0.4 U	0.49 U	**0.42 U**	0.38 U
Phenanthrene	100	0.019 J	0.38 U	0.39 U	0.39 U	0.68 J	0.035 J	0.4 U	0.49 U	**6.4**	0.38 U
Pyrene	100	0.4 U	0.38 U	0.39 U	0.39 U	0.25 J	0.38 U	0.4 U	0.49 U	**22.0 D**	0.38 U

Notes:

270 Result exceeds Restricted Residential Soil Cleanup Criteria

NYCRR = New York Codes, Rules and Regulations

BTEX = Benzene, Toluene, Ethylbenzene and Xylene

PAHs = Polycyclic Aromatic Hydrocarbons

mg/kg = milligram per kilogram

U The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ The analyte was analyzed for, but was not detected. The reported quantitation limit is approximated and may be inaccurate or imprecise.

J The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.

NS: Not Sampled

* Samples collected from borings completed in 2010.

\+ Value adapted from Residential Use SSCO

MGP - Former Sag Harbor Manufactured Gas Plant Site

SHROW - Village of Sag Harbor Right of Way Areas

Table 7. Matrix of Responsibilities – 31 Long Island Avenue & 11 Bridge Street
Site Management Plan
Sag Harbor Former MGP Site
National Grid

	Responsible Party			**Action**		
Trigger	**NYSDEC**	**National Grid**	**Property Owners**	**NYSDEC**	**National Grid**	**Property Owners**
Access Agreement (AA)		✓	✓		AA executed between the Property Owner and National Grid for SMP implementation including maintaining engineering controls, following restrictions and institutional controls, annual inspection, groundwater monitoring, and indoor air monitoring (as needed).	AA executed between the Property Owner and National Grid for SMP implementation including maintaining engineering controls, following restrictions and institutional controls, annual inspection, groundwater monitoring, and indoor air monitoring (as needed).
Annual Report	✓	✓		Review and Comment, as necessary	Report will be completed by National Grid and submitted to NYSDEC. Report will include results of GW Monitoring.	
Emergency Response	✓	✓	✓	Review and Comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days. National Grid will review emergency activities, conduct maintenance or repair (if necessary) and submit update to NYSDEC with Annual Inspection Report.	Property Owner or Lessee have to provide details of emergency work to National Grid and NYSDEC within 48 hrs. of emergency.
Environmental Easement (EE)	✓		✓	EE will be executed between the Property Owner and the NYSDEC		EE will be executed between the Property Owner and the NYSDEC.
Future Property Development	✓	✓	✓	Review and Comment, as necessary	National Grid to review and decide if oversight is required upon notification by the Property Owner. If new building, decision on vapor intrusion sampling will be evaluated. Following development, National Grid to update SMP and submit to NYSDEC with Annual Inspection Report.	Property Owner has to provide at a minimum 15- business days notice to National Grid and NYSDEC. Restrictions on type of development activities should be followed.
Ground Intrusion Work	✓	✓	✓	Review and Comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days of notification by the Property Owner. National Grid to review and decide if oversight is required. Following development, National Grid to update SMP and submit to NYSDEC with Annual Inspection Report.	Property Owner has to provide at a minimum 15- business days notice to National Grid and NYSDEC. All ground intrusive activities shall be pursuant to the SMP.
Groundwater Use			✓			Never; removed groundwater shall be managed pursuant to the SMP.
HASP Development		✓	✓		National Grid will aid in the development of task- specific HASP.	Develop a Site-specific HASP for any subsurface work deeper than 24-inches below ground surface or top of groundwater table whichever is shallower.
Inspections		✓	✓		Annual Site-wide inspection of Engineering Controls and Institutional Controls.	Inspections (annual and following any emergency) of the Engineering Controls and Institutional Controls.
Interviews		✓	✓		National Grid to discuss annually with the Property Owner and Lessee.	National Grid to discuss annually with the Property Owner and Lessee.
Survey for Easement		✓			National Grid will perform a Metes and Bounds (or similar) Survey to include in the Site Management Plan and Environmental Easement.	Property Owner shall provide access to property to National Grid.
Monitoring		✓	✓		Monitoring will be completed by National Grid quarterly, semi-annually, or annually or as needed. Indoor air monitoring will be completed for any building modification or new buildings.	Property Owner shall provide National Grid with access to monitoring locations.
Property Ownership Change		✓	✓		National Grid will notify DEC of any event and associated changes within 15 days of notification by the Property Owner. National Grid will submit update to NYSDEC with Annual Inspection Report.	Property Owner shall provide at a minimum 60 days notice to National Grid and NYSDEC.
Property Use Change (currently Restricted Residential)	✓	✓	✓	Review and Comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days of notification by the Property Owner. National Grid to review and confer with DEC if SMP revision and/or additional ECs/ICs are required. Following use change, National Grid to update SMP and submit to NYSDEC with Annual Inspection Report.	Property Owner has to provide at a minimum 60 days notice to National Grid and NYSDEC.
SMP Implementation			✓			Implement the Site Management Plan for any ground intrusive work that will disturb composite cover system.

Table 8. Matrix of Responsibilities – Off-Site Properties South of Long Island Avenue
Off-Site Properties South of Long Island Avenue [18 Bridge Street, Village of Sag Harbor Properties (VSHP) & 21 Long Island Avenue]
Site Management Plan
Sag Harbor Former MGP Site
National Grid

	Responsible Party			Action		
Trigger	**NYSDEC**	**National Grid**	**Property Owner**	**NYSDEC**	**National Grid**	**Property Owner**
Access Agreement (AA) or Memorandum of Understanding (MOU)		✓	✓		AA (21 Long Island Avenue-USPS) or MOU (VSHP) was executed between the property owners and National Grid for SMP implementation including maintaining engineering controls, following restrictions and institutional controls, annual inspection, groundwater monitoring (18 Bridge Street and 21 LIA), DNAPL recovery (VHSP only) and indoor air monitoring (as needed).	AA or MOU was executed between the above referenced property owners and National Grid for SMP implementation including maintaining engineering controls, following restrictions and institutional controls, annual inspection, groundwater monitoring (18 Bridge Street and VSHP), DNAPL recovery (VSHP only) and indoor air monitoring (as needed).
Annual Report	✓	✓		Review and comment, as necessary	Report will be completed by National Grid and Submitted to NYSDEC. Report will include results of groundwater monitoring and DNAPL recovery (VSHP only).	
Emergency Response	✓	✓	✓	Review and comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days of notification by the property owner. National Grid will review emergency activities, conduct maintenance or repair (if necessary) and submit update to NYSDEC with Annual Inspection Report.	Property owners (18 Bridge Street and VHSP) shall provide details of emergency work to National Grid and NYSDEC within 48 hrs. of emergency. Similar notification from the 21 Long Island Avenue property owner is recommended.
Future Property Development	✓	✓	✓	Review and comment, as necessary	National Grid to review and decide if oversight is required upon notification by the property owner. If new building is contemplated, an evaluation will be conducted to determine if indoor air or soil vapor sampling is necessary. Following development, National Grid to update SMP and submit to NYSDEC with Annual Inspection Report.	Property owners shall provide at a minimum 15-business days notice to National Grid and NYSDEC. There are no restrictions on type of development activities.
Ground Intrusion Work (>24-inches or top of groundwater)	✓	✓	✓	Review and comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days of notification by the property owner. National Grid to review and decide if oversight is required.	Property owners (18 Bridge Street and VHSP) shall provide at a minimum 15-business days notice to National Grid and NYSDEC. All ground intrusive activities shall be pursuant to the SMP. Similar notification requirements for the 21 Long Island Avenue property owner have been agreed to, with details regarding excavation requirments to be detailed in a formal access agreeement should intrusive work occur.
Groundwater Use	✓		✓	Review and comment, as necessary		The use of groundwater underlying the properties is prohibited without necessary water quality treatment as determined by the NYSDOH or the Suffolk 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. The exception is the use of groundwater pumped from the existing well located in the southern portion of the 18 Bridge Street property. The groundwater pumped from this well may be used for irrigation purposes only. If a change of use is considered, NYSDEC must be notified and approve the change.
HASP Development		✓	✓		National Grid will aid in development of site or task-specific HASP.	Develop a Site-specific HASP for any subsurface work deeper than 24-inches below ground surface or top of groundwater table, whichever is shallower (18 Bridge Street and VHSP). The development of a Site-specific HASP for similar work is recommended for the 21 Long Island Avenue property and will be recommended for inclusion in the formal access agreement should intrusive work occur.
Inspections		✓	✓		Annual Site-wide inspection of Engineering Controls and Institutional Controls.	Inspections (annual and following any emergency) of the Engineering Controls and Institutional Controls.
Interviews		✓	✓		National Grid to discuss annually with the property owner.	National Grid to discuss annually with the property owners.
Monitoring & DNAPL Recovery (VSHP only)		✓	✓		Monitoring or DNAPL recovery (VSHP only) will be completed by National Grid quarterly, semi-annually, or annually or as needed.	Property owners shall provide National Grid with access to monitoring and DNAPL recovery locations (18 Bridge and VSHP).
Property Ownership (transfer of all existing shares where appropriate)		✓	✓		National Grid will notify NYSDEC of any event and associated changes within 15 days upon notification by the property owner. National Grid will submit update to NYSDEC with Annual Inspection Report.	Property owners (18 Bridge Street and VSHP) shall provide at a minimum 60 days notice to National Grid and NYSDEC if the property is transferred or sold. Similar notification is recommended for the 21 Long Island Avenue property.
Property Use Change (currently Restricted Residential)	✓	✓	✓	Review and comment, as necessary	National Grid will notify NYSDEC of any event and associated changes within 15 days of notification by the property owner. National Grid to review and confer with NYSDEC if SMP revision and/or additional ECs/ICs are required. Following use change, National Grid to update SMP and submit to NYSDEC.	Property owners (18 Bridge Street and VSHP) shall provide at a minimum 60 days notice to National Grid and NYSDEC. Similar notification is recommended for the 21 Long Island Avenue property.
SMP Implementation			✓		Update the SMP, as necessary if condictions change. Implement National Grid's SMP responsibilities identified for these properties.	Property owners (18 Bridge Street and VSHP) shall provide at a minimum 15-business days notice to National Grid and NYSDEC and implement the Site Management Plan for any ground intrusive work that will disturb soil cover system. Similar notification will be recommended for inclusion in a formal access agreement if any intrusive work at 21 Long Island Avenue should occur.
Vegetable Gardens and Farming	✓		✓	Review and comment, as necessary		Vegetable gardens or farming on the common lands may be considered for approval by NYSDEC. 18 Bridge Street and VHSP shall provide at a minium 15 business days notice to NG and NYSDEC prior to intended use of included properties for vegetable gardens/farming. Similar notification is recommended for the 21 Long Island Avenue property.

Table 9. Matrix of Responsibilities - Properties North of Long Island Avenue (2, 4, 8 and 22 West Water Street)
Site Management Plan
Sag Harbor Former MGP Site
National Grid

	Responsible Party			Action		
Trigger	**NYSDEC**	**National Grid**	**Property Owner**	**NYSDEC**	**National Grid**	**Property Owner(s) or their representatives**
Access Agreement (AA)		✓	✓		AA will be executed between the owner(s) of the above referenced properties and National Grid for SMP implementation including maintaining engineering controls, recommended notifications and institutional controls, annual inspection and indoor air monitoring (as needed).	AA will be executed between the owner(s) of the above-referenced properties and National Grid for SMP implementation including maintaining engineering controls, recommended notifications and institutional controls, annual inspection and indoor air monitoring (as needed).
Annual Report	✓	✓		Review and comment, as necessary	Report will be completed by National Grid and Submitted to DEC. Report will include results of groundwater monitoring.	
Emergency Response	✓	✓	✓	Review and comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days of notification by the Owners or the Representatives of the above referenced properties. National Grid will review emergency activities, conduct maintenance or repair (if necessary) and submit update to DEC with Annual Inspection Report.	The DEC recommends the owner(s) of the above referenced properties or their representatives to notify National Grid of any emergency work completed on the property that resulted in contact with soil below an elevation of 1.5 feet above mean sea level on the property or groundwater.
Future Property Development	✓	✓	✓	Review and comment, as necessary	National Grid to review and decide if oversight is required upon notification by the owner(s) of the above referenced properties or their representatives. If new building is proposed, decision on indoor air sampling will be made in consultation with DEC. Following development, National Grid to update SMP and submit to DEC with Annual Inspection Report.	The DEC recommends the owner(s) of the above referenced properties or their representatives to provide a minimum 15-business days notice to National Grid prior to the start of any developmental activities. There are no restrictions on type of development activities.
Ground Intrusion Work (<elevation 1.5 feet Mean Sea Level)	✓	✓	✓	Review and comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days of notification by the owner(s) of the above referenced properties or their representatives. National Grid to review and decide if oversight is required. Following development, National Grid to update SMP and submit to DEC with Annual Inspection Report.	The DEC recommends the owner(s) of the above referenced properties or their representatives to provide at a minimum 15-business days notice to National Grid and DEC prior to any ground intrusive activities below an elevation of 1.5 feet above mean sea level. It is also recommended that all ground intrusive activities shall be pursuant to the SMP.
Groundwater Use	✓		✓	Review and comment, as necessary		The DEC recommends the owner(s) of the above referenced properties or their representatives to provide at a minimum 15-business days notice to National Grid and DEC prior to groundwater use; It is also recommended that dewatered groundwater be managed according to SMP requirements.
HASP Development		✓	✓		National Grid will aid in development of task-specific HASP.	The DEC recommends the owner(s) of the above referenced properties or their representatives to develop a Site-specific HASP for any subsurface work below an elevation of 1.5 feet above mean sea level.
Inspections		✓	✓		Annual Site-wide inspection of Engineering Controls and Institutional Controls.	Inspections (annual and following any emergency) of the Engineering Controls and Institutional Controls will be completed by National Grid.
Interviews		✓	✓		National Grid to discuss annually with the owner(s) of 8 West Water Street property or their representatives.	National Grid to discuss annually with the owner(s) of 8 West Water Street property or their representatives.
Monitoring		✓	✓		Groundwater monitoring will be completed by National grid quarterly, semi-annually, or annually or as needed (2 West Water Street only).	The DEC recommends the owner(s) of 2 West Water Street property or their representatives to provide National Grid with access to groundwater (2 West Water Street only) and indoor air monitoring locations following construction of any new buildings on the property.
Property Ownership (transfer of all existing shares)	✓	✓	✓	Review and comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days upon notification by the owner(s) of the above-reference properties. National Grid will submit update to DEC with Annual Inspection Report.	The DEC recommends the owner(s) of the above-referenced properties or their representatives to provide at a minimum 60 days notice to National Grid and DEC if the property is transferred or sold.
Property Use Change [currently Restricted Residential, exluding 22 West Water Street Commercial)]	✓	✓	✓	Review and comment, as necessary	National Grid will notify DEC of any event and associated changes within 15 days of notification by the owner(s) of the above referenced properties or their representatives. National Grid to review and confer with DEC if SMP revision and/or additional ECs/ICs are required. Following use change, National Grid to update SMP and submit to DEC with Annual Inspection Report.	The DEC recommends the owner(s) of the above referenced properties or their representatives to provide at a minimum 60 days notice to National Grid and DEC of any application to change the current Property Use.
SMP Implementation	✓		✓	Review and comment, as necessary		The DEC recommends the owner(s) of the above referenced properties or their representatives to implement the Site Management Plan for any ground intrusive work that will disturb soil below an elevation of 1.5 feet above mean sea level.
Vegetable Gardens and Farming on Common Grounds	✓		✓	Review and comment, as necessary		The DEC recommends the owner(s) of the above referenced properties or their representatives to provide at a minimum 15-business days notice to National Grid and DEC prior to use of a portion or all of the property for vegetable gardens and/or farming.

Table 10. Monitoring and Inspection Schedule
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Monitoring Program	Frequency*	Matrix	Analysis
Soil Cover System	Annually	Cap	Inspection
Composite Cover System	Annually	Cap	Inspection
Monitored Natural Attenuation	Semi-Annually	Groundwater	BTEX, PAHs
Passive DNAPL Recovery System	Quarterly	DNAPL	None
Excavation	Prior to Disposal	Soil	Disposal Facility Parameters
Dewatering	Prior to Disposal	Water	Disposal Facility Parameters
18 Bridge Street Property Irrigation Well	Semi-Annually	Groundwater	BTEX, PAHs

***The frequency of events will be conducted as specified until otherwise approved by NYSDEC and NYSDOH**

Notes:

DNAPL = Dense Nonaqueous Phase Liquid
NYSDEC = New York State Department of Environmental Conservation
NYSDOH = New York State Department of Health
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes
PAHs = Polycyclic Aromatic Hydrocarbons

Table 11. Monitoring Well Construction Details
Site Management Plan
Sag Harbor Former MGP Site
National Grid

Monitoring Well I.D.	Well Construction			Depth of Well (ft bgs)	Screen Type	Screen Slotted (inches) size/ diameter	Screen Interval (ft bgs)	Ground Surface (ft msl)
	Protective Casing	Well Type	Diameter (Inches)					
SHMW-01SR	Flush-Mount	PVC	1.0	6.00	Slotted PVC	0.020/1.00	1.0 - 6.0	3.99
SHMW-01IR	Flush-Mount	PVC	1.0	47.00	Slotted PVC	0.020/1.00	35.0 - 45.0	3.96
SHMW-01D	Flush-Mount	PVC	1.0	75.00	Slotted PVC	0.020/1.00	65.0 - 75.0	3.78
SHMW-02S	Flush-Mount	PVC	1.0	6.00	Slotted PVC	0.020/1.00	1.0 - 6.0	4.21
SHMW-02IR	Flush-Mount	PVC	4.0	39.00	Slotted PVC	0.020/4.00	27.0 - 37.0	4.32
SHMW-02DR	Flush-Mount	PVC	1.0	75.00	Slotted PVC	0.020/1.00	65.0 - 75.0	4.14
SHMW-03S	Flush-Mount	PVC	2.0	14.00	Slotted PVC	0.020/2.00	2.0 - 12.0	5.23
SHMW-03I	Flush-Mount	PVC	2.0	48.00	Slotted PVC	0.020/2.00	35.0 - 45.0	5.27
SHMW-04SR	Flush-Mount	PVC	4.0	14.00	Slotted PVC	0.020/4.00	2.0 - 12.0	4.43
SHMW-05SR	Flush-Mount	PVC	1.0	12.00	Slotted PVC	0.020/1.00	2.0 - 12.0	5.31
SHMW-05IR	Flush-Mount	PVC	1.0	45.00	Slotted PVC	0.020/1.00	35.0 - 45.0	5.42
SHMW-07SR	Flush-Mount	PVC	1.0	11.00	Slotted PVC	0.020/1.00	1.0 - 11.0	3.81
SHMW-07IR	Flush-Mount	PVC	1.0	45.00	Slotted PVC	0.020/1.00	35.0 - 45.0	3.74
SHMW-08S	Flush-Mount	PVC	2.0	12.00	Slotted PVC	0.020/2.00	1.0 - 7.0	5.26
SHMW-08I	Flush-Mount	PVC	2.0	48.00	Slotted PVC	0.020/2.00	35.0 - 45.0	5.08
SHMW-09S	Flush-Mount	PVC	2.0	12.00	Slotted PVC	0.020/2.00	2.0 - 12.0	4.36
SHMW-09I	Flush-Mount	PVC	2.0	48.00	Slotted PVC	0.020/2.00	35.0 - 45.0	4.41
SHMW-10S	Flush-Mount	PVC	1.0	15.00	Pre-Packed	20/40 Mesh	5.00 - 15.00	5.91
SHMW-10I	Flush-Mount	PVC	1.0	45.50	Pre-Packed	20/40 Mesh	35.0 - 45.0	5.89
SHMW-11S	Flush-Mount	PVC	1.0	13.50	Pre-Packed	20/40 Mesh	3.50 - 15.50	5.74
SHMW-11I	Flush-Mount	PVC	1.0	45.00	Pre-Packed	20/40 Mesh	35.0 - 45.0	5.79
SHMW-12S	Flush-Mount	PVC	1.0	6.50	Pre-Packed	20/40 Mesh	1.50 - 6.50	3.42
SHMW-12I	Flush-Mount	PVC	1.0	45.00	Pre-Packed	20/40 Mesh	35.0 - 45.0	3.29
SHMW-13S	Flush-Mount	PVC	1.0	6.50	Pre-Packed	20/40 Mesh	1.50 - 6.50	4.68
SHMW-13I	Flush-Mount	PVC	1.0	45.00	Pre-Packed	20/40 Mesh	35.0 - 45.0	4.70

Notes:
ft bgs = feet below ground surface
ft msl = feet below mean sea level
PVC = Polyvinyl Chloride

FIGURES

SOURCE:
Map created with TOPO! ® © 2001 National Geographic
(www.nationalgeographic.com/topo)

0 2000 4000
SCALE: 1" = 2000'

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

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SITE LOCATION MAP

Project 1702897

May 2020

Fig. 1

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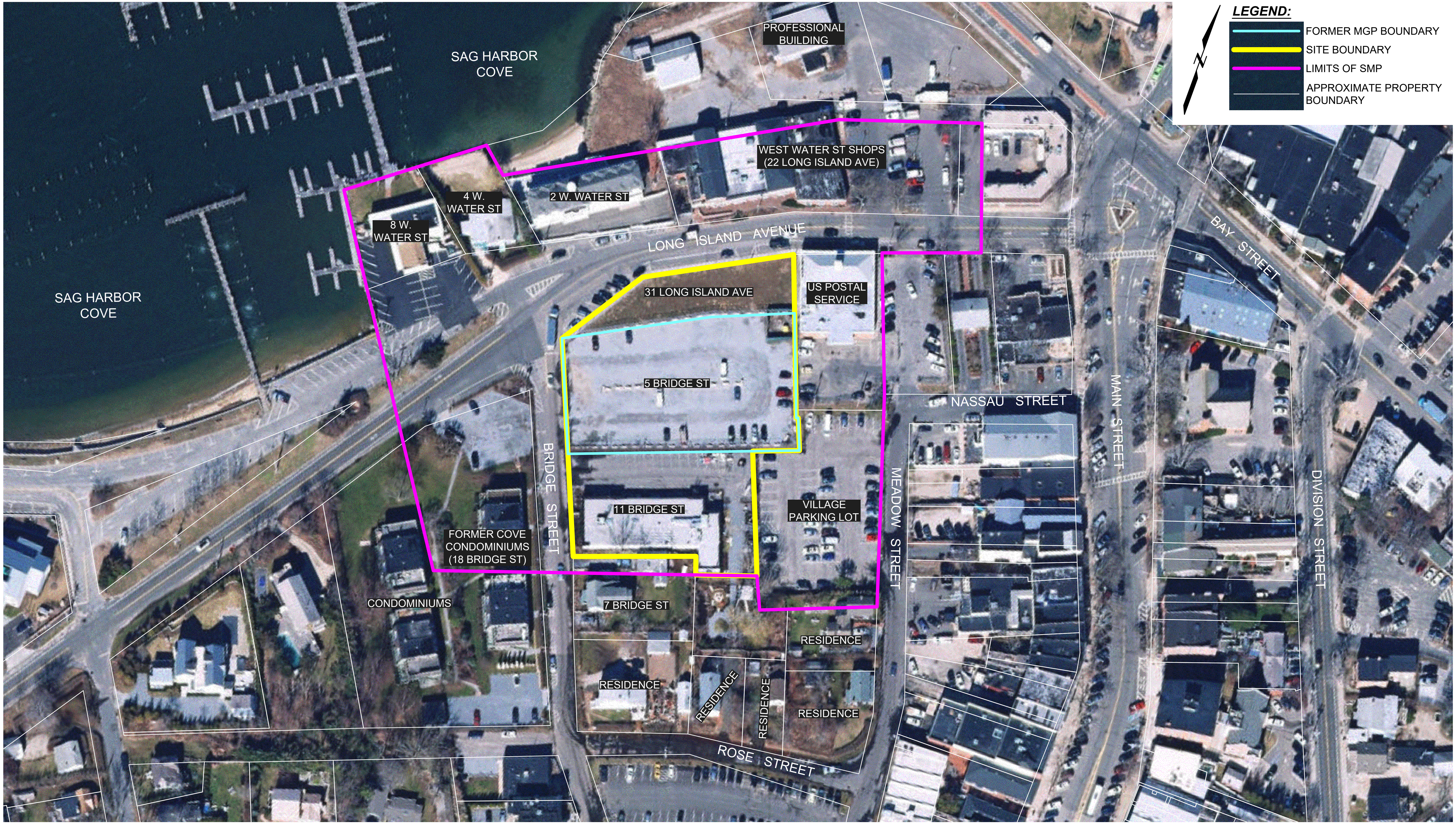

SOURCES:

1. AERIAL IMAGERY DATE: 02/26/2016, OBTAINED FROM WORLD IMAGERY LAYER ACCESSED VIA ARCGIS ONLINE.
2. *SAG HARBOR SITE MANAGEMENT PLAN FIGURE 1-2: SITE LAYOUT MAP,* PREPARED BY AECOM, DATE: 2/18/11.

0 100 200

SCALE: 1" = 100'

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

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SITE LAYOUT MAP

Project 1702897

May 2020

Fig. 2

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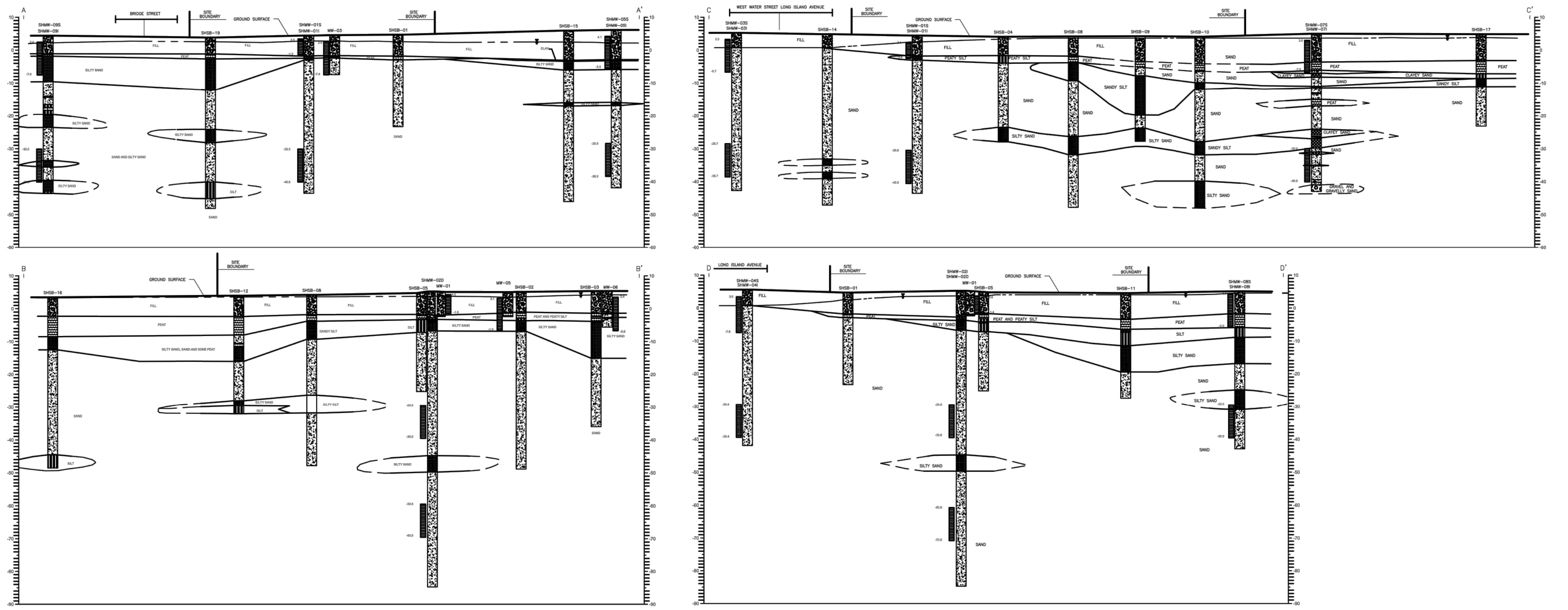
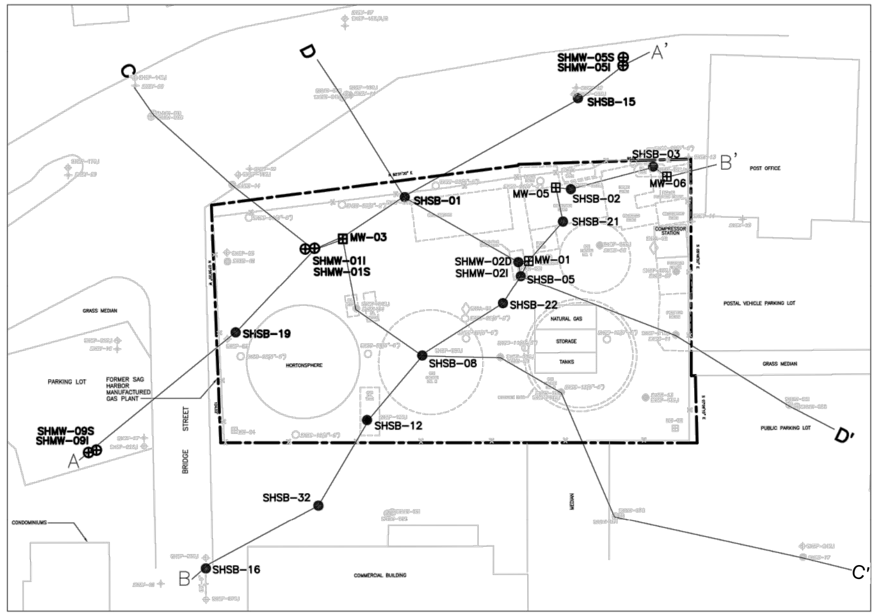
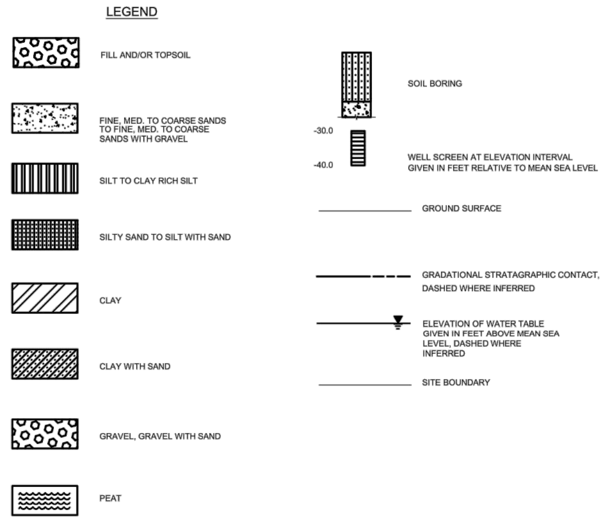




KEY MAP
SHOWING CROSS-SECTION LINES
SCALE: 1" = 100'



0 80 160

SCALE: 1" = 80'
VERTICAL EXAGGERATION = 2X

SOURCE:
SAG HARBOR SITE MANAGEMENT PLAN FIGURE 1-3: GEOLOGIC CROSS SECTION, PREPARED BY AECOM, DATE: 2/18/11.

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Sag Harbor, New York

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GEOLOGIC CROSS SECTIONS

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Fig. 3

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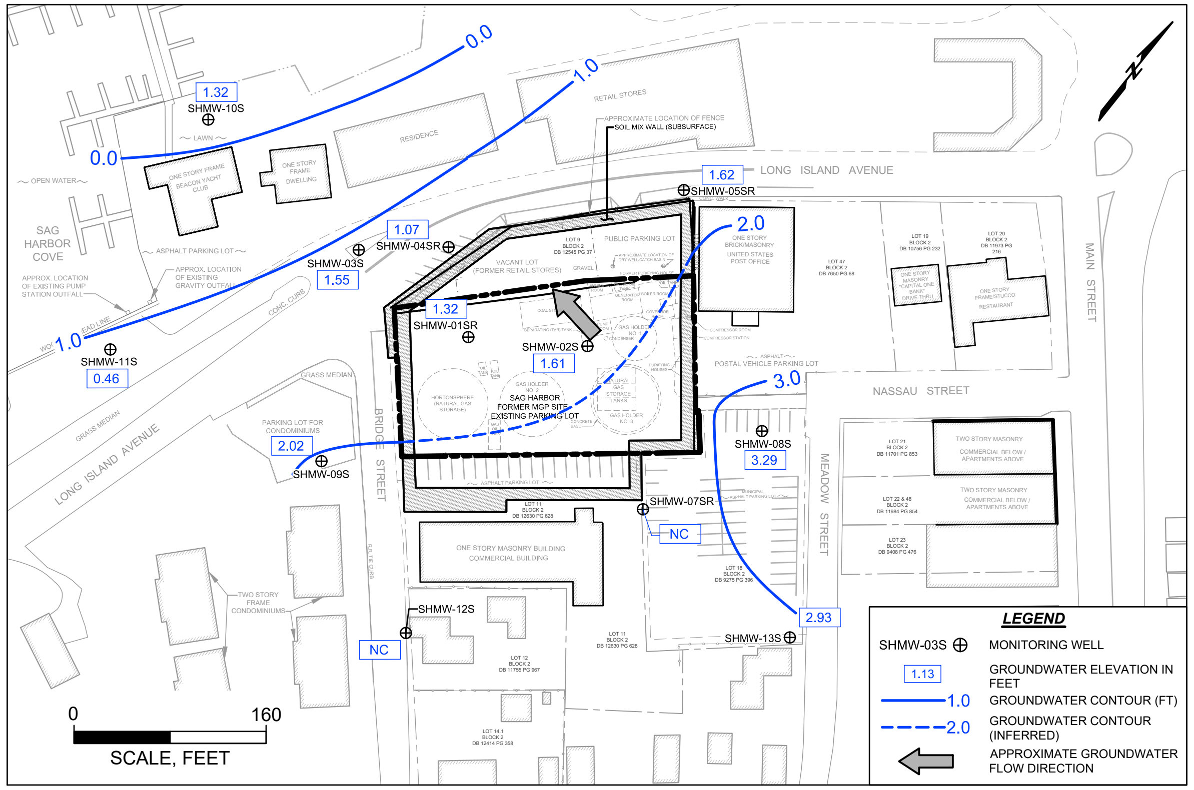
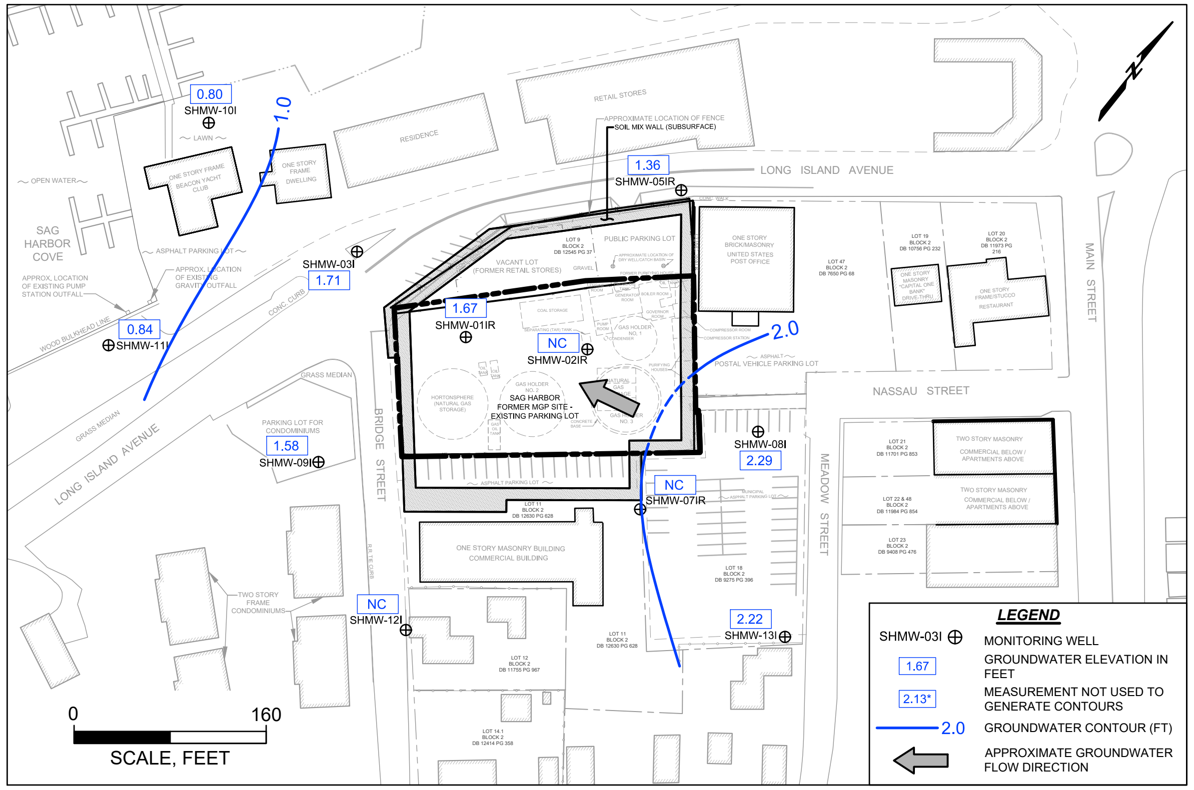
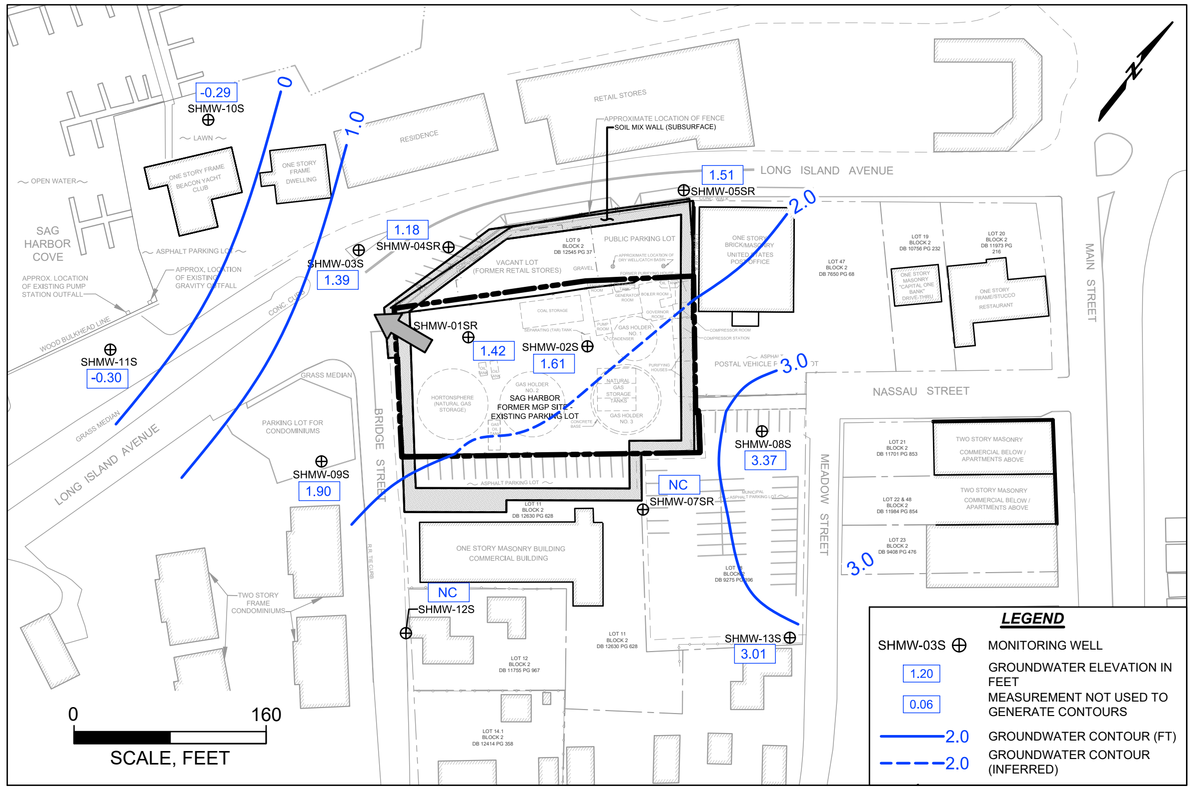
LEGEND	
⬚	MGP STRUCTURE APPROXIMATE LOCATION OF FORMER
▨	LOCATION OF EXISTING STRUCTURE
━ ━ ━	CURRENT SITE BOUNDARY
— · —	ADJACENT SITE BOUNDARY
—×—×—	CHAIN-LINK FENCE
—○—○—	STOCKADE FENCE



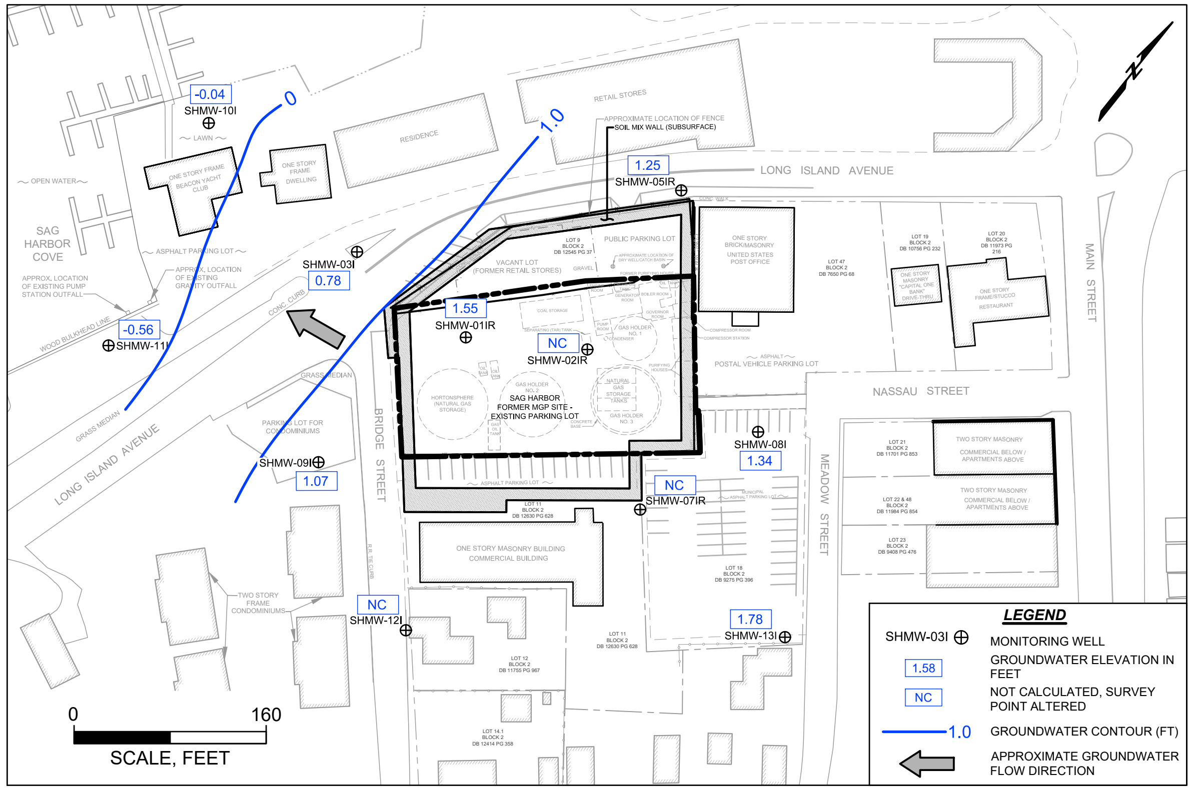
SHALLOW GROUNDWATER CONTOUR MAP
HIGH TIDE - MARCH 28, 2022



INTERMEDIATE GROUNDWATER CONTOUR MAP
HIGH TIDE - MARCH 28, 2022



SHALLOW GROUNDWATER CONTOUR MAP
LOW TIDE - MARCH 28, 2022



INTERMEDIATE GROUNDWATER CONTOUR MAP
LOW TIDE - MARCH 28, 2022

SOURCES:

1. *FIG 3: SHALLOW GROUNDWATER CONTOURS - HIGH TIDE 3/28/2022,* PREPARED BY GEI CONSULTANTS, INC., DATE: APRIL 2023.
2. *FIG 4: SHALLOW GROUNDWATER CONTOURS - LOW TIDE 3/28/2022,* PREPARED BY GEI CONSULTANTS, INC., DATE: APRIL 2023.
3. *FIG 5: INTERMEDIATE GROUNDWATER CONTOURS - HIGH TIDE 3/28/2022,* PREPARED BY GEI CONSULTANTS, INC., DATE: APRIL 2023.
4. *FIG 4: INTERMEDIATE GROUNDWATER CONTOURS - LOW TIDE 3/28/2022,* PREPARED BY GEI CONSULTANTS, INC., DATE: APRIL 2023.

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

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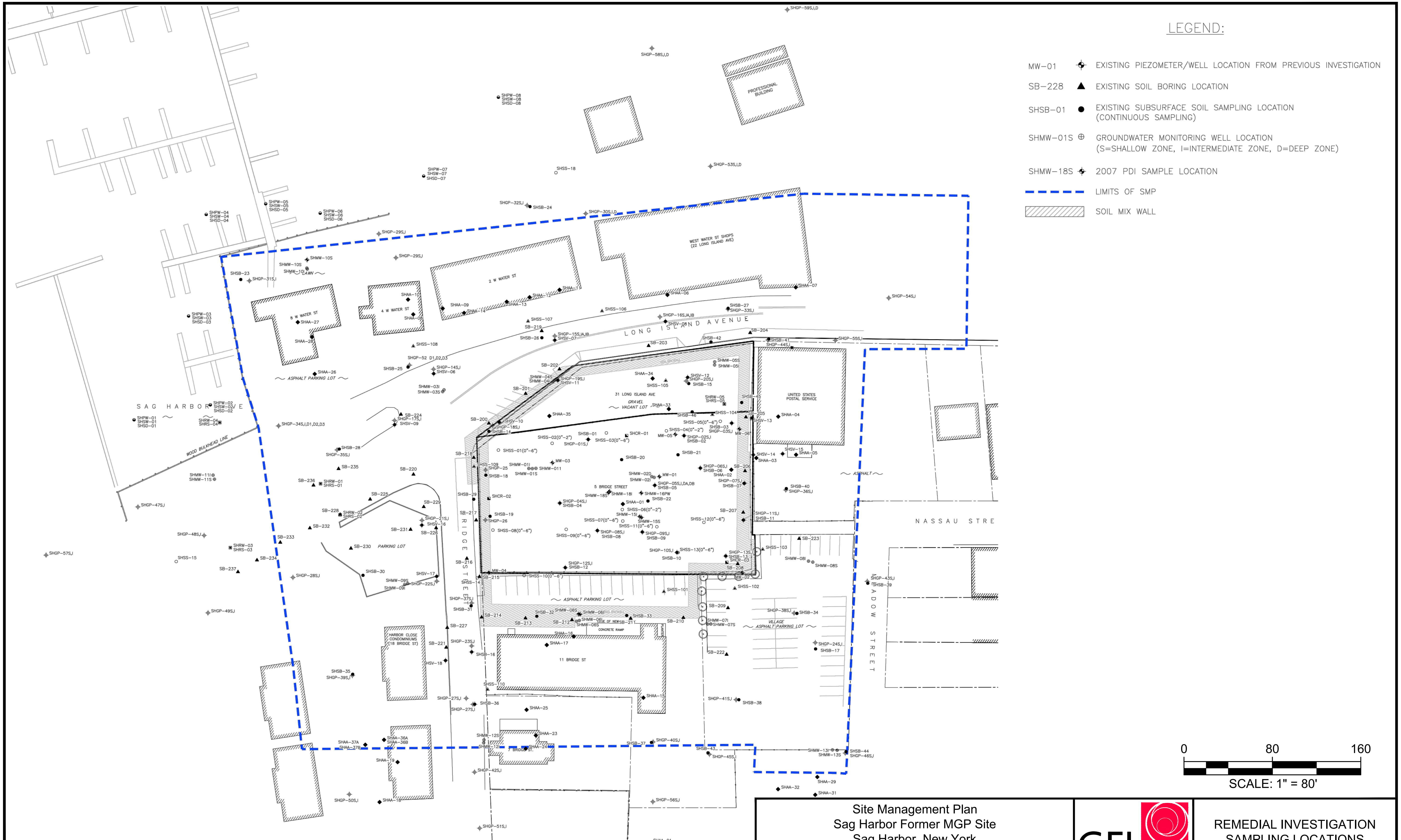
GROUNDWATER CONTOURS

Project 1905774
April 2023
Fig. 4

\\Gtb-pzcc-1\ I:\Tech\Environmental Projects\National Grid\OMM Downstate\13 Sites\Sag Harbor\SMP\SMP Update\2022 Revs\1905774 SMP FIG 4.dwg - 4/28/2023



SOURCE:

SAG HARBOR SITE MANAGEMENT PLAN FIGURE 1-5: REMEDIAL INVESTIGATION SAMPLING LOCATIONS, PREPARED BY AECOM, DATE: 2/18/11.

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Sag Harbor, New York

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REMEDIAL INVESTIGATION
SAMPLING LOCATIONS

Project 1702897 | May 2020 | Fig. 5

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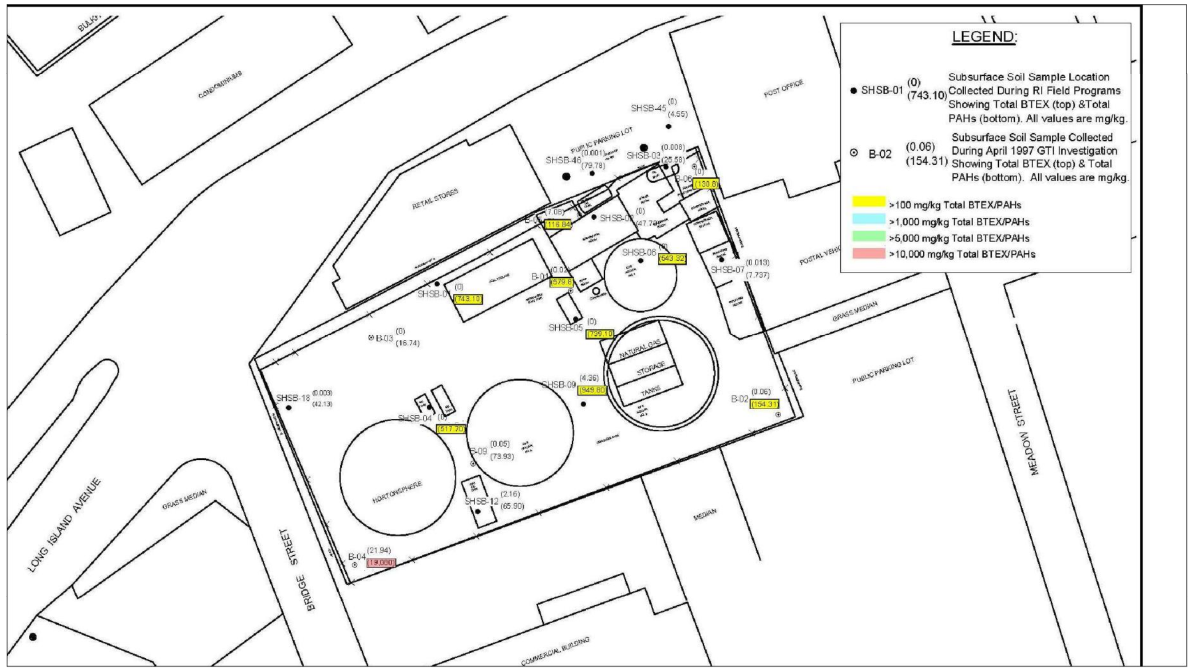
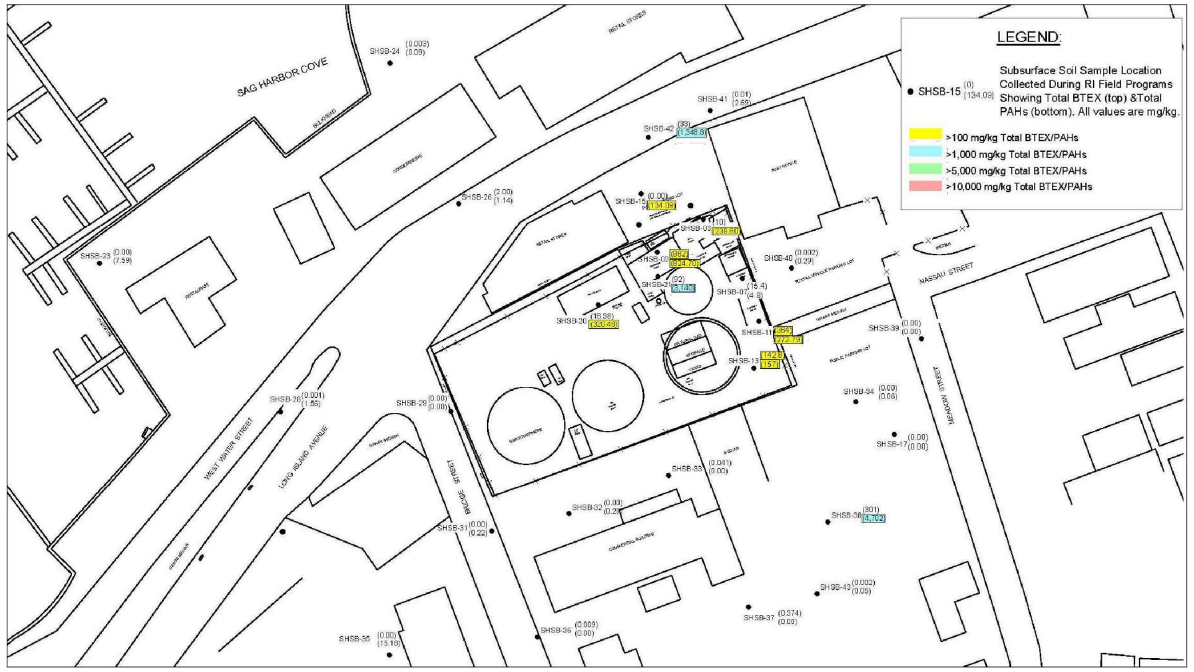
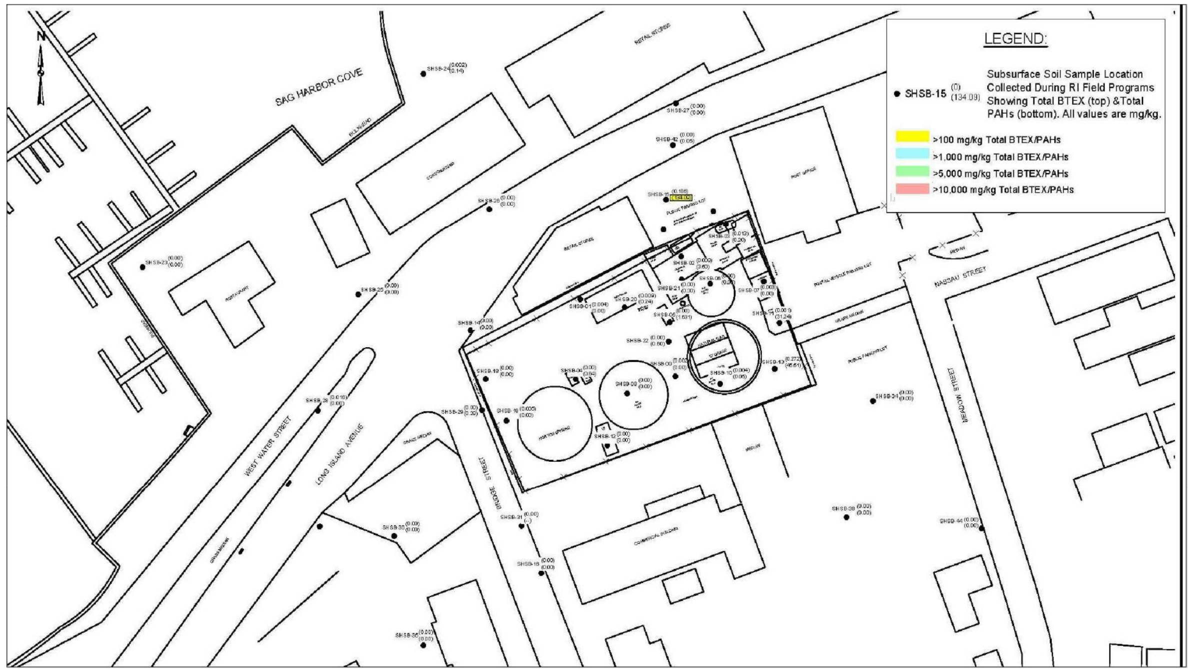


TOTAL BTEX/PAHs IN SHALLOW SUBSURFACE SOIL
(0-2 FEET)

TOTAL BTEX/PAHs IN SHALLOW SUBSURFACE SOIL
(2-8 FEET)



TOTAL BTEX/PAHs IN INTERMEDIATE SUBSURFACE SOIL
(8-18 FEET)



TOTAL BTEX/PAHs IN DEEP SUBSURFACE SOIL
(GREATER THAN 18 FEET)

SOURCE:
SAG HARBOR SITE MANAGEMENT PLAN FIGURE 1-6:
PRE-REMEDIAL IACTION EXTENT OF MGP RAR CONTAMINATION
IN SOILS, PREPARED BY AECOM, DATE: 2/20/14.

NOT TO SCALE

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

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PRE-REMEDIAL ACTION
EXTENT OF TAR
IMPACTS IN SOIL

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May 2020
Fig. 6

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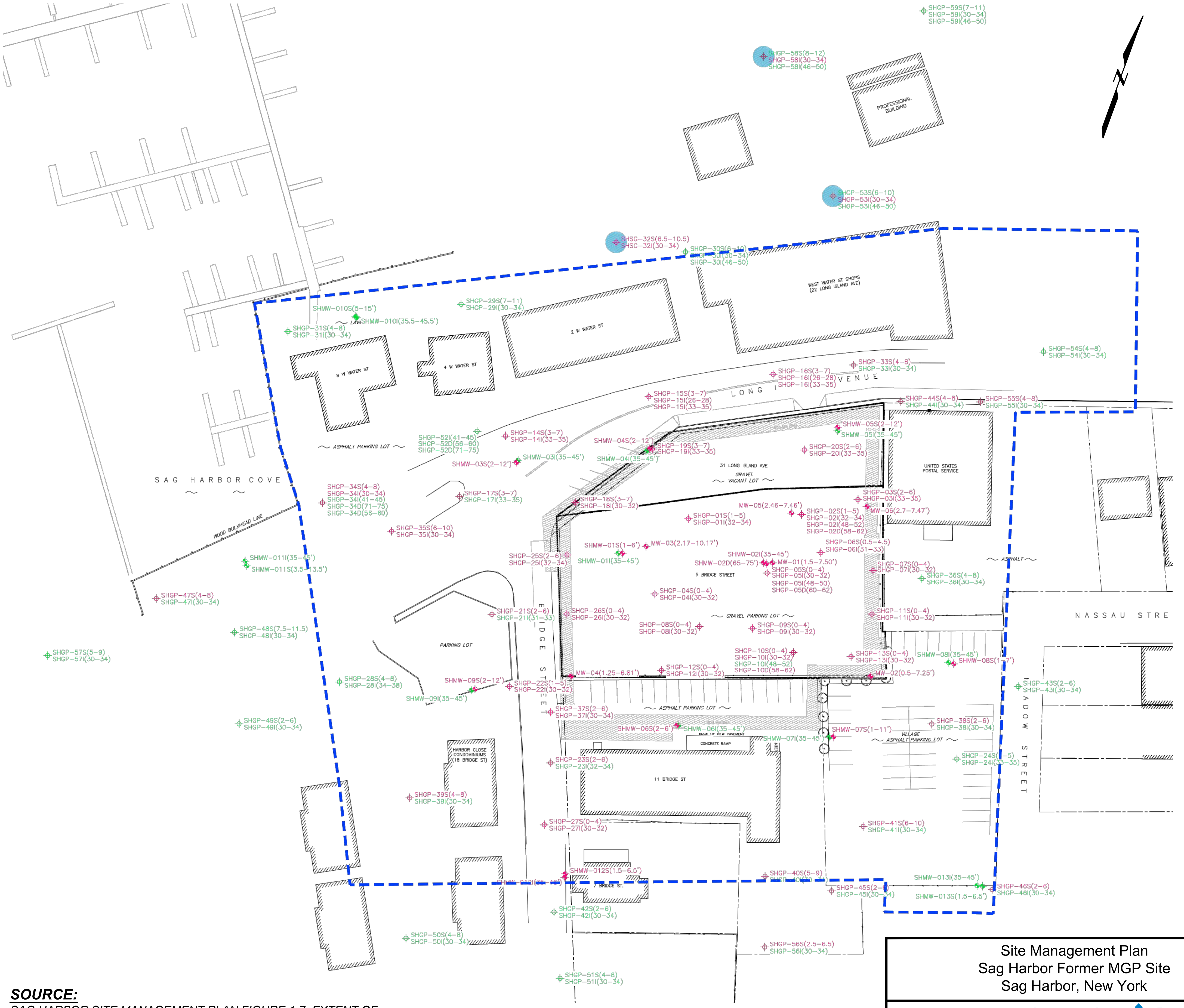

LEGEND:

SHMW–010S(5–15')	PIEZOMETER/WELL LOCATION (SAMPLE DEPTH)
SHGP–54I(30–34)	GROUNDWATER PROBE LOCATION (SAMPLE DEPTH) (S=SHALLOW ZONE, I=INTERMEDIATE ZONE, D=DEEP ZONE)
SHGP–33S(4–8)	PIEZOMETER/WELL OR GROUNDWATER PROBE ANALYTICAL SAMPLE EXCEEDS NYSDEC CLASS GA GROUNDWATER STANDARDS (SHOWN IN RED)
SHGP–54I(30–34)	PIEZOMETER/WELL OR GROUNDWATER PROBE ANALYTICAL SAMPLE DOES NOT EXCEED NYSDEC CLASS GA GROUNDWATER STANDARDS (SHOWN IN GREEN)
●	SUSPECTED FUEL IMPACTS NOT ASSOCIATED WITH MGP OPERATIONS OR RESIDUALS
– – –	LIMITS OF SMP
▨	SOIL MIX WALL

0 80 160

SCALE: 1" = 80'

SOURCE:

SAG HARBOR SITE MANAGEMENT PLAN FIGURE 1-7: EXTENT OF GROUNDWATER CONTAMINATION, PREPARED BY AECOM, DATE: 2/18/11.

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Sag Harbor Former MGP Site
Sag Harbor, New York

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PRE-REMEDIAL ACTION
EXTENT OF
GROUNDWATER IMPACTS

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May 2020

Fig. 7

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SOURCE:
SAG HARBOR SITE MANAGEMENT PLAN
FIGURE 1-8: EXTENT OF REMEDIAL ACTION,
PREPARED BY AECOM, DATE: 2/18/11.

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

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EXTENT OF REMEDIAL ACTION

Project 1702897
May 2020
Fig. 8

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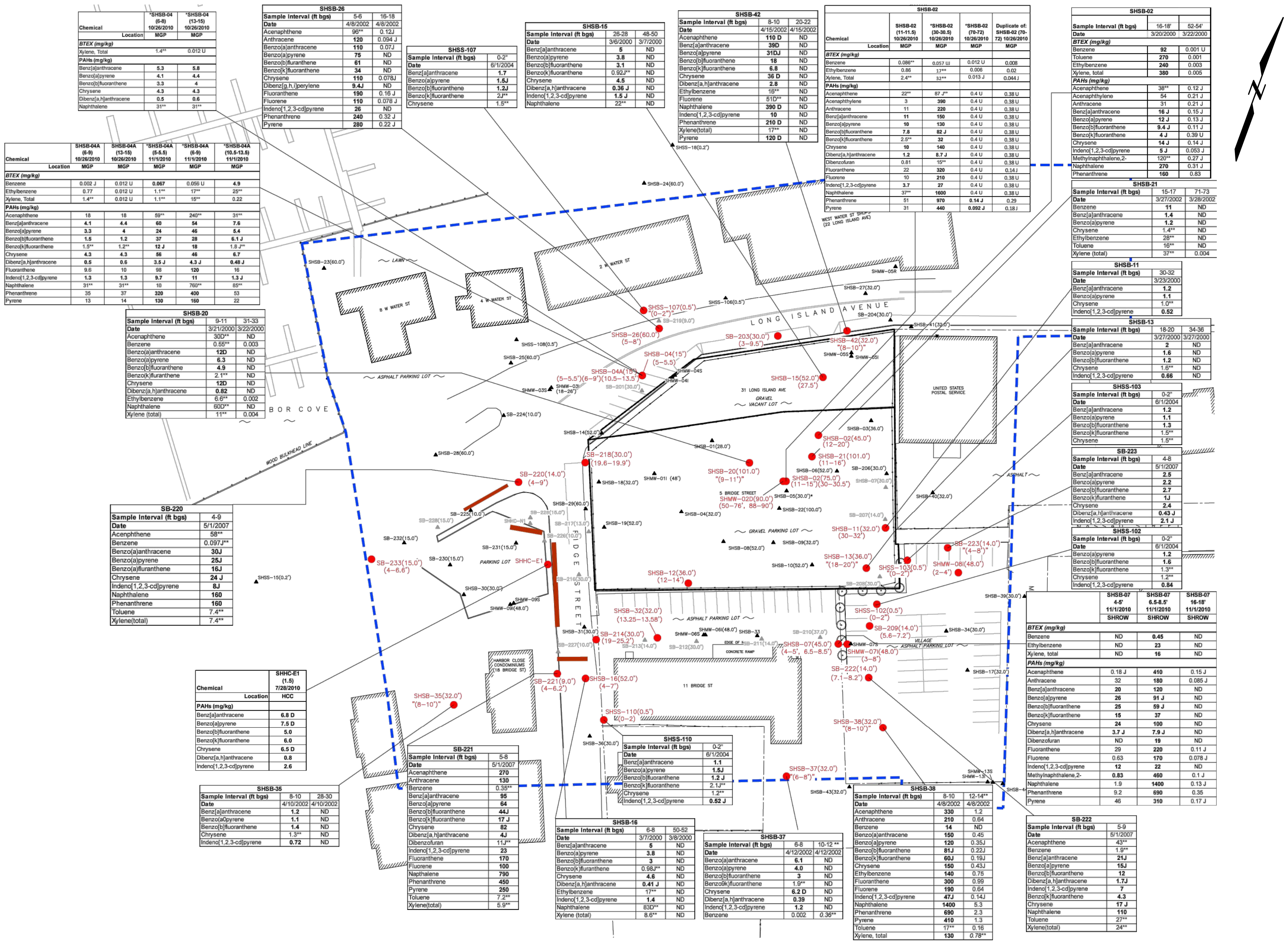
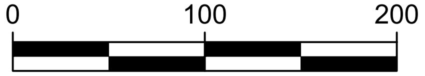


SHMW-10S ▲	SOIL BORING LOCATION
●	SOIL BORING LOCATION WITH VISUAL OBSERVATION OF CONTAMINATION AND/OR EXCEEDANCES OF THE NYSDEC RESTRICTED USE RESIDENTIAL SOIL CLEANUP OBJECTIVES (mg/kg) (SEE NOTE)
SHSB-20(101.0')	BORING ID (TOTAL DEPTH)
(9-11')	DEPTH INTERVAL IN FEET BGS WHERE VISUAL IMPACTS WERE OBSERVED (SEE NOTE)
ND	NOT DETECTED
J	ESTIMATED VALUE
B	VALUE IS GREATER THAN CRDL, BUT LESS THAN OR EQUAL TO IDL
D	COMPOUND QUATITATED ON A DILUTED SAMPLE
**	EXCEEDANCES FOR THE NYSDEC UNRESTRICTED USE SOIL CLEANUP OBJECTIVES (mg/kg)
BOLD	EXCEEDANCES FOR THE NYSDEC RESTRICTED USE RESIDENTIAL SOIL CLEANUP OBJECTIVES (mg/kg)
━━	LOCATION OF VISUAL IMPACTS OBSERVED DURING REMEDIAL ACTION IMPLEMENTATION
SB-226(10.0') ▲	SOIL SAMPLES NOT COLLECTED AT THIS LOCATION
– – – –	LIMITS OF SMP
▨	SOIL MIX WALL

NOTE: DEPTH INTERVAL WITH A "" INDICATE ONLY EXCEEDANCE OF THE NYSDEC RESTRICTED USE RESIDENTIAL SOIL CLEANUP OBJECTIVES. NO VISUAL CONTAMINATION OBSERVED AT THESE LOCATIONS.

* SAMPLE COLLECTED FROM SHSB-02D LOCATION, REPORTED IN SHSB-05 LOCATION

Chemical	6NYCRR Part 375 Track 1 UNRESTRICTED USE	6NYCRR Part 375 Track 4 RESTRICTED USE RESIDENTIAL
BTEX (mg/kg)		
Benzene	0.06	4.8
Toluene	0.7	100
Ethylbenzene	1	41
Xylene, total	0.26	100
PAHs (mg/kg)		
Acenaphthene	20	100
Acenaphthylene	100	100
Anthracene	100	100
Benz[a]anthracene	1	1
Benzo[a]pyrene	1	1
Benzo[b]fluoranthene	1	1
Benzo[g,h,i]perylene	100	100
Benzo[k]fluoranthene	0.8	3.9
Chrysene	1	3.9
Dibenz[a,h]anthracene	0.33	0.33
Dibenzofuran	7	59
Fluoranthene	100	100
Fluorene	30	100
Indeno[1,2,3-cd]pyrene	0.5	0.5
Methylnaphthalene,2-	NE	NE
Naphthalene	12	100
Phenanthrene	100	100
Pyrene	100	100



SCALE: 1" = 100'

SOURCE:

SAGA HARBOR SITE MANAGEMENT PLAN FIGURE 1-9: EXTENT OF REMAINING CONTAMINATION IN SOILS, PREPARED BY AECOM, DATE: 2/21/14.

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

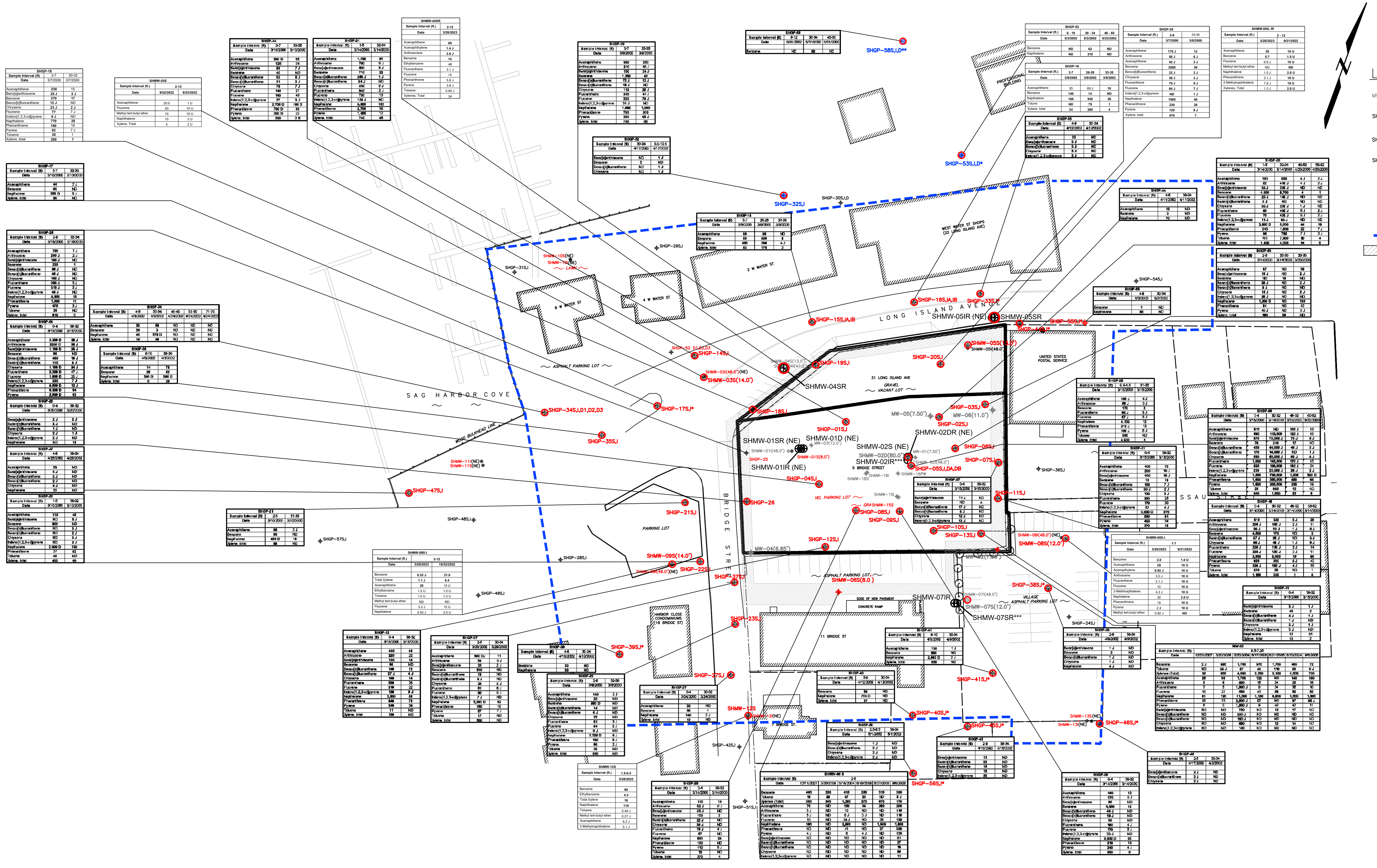
nationalgrid

GEI Consultants

EXTENT OF REMAINING
SOIL IMPACTS

Project 1702897 | May 2020 | Fig. 9

\\GTB2L-PHERI I:\Project\National Grid\Sag Harbor\CAD\Figures\SMP\1702897_SMP_RSIM.dwg - 8/29/2019



LEGEND:

MW–01 ⌖	ABANDONED PIEZOMETER/WELL LOCATION FROM PREVIOUS INVESTIGATION
SHMW–03S ⊕	GROUNDWATER MONITORING WELL LOCATION (S,I, OR D DESIGNATES DEPTH ZONE)
SHMW–18S ⌖	2007 PDI SAMPLE LOCATION
SHGP–01S ⌖	GROUNDWATER PROBE LOCATION (S,I, OR D DESIGNATES DEPTH ZONE)
R	REPLACEMENT WELL
(NE)	NO EXCEEDANCES IN THE PREVIOUS TWO SAMPLING EVENTS
***	NAPL PRESENT IN WELL
▬ ▬ ▬	LIMITS OF SMP
▨	SOIL MIX WALL
SHGP–39S,I* ⊕	GROUNDWATER SAMPLE EXCEEDS NYSDEC CLASS GA GW CRITERIA
*	EXCEEDANCES IN SHALLOW AQUIFER ZONE ONLY
**	EXCEEDANCES IN INTERMEDIATE AQUIFER ZONE ONLY
SHGP–32I,S ⊕	SUSPECTED FUEL IMPACTS NOT ASSOCIATED WITH MGP OPERATIONS OR RESIDUALS
ND	NOT DETECTED
J	ESTIMATED VALUE
B	VALUE IS GREATER THAN CRDL, BUT LESS THAN OR EQUAL TO IDL
D	COMPOUND QUANTITATED ON A DILUTED SAMPLE

	NYSDEC Class GA Groundwater Criteria (ug/L)
Acenaphthene	20
Anthracene	50
Benz[a]anthracene	0.002
Benzene	1
Benzo[b]fluoranthene	0.002
Benzo[k]fluoranthene	0.002
Chrysene	0.002
Fluoranthene	50
Fluorene	50
Indeno[1,2,3-cd]pyrene	0.002
Napthalene	10
Napthalene	10
Phenanthrene	50
Pyrene	50
Toluene	5
Xylens (Total)	5

0 100 200

SCALE: 1" = 100'

SOURCE:

SAG HARBOR SITE MANAGEMENT PLAN FIGURE 1-10: EXTENT OF REMAINING CONTAMINATION IN GROUNDWATER, PREPARED BY AECOM, DATE: 2/18/11.

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

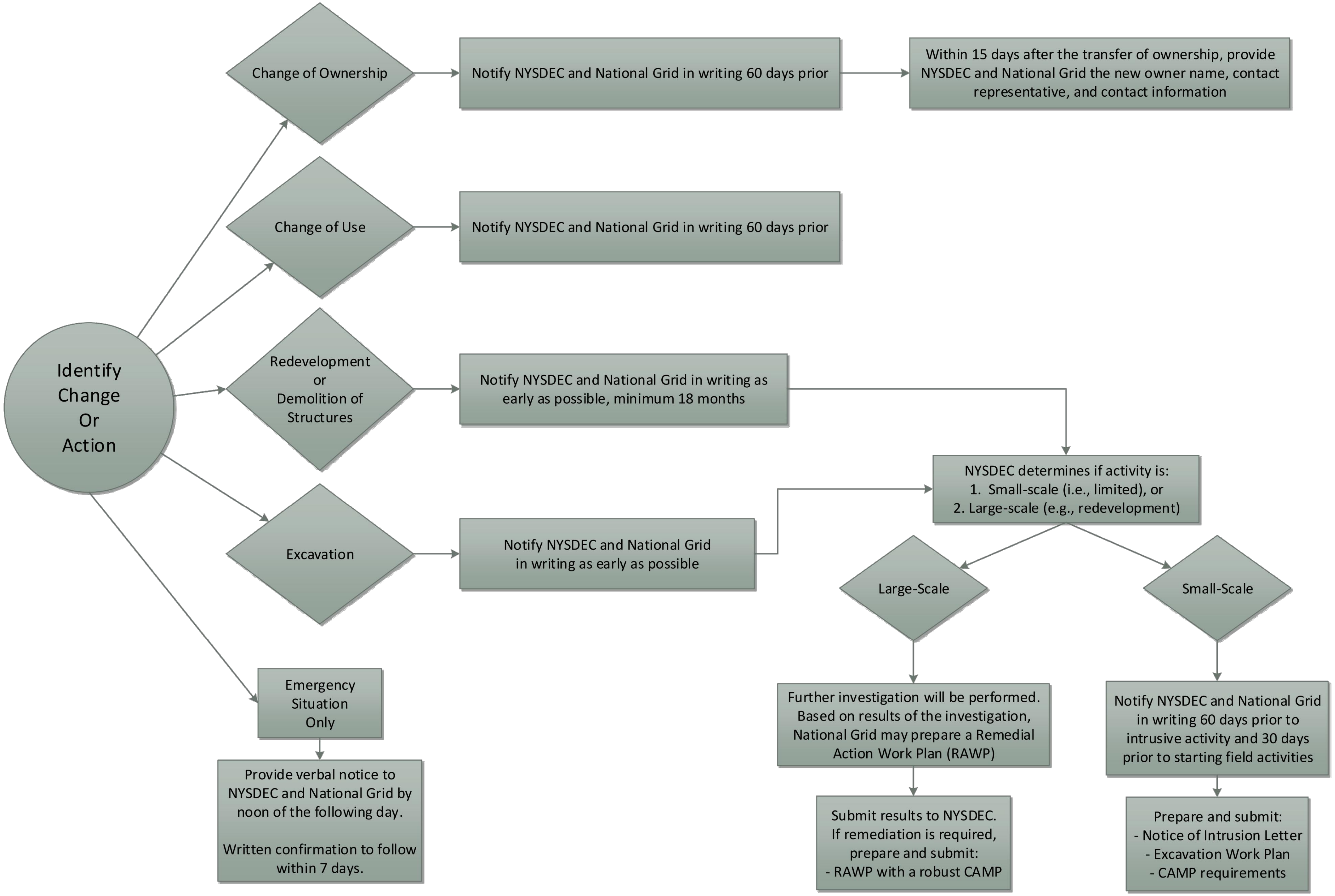
nationalgrid

GEI Consultants

EXTENT OF REMAINING GROUNDWATER IMPACTS

Project 1905774
April 2023
Fig. 10

\\Gtb-pzcc-1\ I:\Tech\Environmental Projects\National Grid\OMM Downstate\13 Sites\Sag Harbor\SMP\SMP Update\2022 Revs\1905774 SMP FIG 10.dwg - 4/28/2023



Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

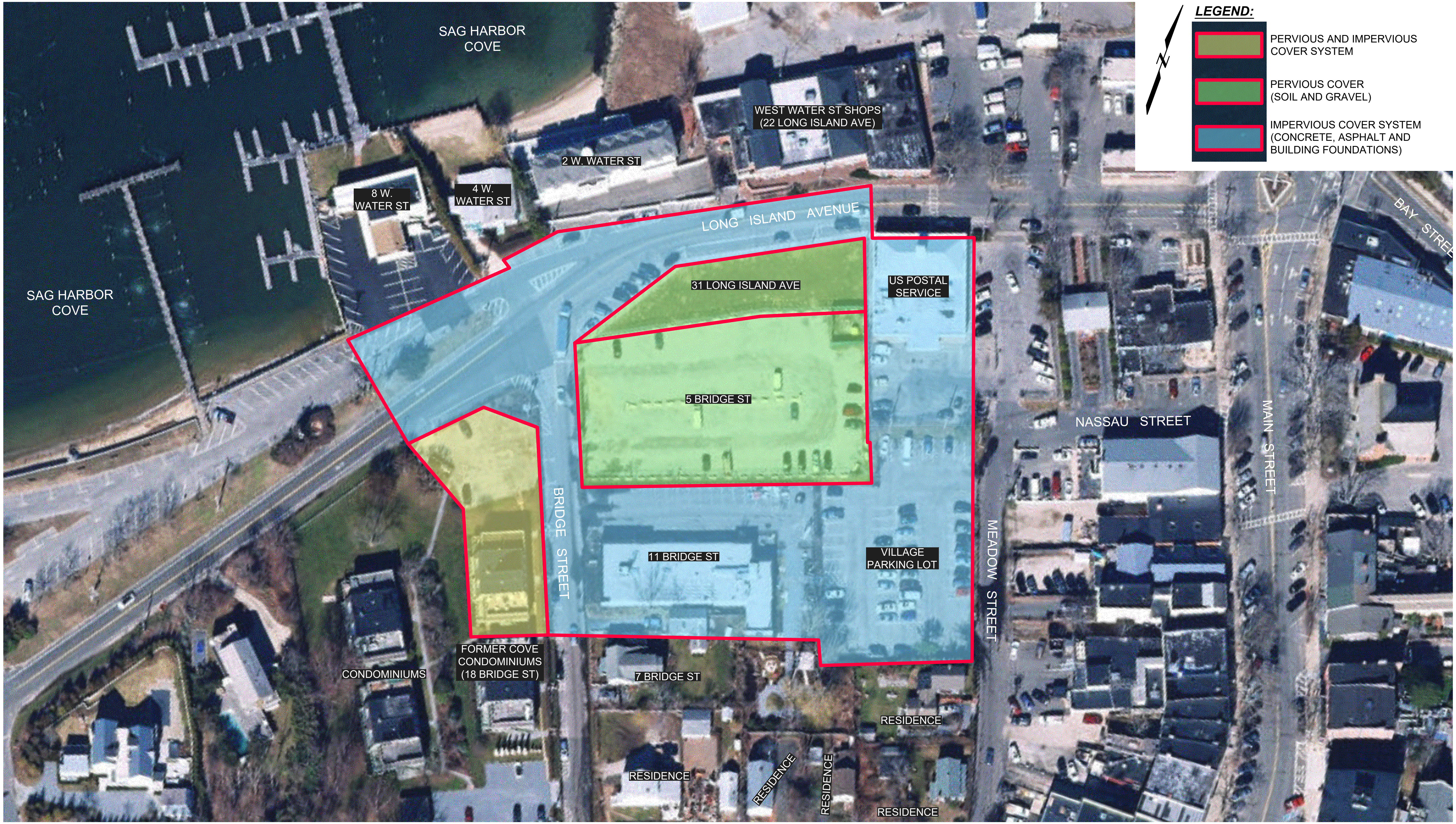
nationalgrid

GEI Consultants

PROPERTY OWNER DECISION TREE FOR INTRUSIVE ACTIVITIES ON-SITE

Project 1702897 | May 2020 | Fig. 11

\\GTB2L-PHERI I:\Project\National Grid\Sag Harbor\CAD\Figures\SMP\1702897_SMP_DECT.dwg - 8/29/2019



SOURCES:

1. AERIAL IMAGERY DATE: 02/26/2016, OBTAINED FROM WORLD IMAGERY LAYER ACCESSED VIA ARCGIS ONLINE.
2. *SAG HARBOR SITE MANAGEMENT PLAN FIGURE 2-12: SOIL AND COMPOSITE COVER SYSTEM LOCATIONS*, PREPARED BY AECOM, DATE: 2/18/11.

0 80 160

SCALE: 1" = 80'

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

nationalgrid

GEI Consultants

ENGINEERING CONTROL LOCATIONS (COVER SYSTEM)

Project 1702897	May 2020	Fig. 12

\\gtb1v-fs01\ I:\Project\National Grid\Sag Harbor\CAD\Figures\SMP\1702897_SMP_ENGR.dwg - 9/16/2019

SOURCES:

1. AERIAL IMAGERY DATE: 02/26/2016, OBTAINED FROM WORLD IMAGERY LAYER ACCESSED VIA ARCGIS ONLINE.
2. *SAG HARBOR SITE MANAGEMENT PLAN FIGURE 1-2: SITE LAYOUT MAP,* PREPARED BY AECOM, DATE: 2/18/11.

0 100 200

SCALE: 1" = 100'

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

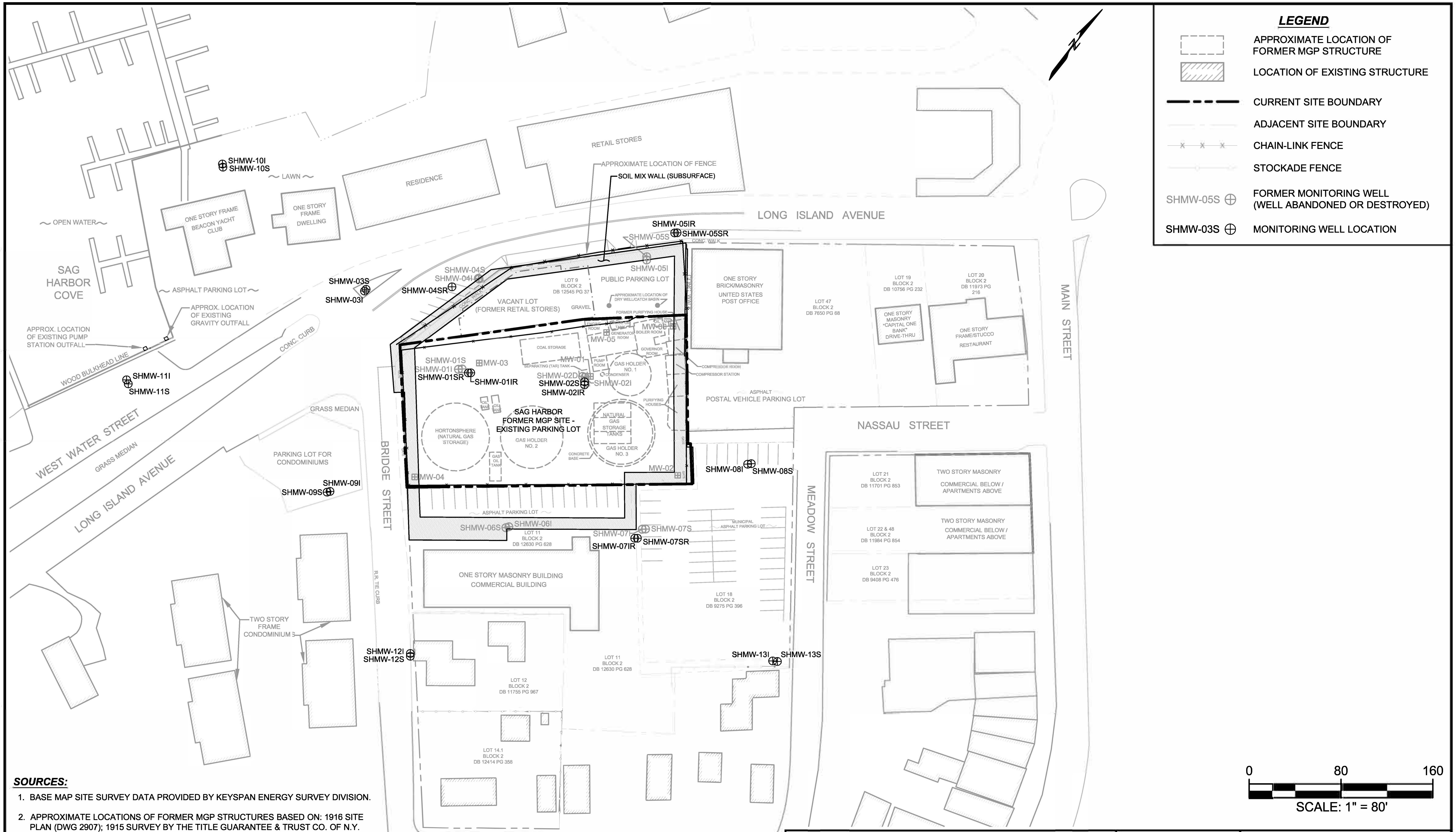
nationalgrid

GEI Consultants

INSTITUTIONAL CONTROL BOUNDARIES

Project 1702897 | May 2020 | Fig. 13

\\gtb1v-fs01\ I:\Project\National Grid\Sag Harbor\CAD\Figures\SMP\1702897_SMP_INCT.dwg - 8/29/2019



LEGEND

⬚	APPROXIMATE LOCATION OF FORMER MGP STRUCTURE
▨	LOCATION OF EXISTING STRUCTURE
━ ━ ━	CURRENT SITE BOUNDARY
— — —	ADJACENT SITE BOUNDARY
—x—x—x—	CHAIN-LINK FENCE
—o—o—	STOCKADE FENCE
SHMW-05S ⊕	FORMER MONITORING WELL (WELL ABANDONED OR DESTROYED)
SHMW-03S ⊕	MONITORING WELL LOCATION

SOURCES:

1. BASE MAP SITE SURVEY DATA PROVIDED BY KEYSPAN ENERGY SURVEY DIVISION.
2. APPROXIMATE LOCATIONS OF FORMER MGP STRUCTURES BASED ON: 1916 SITE PLAN (DWG 2907); 1915 SURVEY BY THE TITLE GUARANTEE & TRUST CO. OF N.Y. (DWG 2290); AND SANBORN MAPS; SAG HARBOR FORMER MGP SITE DRAFT FINAL REMEDIAL INVESTIGATION REPORT, PREPARED BY DVIRKA & BARTILUCCI, DATED DECEMBER 2002.
3. ADDITIONAL SURVEY DATA FROM DRAWING TITLED *BOUNDARY AND TOPOGRAPHIC SURVEY SECTION 2, BLOCK 2, LOT 10, VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, NEW YORK* PROVIDED BY KS ENGINEERS, P.C, NEWARK, NJ., DATED 12/02/10

Site Management Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

nationalgrid

GEI

Project 1702897

MONITORING WELL
LOCATION MAP

May 2020

Fig. 14

\\gtb1v-fs01\ I:\Project\National Grid\Sag Harbor\CAD\Figures\SMP\1702897_SMP_WELL.dwg - 8/29/2019

APPENDIX A. ENVIRONMENTAL EASEMENT

CC # : C15-17376

COUNTY CLERK'S OFFICE

STATE OF NEW YORK
COUNTY OF SUFFOLK

I, JUDITH A. PASCALE, Clerk of the County of Suffolk and the Court of Record thereof do hereby certify that I have compared the annexed with the original **EASEMENT** recorded in my office on **04/30/2015** under Liber **D00012815** and Page **396** and, that the same is a true copy thereof, and of the whole of such original.

In Testimony Whereof, I have hereunto set my hand and affixed the seal of said County and Court this **04/30/2015** .

SUFFOLK COUNTY CLERK

Judith A. Pascale

JUDITH A. PASCALE

SEAL

[redacted]

SUFFOLK COUNTY CLERK
RECORDS OFFICE
RECORDING PAGE

Type of Instrument: EASEMENT
Number of Pages: 11
Receipt Number : 15-0057756
TRANSFER TAX NUMBER: 14-24151

Recorded: 04/30/2015
At: 10:08:58 AM

LIBER: D00012815
PAGE: 396

District:	Section:	Block:	Lot:
0903	002.00	02.00	009.000

EXAMINED AND CHARGED AS FOLLOWS

Deed Amount: $0.00

Received the Following Fees For Above Instrument

		Exempt			Exempt
Page/Filing	$55.00	NO	Handling	$20.00	NO
COE	$5.00	NO	NYS SRCHG	$15.00	NO
TP-584	$5.00	NO	Notation	$0.00	NO
Cert.Copies	$7.15	NO	RPT	$60.00	NO
Transfer tax	$0.00	NO	Comm.Pres	$0.00	NO
			Fees Paid	$167.15	

TRANSFER TAX NUMBER: 14-24151

THIS PAGE IS A PART OF THE INSTRUMENT
THIS IS NOT A BILL

JUDITH A. PASCALE
County Clerk, Suffolk County

1 2

Number of pages 11

RECORDED
2015 Apr 30 10:08:58 AM
JUDITH A. PASCALE
CLERK OF
SUFFOLK COUNTY
L D00012815
P 396
DT# 14-24151

This document will be public record. Please remove all Social Security Numbers prior to recording.

Deed / Mortgage Instrument	Deed / Mortgage Tax Stamp	Recording / Filing Stamps

3 FEES

Page / Filing Fee			
Handling	20. 00		
TP-584	5 –		
Notation			
EA-52 17 (County)		Sub Total	
EA-5217 (State)			
R.P.T.S.A.	60		
Comm. of Ed.	5. 00		
Affidavit			
[✓ Certified Copy] Cm	7.15		
NYS Surcharge	15. 00	Sub Total	
Other		Grand Total	167.15

Mortgage Amt.	
1. Basic Tax	
2. Additional Tax	
Sub Total	
Spec./Assit. or Spec. /Add.	
TOT. MTG. TAX	
Dual Town ___ Dual County ___	
Held for Appointment	0
Transfer Tax	
Mansion Tax	

The property covered by this mortgage is or will be improved by a one or two family dwelling only.

YES ________ or NO ________

If NO, see appropriate tax clause on page # ______ of this instrument. 4/8/15

4 Dist. 0903

2919606

0903 00200 0200 009000

Real Property Tax Service Agency Verification

P T S
R DHO A
28-APR-15

5 **Community Preservation Fund**

Consideration Amount $ 0

CPF Tax Due $

Improved ______

Vacant Land ______

TD 09

TD ______

TD ______

✓

6 Satisfactions/Discharges/Releases List Property Owners Mailing Address
RECORD & RETURN TO:

Hiscock & Barclay
One Park Place - 300 South State Street
Syracuse NY 13202

Mail to: Judith A. Pascale, Suffolk County Clerk
310 Center Drive, Riverhead, NY 11901
www.suffolkcountyny.gov/clerk

7 **Title Company Information**

Co. Name all State

Title # courtesy

8 Suffolk County Recording & Endorsement Page

This page forms part of the attached environmental easement made by:
(SPECIFY TYPE OF INSTRUMENT)

Vacs Enterprise, LLC

TO

The People of the State Of NY

The premises herein is situated in
SUFFOLK COUNTY, NEW YORK.

In the TOWN of Southampton

In the VILLAGE or HAMLET of Sag Harbor

BOXES 6 THRU 8 MUST BE TYPED OR PRINTED IN BLACK INK ONLY PRIOR TO RECORDING OR FILING.

(over)

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 8th day of APRIL, 2015, between Owner(s) VACS ENTERPRISES, LLC, having an office at c/o Mr. and Mrs. George Schiavoni, 14 Oakland Avenue, Sag Harbor, New York 11963 (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233.

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 31 Long Island Avenue in the Village of Sag Harbor, Town of Southampton, County of Suffolk and State of New York, known and designated on the tax map of the County Clerk of Suffolk as tax map parcel numbers: District: 0903 Section: 002.00 Block: 02.00 Lot: 009.000, being the same as that property conveyed to grantor by deed dated March 20, 2008 and recorded in the Suffolk County Clerk's Office in Liber 11902 at page 810. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.2625 +/- acres, and is hereinafter more fully described in the Land Title Survey dated April 05, 2013, signed and certified on August 13, 2013 prepared by Kennon Surveying Services Inc., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: D1-0002-98-11, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) 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 this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved b the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5 the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her 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

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. <u>Notice</u>. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: 152159
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. <u>Recordation</u>. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. <u>Amendment</u>. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the

Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Grantor: VACS ENTERPRISES, LLC

By: ______________________

Print Name: David Schiavoni

Title: Member Date: 4/25/14

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Suffolk)

On the 25th day of April, in the year 2014 before me, the undersigned, personally appeared David T. Schiavoni personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

____
Notary Public - State of New York

KIM A. REDMOND
NOTARY PUBLIC-STATE OF NEW YORK
No. 01RE6222292
Qualified in Suffolk County
My Commission Expires May 24, 2014

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: ___________________________
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 8th day of April, in the year 2015, before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2018

SCHEDULE "A"
ENVIRONMENTAL EASEMENT
PROPERTY DESCRIPTION

PROPERTY DESCRIPTION

DISTRICT 903 - SECTION 02 - BLOCK 02 - LOT 9
31 LONG ISLAND AVENUE
VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON
SUFFOLK COUNTY, NEW YORK

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT MARKING THE INTERSECTION OF THE SOUTHERLY SIDE OF LONG ISLAND AVENUE AND THE EASTERLY SIDE OF BRIDGE STREET:

RUNNING THENCE FROM SAID POINT OF BEGINNING ALONG THE SOUTHERLY SIDE OF LONG ISLAND AVENUE THE FOLLOWING TWO (2) COURSES AND DISTANCES:

1. NORTH 32° 45' 33" EAST 108.37 FEET,
2. NORTH 61° 31' 13" EAST 163.98 FEET TO LAND NOW OR FORMERLY UNITED STATES POSTAL SERVICE;

RUNNING THENCE SOUTH 20° 51' 57" EAST ALONG LAND NOW OR FORMERLY UNITED STATES POSTAL SERVICE 62.95 FEET TO LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION;

RUNNING THENCE ALONG LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION THE FOLLOWING TWO (2) COURSES AND DISTANCES:

1. SOUTH 67° 25' 53" WEST 90.09 FEET,
2. SOUTH 61° 52' 03" WEST 161.03 FEET TO THE POINT OF OR PLACE OF BEGINNING.

CONTAINING AN AREA OF 0.2625 ACRE.

ENVIRONMENTAL EASEMENT

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

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CONTAINING AN AREA OF 0.2625 ACRE.

Date

Kenny L. Kennon, P.L.S.
N.Y. License No. 50171

SURVEY (attached)

ENGINEERING/INSTITUTIONAL CONTROLS

- COMPLIANCE WITH THE ENVIRONMENTAL EASEMENT AND THE SMP BY THE GRANTOR AND THE GRANTOR'S SUCCESSORS AND ASSIGNS:
- ALL ENGINEERING CONTROLS MUST BE OPERATED AND MAINTAINED AS SPECIFIED IN THE SMP;
- ALL ENGINEERING CONTROLS ON THE CONTROLLED PROPERTY MUST BE INSPECTED AT A FREQUENCY AND IN A MANNER DEFINED IN THE SMP;
- GROUNDWATER, SOIL VAPOR AND OTHER ENVIRONMENTAL OR PUBLIC HEALTH MONITORING MUST BE PERFORMED AS DEFINED IN THE SMP;
- DATA AND INFORMATION PERTINENT TO SITE MANAGEMENT OF THE CONTROLLED PROPERTY MUST BE REPORTED AT THE FREQUENCY AND IN A MANNER DEFINED IN THE SMP;
- THE USE AND DEVELOPMENT OF THE SITE IS LIMITED TO COMMERCIAL AND INDUSTRIAL USE ONLY AS DESCRIBED IN 6NYCRR PART 375-1.8(G)(2)(III) & (IV);
- THE PROPERTY MAY NOT BE USED FOR A HIGHER LEVEL OF USE, SUCH AS UNRESTRICTED OR RESIDENTIAL USE WITHOUT ADDITIONAL REMEDIATION AND AMENDMENT OF THE ENVIRONMENTAL EASEMENT AS APPROVED BY THE NYSDEC;
- ALL FUTURE ACTIVITIES ON THE PROPERTY THAT WILL DISTURB REMAINING CONTAMINATED MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH THE SMP;
- THE USE OF THE GROUNDWATER UNDERLYING THE PROPERTY IS PROHIBITED WITHOUT TREATMENT RENDERING IT SAFE FOR INTENDED USE;
- THE POTENTIAL FOR VAPOR INTRUSION MUST BE EVALUATED FOR ANY BUILDINGS DEVELOPED IN THE AREA NOTED ON FIGURE (X) AND ANY POTENTIAL IMPACTS THAT ARE IDENTIFIED MUST BE MONITORED OR MITIGATED;
- VEGETABLE GARDENS AND FARMING ON THE PROPERTY ARE PROHIBITED;
- IMPLEMENTATION OF A HEALTH AND SAFETY PLAN (HASP) AND AN EWP PRIOR TO ANY GROUND INTRUSIVE ACTIVITY INCLUDING UTILITY WORK, BORING COMPLETION, MONITORING WELL INSTALLATION, AND EXCAVATION;
- THE SITE OWNER OR REMEDIAL PARTY WILL SUBMIT TO NYSDEC A WRITTEN STATEMENT THAT CERTIFIES, UNDER PENALTY OF PERJURY, THAT: (1) CONTROLS EMPLOYED AT THE CONTROLLED PROPERTY ARE UNCHANGED FROM THE PREVIOUS CERTIFICATION OR THAT ANY CHANGES TO THE CONTROLS WERE APPROVED BY THE NYSDEC; AND , (2) NOTHING HAS OCCURRED THAT IMPAIRS THE ABILITY OF THE CONTROLS TO PROTECT PUBLIC HEALTH AND ENVIRONMENT OR THAT CONSTITUTE A VIOLATION OR FAILURE TO COMPLY WITH THE SMP.
- THE ENTIRE PROPERTY CONSISTS OF A SOIL COVER SYSTEM AS DESCRIBED IN THE SITE MANAGEMENT PLAN.
- MONITORED NATURAL ATTENUATION WILL BE CONDUCTED BY NATIONAL GRID FOR THE GROUNDWATER UNDERNEATH THE PROPERTY AS DESCRIBED IN THE SMP.

SURVEYOR'S DESCRIPTION - PROPERTY (903-02-2-9)

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

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CONTAINING AN AREA OF 0.2625 ACRE.

SURVEYOR'S DESCRIPTION --ENVIRONMENTAL EASEMENT

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

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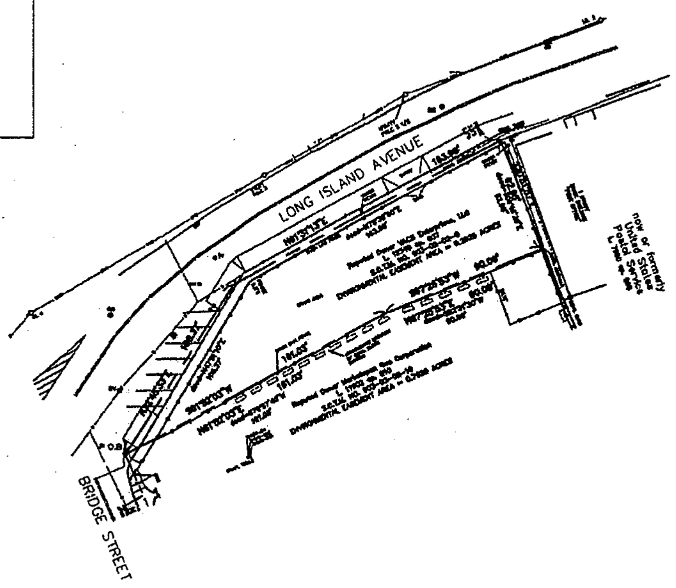
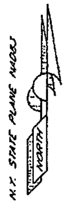
CONTAINING AN AREA OF 0.2625 ACRE.

INTENDING AND BEING THE SAME PROPERTY AS THAT DESCRIBED IN DEED DATED MARCH 20, 2008 FROM GEORGE SCHIAVONI, DIANE SCHIAVONI, DEBORAH SCHIAVONI, DAVID SHIAVONI, AND MARITZA SCHIAVONI, TO VACS ENTERPRISES, LLC, RECORDED IN BOOK 09163 AT PAGE 0460 AT THE SUFFOLK COUNTY CLERK'S OFFICE ON MARCH 20, 2008, RECORDED ON MARCH 24, 2008 IN LIBER 12545 AT PAGE 037.





THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL EASEMENT BY THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION PURSUANT TO THE TITLE 36 OF ARTICLE 71 OF THE NEW YORK ENVIRONMENTAL CONSERVATION LAW. FAILURE TO COMPLY WITH THE SMP.

THE ENGINEERING AND INSTITUTIONAL CONTROLS FOR THIS EASEMENT ARE SET FORTH IN THE SITE MANAGEMENT PLAN (SMP). A COPY OF THE SMP MUST BE OBTAINED BY ANY PARTY WITH INTEREST IN THE PROPERTY. THE SMP CAN BE OBTAINED FROM NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION, DIVISION OF ENVIRONMENTAL REMEDIATION, SITE CONTROL SECTION, 625 BROADWAY, ALBANY, N.Y. 12233 OR AT "DERWEB@GW.DEC.NY.US"

ENVIRONMENTAL EASEMENT AREA ACCESS

THE DEC OR THEIR AGENT MAY ACCESS THE ENVIRONMENTAL EASEMENT AREA AS SHOWN HEREON THROUGH ANY EXISTING STREET ACCESS OR BUILDING INGRESS/EGRESS ACCESS POINT.

LEGEND

CB	= CATCH BASIN
CMF	= CONCRETE MONUMENT FOUND
CIC	= CAST IRON COVER
DI	= DRAINAGE INLET
GV	= GAS VALVE
TMH	= TELEPHONE MANHOLE
—	= OVERHEAD UTILITIES
●	= MONITORING WELL
✱	= FIRE HYDRANT
—	= GAS MARKOUT
	= TELEPHONE MARKOUT
▭	= APPROX LOC OF CONCRETE BLOCK
WMT	= WATER METER
WV	= WATER VALVE

CERTIFICATION

WE HEREBY CERTIFY TO (1) THE PEOPLE OF THE STATE OF NEW YORK ACTING THROUGH THEIR COMMISSIONER OF THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION. (2) NATIONAL LAND TENURE COMPANY, LLC. (3) CHICAGO TITLE INSURANCE COMPANY TITLE #NLT-22313-S-11 (4) VACS ENTERPRISES, LLC THAT THIS SURVEY WAS PREPARED IN ACCORDANCE WITH THE CODE OF PRACTICE FOR LAND SURVEYORS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS.

THIS MAP HAS BEEN REVISED WITH THE BENEFIT OF TITLE REPORT COMMITMENT NO. NLT-22313-S-11, DATED 02-25-2013, PREPARED BY THE CHICAGO TITLE INSURANCE COMPANY.

KENNY L. KENNON, P.L.S.
NEW YORK PROFESSIONAL LAND SURVEYOR LICENSE NO 50171
Kenny Kennon DATE 12-09-13

THE PURPOSE OF THIS MAP WAS TO PREPARE AN INDIVIDUAL MAP OF LOT 9, BASED ON ORIGINAL SURVEY ENTITLED "SURVEY FOR NATIONAL GRID AT VILLAGE OF SAG HARBOR - CERTIFIED SURVEY", PREPARED BY HOWARD W. YOUNG, N.Y.S.L.S NO. 45893, DATED 04-12-2012, AND WAS PREPARED TO ASSIST IN REGULATORY AGENCY REVIEW. NO RESEARCH OR FIELD SURVEYS WERE COMPLETED TO ASSIST IN THE PREPARATION OF THIS MAP.

REV: 12-09-13 PER REVIEW COMMENTS
REV: 08-13-13 PER REVIEW COMMENTS

SURVEY MAP FOR
NATIONAL GRID
DISTRICT 903 - SECTION 02 - BLOCK 02 - LOT 9
31 LONG ISLAND AVENUE
VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON
SUFFOLK COUNTY, NEW YORK
SITE NAME: SAG HARBOR MGP
SITE No.: 152159

KSS KENNON SURVEYING SERVICES INC.
3 POWDER HORN DRIVE, SUITE 6
P.O. BOX 4477
WARREN, NEW JERSEY 07059
PHONE 732-564-1818 CERTIFICATE OF AUTHORIZATION NO. 27944900 FAX 732-564-8990

DATE	SCALE	JOB NO.	SHEET
04-05-13	1" = 30'	2412	1 OF 1

CC # : C15-20549

COUNTY CLERK'S OFFICE

STATE OF NEW YORK

COUNTY OF SUFFOLK

I, JUDITH A. PASCALE, Clerk of the County of Suffolk and the Court of Record thereof do hereby certify that I have compared the annexed with the original **EASEMENT** recorded in my office on **05/21/2015** under Liber **D00012817** and Page **708** and, that the same is a true copy thereof, and of the whole of such original.

In Testimony Whereof, I have hereunto set my hand and affixed the seal of said County and Court this **05/21/2015** .

SUFFOLK COUNTY CLERK

Judith A. Pascale

JUDITH A. PASCALE

SEAL

[redacted]

SUFFOLK COUNTY CLERK
RECORDS OFFICE
RECORDING PAGE

Type of Instrument: EASEMENT
Number of Pages: 11
Receipt Number : 15-0068030
TRANSFER TAX NUMBER: 14-25930

Recorded: 05/21/2015
At: 09:55:34 AM

LIBER: D00012817
PAGE: 708

District:	Section:	Block:	Lot:
0903	002.00	02.00	010.000

EXAMINED AND CHARGED AS FOLLOWS

Deed Amount: $0.00

Received the Following Fees For Above Instrument

		Exempt			Exempt
Page/Filing	$55.00	NO	Handling	$20.00	NO
COE	$5.00	NO	NYS SRCHG	$15.00	NO
TP-584	$5.00	NO	Notation	$0.00	NO
Cert.Copies	$7.15	NO	RPT	$60.00	NO
Transfer tax	$0.00	NO	Comm.Pres	$0.00	NO
			Fees Paid	$167.15	

TRANSFER TAX NUMBER: 14-25930

THIS PAGE IS A PART OF THE INSTRUMENT
THIS IS NOT A BILL

JUDITH A. PASCALE
County Clerk, Suffolk County

1 | 2

Number of pages 11

This document will be public record. Please remove all Social Security Numbers prior to recording.

RECORDED
2015 May 21 09:55:34 AM
JUDITH A. PASCALE
CLERK OF
SUFFOLK COUNTY
L D00012817
P 708
DT# 14-25930

Deed / Mortgage Instrument	Deed / Mortgage Tax Stamp	Recording / Filing Stamps

3 FEES

Page / Filing Fee	55	
Handling	20.	00
TP-584	5	–
Notation		
EA-52 17 (County)		
EA-5217 (State)		
R.P.T.S.A.	60	
Comm. of Ed.	5.	00
Affidavit		
[✓ Certified Copy] PP	7	15
NYS Surcharge	15.	00
Other		

Sub Total 80

Sub Total 87^15

Grand Total 167^15

KW

Mortgage Amt.		
1. Basic Tax		
2. Additional Tax		
Sub Total		
Spec./Assit. or		
Spec. /Add.		
TOT. MTG. TAX		
Dual Town ____ Dual County ____		
Held for Appointment		
Transfer Tax	0	
Mansion Tax		

The property covered by this mortgage is or will be improved by a one or two family dwelling only.
YES ________ or NO ________

If NO, see appropriate tax clause on page # ______ of this instrument.

4/8/15

4 Dist. 0903 Se 2919601 0903 00200 0200 010000

Real Property Tax Service Agency Verification

R P T S A
DHO
28-APR-15

5 **Community Preservation Fund**

Consideration Amount $ 0

CPF Tax Due $ ______

Improved ______

Vacant Land ______

TD ______

TD ______

TD ______

6 Satisfactions/Discharges/Releases List Property Owners Mailing Address
RECORD & RETURN TO:

Hiscock & Barclay
One Park Place, 300 South State St.
Syracuse NY 13202

Mail to: Judith A. Pascale, Suffolk County Clerk
310 Center Drive, Riverhead, NY 11901
www.suffolkcountyny.gov/clerk

7 **Title Company Information**

Co. Name All State

Title # Courtesy

8 **Suffolk County Recording & Endorsement Page**

This page forms part of the attached environmental easement made by:
(SPECIFY TYPE OF INSTRUMENT)

Keyspan Gas East Corporation

TO

Marketspan Gas Corporation

The premises herein is situated in
SUFFOLK COUNTY, NEW YORK.

In the TOWN of Southampton

In the VILLAGE or HAMLET of Sag Harbor

BOXES 6 THRU 8 MUST BE TYPED OR PRINTED IN BLACK INK ONLY PRIOR TO RECORDING OR FILING.

12-0104..10/08kk

(over)

IMPORTANT NOTICE

If the document you've just recorded is your **SATISFACTION OF MORTGAGE**, please be aware of the following:

If a portion of your monthly mortgage payment included your property taxes, *you will now need to contact your local Town Tax Receiver so that you may be billed directly for all future property tax statements.

Local property taxes are payable twice a year: on or before January 10th and on or before May 31st. Failure to make payments in a timely fashion could result in a penalty.

Please contact your local Town Tax Receiver with any questions regarding property tax payment.

Babylon Town Receiver of Taxes
200 East Sunrise Highway
North Lindenhurst, N.Y. 11757
(631) 957-3004

Brookhaven Town Receiver of Taxes
One Independence Hill
Farmingville, N.Y. 11738
(631) 451-9009

East Hampton Town Receiver of Taxes
300 Pantigo Place
East Hampton, N.Y. 11937
(631) 324-2770

Huntington Town Receiver of Taxes
100 Main Street
Huntington, N.Y. 11743
(631) 351-3217

Islip Town Receiver of Taxes
40 Nassau Avenue
Islip, N.Y. 11751
(631) 224-5580

Riverhead Town Receiver of Taxes
200 Howell Avenue
Riverhead, N.Y. 11901
(631) 727-3200

Shelter Island Town Receiver of Taxes
Shelter Island Town Hall
Shelter Island, N.Y. 11964
(631) 749-3338

Smithtown Town Receiver of Taxes
99 West Main Street
Smithtown, N.Y. 11787
(631) 360-7610

Southampton Town Receiver of Taxes
116 Hampton Road
Southampton, N.Y. 11968
(631) 283-6514

Southold Town Receiver of Taxes
53095 Main Street
Southold, N.Y. 11971
(631) 765-1803

Sincerely,

Judith A. Pascale

Judith A. Pascale
Suffolk County Clerk

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 8th day of April, 2015, between Owner(s) KEYSPAN GAS EAST CORPORATION, as successor-in-interest by name change to MARKETSPAN GAS CORPORATION, having an office at 175 East Old Country Road, Hicksville, County of Suffolk, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233.

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 5 Bridge Street in the Village of Sag Harbor, Town of Southampton, County of Suffolk and State of New York, known and designated on the tax map of the County Clerk of Suffolk as tax map parcel numbers: District: 903 Section: 02 Block: 02 Lot: 10, being the same as that property conveyed to grantor by deed dated May 27, 1998 and recorded in the Suffolk County Clerk's Office in Liber 11902 at page 810. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.8 +/- acres, and is hereinafter more fully described in the Land Title Survey dated April 05, 2013, signed and certified on September 13, 2013 prepared by Kennon Surveying Services Inc., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: D1-0002-98-11, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) 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 this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved b the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5 the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her 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

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: 152159
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by

the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Grantor: KEYSPAN GAS EAST CORPORATION

By: ______________________

Print Name: Charles Willard

Title: Director, Site Inv + Rem Date: 4/14/2014

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Onondaga)

On the 14th day of April, in the year 2014, before me, the undersigned, personally appeared Charles Willard, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (~~are~~) subscribed to the within instrument and acknowledged to me that he/~~she~~/~~they~~ executed the same in his/~~her~~/~~their~~ capacity(~~ies~~), and that by his/~~her~~/~~their~~ signature(~~s~~) on the instrument, the individual(~~s~~), or the person upon behalf of which the individual(~~s~~) acted, executed the instrument.

Gayl Lynn Franssen
Notary Public - State of New York

GAYL LYNN FRANSSEN
Notary Public, State of New York
No. 01FR6220451
Qualified in Onondaga County
Commission Expires Apr. 12, 2018

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: ____________________________
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 8th day of April, in the year 2015 before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2018

SCHEDULE "A"
ENVIRONMENTAL EASEMENT
PROPERTY DESCRIPTION

PROPERTY DESCRIPTION

DISTRICT 903 - SECTION 02 - BLOCK 02 - LOT 10
5 BRIDGE STREET
VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON
SUFFOLK COUNTY, NEW YORK

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT MARKING THE INTERSECTION OF THE SOUTHERLY SIDE OF LONG ISLAND AVENUE AND THE EASTERLY SIDE OF BRIDGE STREET;

RUNNING THENCE FROM SAID POINT OF BEGINNING ALONG LAND NOW OR FORMERLY VACS ENTERPRISES, LLC THE FOLLOWING TWO (2) COURSES AND DISTANCES:

1. NORTH 61° 52' 03" EAST 161.03 FEET,
2. NORTH 67° 25' 53" EAST 90.09 FEET TO LAND NOW OR FORMERLY UNITED STATES POSTAL SERVICE;

RUNNING THENCE SOUTH 20° 52' 27" EAST ALONG LAND NOW OR FORMERLY UNITED STATES POSTAL SERVICE AND ALONG LAND NOW OR FORMERLY VILLAGE OF SAG HARBOR 112.31 FEET TO A POINT;

RUNNING THENCE ALONG LAND NOW OR FORMERLY VILLAGE OF SAG HARBOR THE FOLLOWING THREE (3) COURSES AND DISTANCES:

1. NORTH 68° 53' 53" EAST 2.19 FEET,
2. SOUTH 22° 11' 47" EAST 35.00 FEET,
3. SOUTH 69° 12' 13" WEST 50.23 FEET TO A MONUMENT FOUND AND LAND NOW OR FORMERLY FRB 1, LLC;

RUNNING THENCE SOUTH 69° 12' 13" WEST ALONG LAND NOW OR FORMERLY FBR 1, LLC 198.00 FEET TO THE EASTERLY SIDE OF BRIDGE STREET;

RUNNING THENCE NORTH 23° 00' 57" WEST ALONG THE EASTERLY SIDE OF BRIDGE STREET 124.03 FEET TO THE POINT OR PLACE OF BEGINNING.

CONTAINING AN AREA OF 0.7925 ACRES.

ENVIRONMENTAL EASEMENT

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

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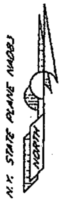
CONTAINING AN AREA OF 0.7925 ACRES.

Date

Kenny L. Kennon, P.L.S.
N.Y. License No. 50171

SURVEY (Attached)



SURVEYOR'S DESCRIPTION – PROPERTY (903-02-2-10)

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

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RUNNING THENCE NORTH 23° 00' 57" WEST ALONG THE EASTERLY SIDE OF BRIDGE STREET 124.03 FEET TO THE POINT OR PLACE OF BEGINNING.

CONTAINING AN AREA OF 0.7925 ACRES.

SURVEYOR'S DESCRIPTION – ENVIRONMENTAL EASEMENT

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT MARKING THE INTERSECTION OF THE SOUTHERLY SIDE OF LONG ISLAND AVENUE AND THE EASTERLY SIDE OF BRIDGE STREET;

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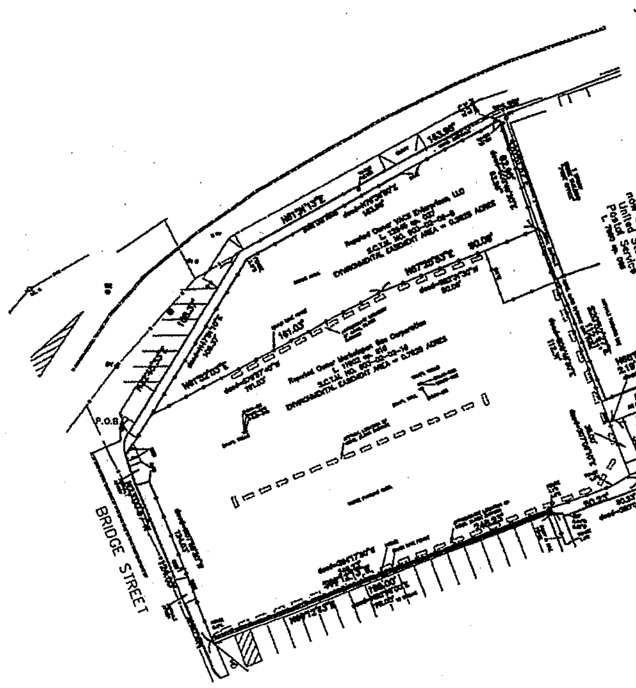
CONTAINING AN AREA OF 0.7925 ACRES.

INTENDING AND BEING THE SAME PROPERTY AS THAT DESCRIBED IN DEED DATED MAY 27, 1998 FROM LONG ISLAND LIGHTING COMPANY TO MARKETSPAN GAS CORPORATION, RECORDED IN BOOK 11902 AT PAGE 810 RECORDED IN THE SUFFOLK COUNTY CLERK'S OFFICE ON JULY 6, 1998.



LEGEND

CB	= CATCH BASIN
CMF.	= CONCRETE MONUMENT FOUND
CIC	= CAST IRON COVER
DI	= DRAINAGE INLET
GV	= GAS VALVE
TMH	= TELEPHONE MANHOLE
— — —	= OVERHEAD UTILITIES
⊕	= MONITORING WELL
⚲	= FIRE HYDRANT
—— G ——	= GAS MARKOUT
- - -	= TELEPHONE MARKOUT
▭	= APPROX LOC OF CONCRETE BLOCK
WMT	= WATER METER
WV	= WATER VALVE

THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL EASEMENT BY THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION PURSUANT TO THE TITLE 36 OF ARTICLE 71 OF THE NEW YORK ENVIRONMENTAL CONSERVATION LAW.

THE ENGINEERING AND INSTITUTIONAL CONTROLS FOR THIS EASEMENT ARE SET FORTH IN MORE DETAIL IN THE SITE MANAGEMENT PLAN (SMP). A COPY OF THE SMP MUST BE OBTAINED BY ANY PARTY WITH INTEREST IN THE PROPERTY. THE SMP MAY BE OBTAINED FROM NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION, DIVISION OF ENVIRONMENTAL REMEDIATION, SITE CONTROL SECTION, 625 BROADWAY, ALBANY, N.Y. 12233 OR AT derweb@gw.dec.ny.us.

ENGINEERING/INSTITUTIONAL CONTROLS

- COMPLIANCE WITH THE ENVIRONMENTAL EASEMENT AND THE SMP BY THE GRANTOR AND THE GRANTOR'S SUCCESSORS AND ASSIGNS;
- ALL ENGINEERING CONTROLS MUST BE OPERATED AND MAINTAINED AS SPECIFIED IN THE SMP;
- ALL ENGINEERING CONTROLS ON THE CONTROLLED PROPERTY MUST BE INSPECTED AT A FREQUENCY AND IN A MANNER DEFINED IN THE SMP;
- GROUNDWATER, SOIL VAPOR AND OTHER ENVIRONMENTAL OR PUBLIC HEALTH MONITORING MUST BE PERFORMED AS DEFINED IN THE SMP;
- DATA AND INFORMATION PERTINENT TO SITE MANAGEMENT OF THE CONTROLLED PROPERTY MUST BE REPORTED AT THE FREQUENCY AND IN A MANNER DEFINED IN THE SMP;
- THE USE AND DEVELOPMENT OF THE SITE IS LIMITED TO COMMERCIAL AND INDUSTRIAL USE ONLY AS DESCRIBED IN 6NYCRR PART 375-1.8(G)(2)(III) & (IV);
- THE PROPERTY MAY NOT BE USED FOR A HIGHER LEVEL OF USE, SUCH AS UNRESTRICTED OR RESIDENTIAL USE WITHOUT ADDITIONAL REMEDIATION AND AMENDMENT OF THE ENVIRONMENTAL EASEMENT AS APPROVED BY THE NYSDEC;
- ALL FUTURE ACTIVITIES ON THE PROPERTY THAT WILL DISTURB REMAINING CONTAMINATED MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH THE SMP;
- THE USE OF THE GROUNDWATER UNDERLYING THE PROPERTY IS PROHIBITED WITHOUT TREATMENT RENDERING IT SAFE FOR INTENDED USE;
- THE POTENTIAL FOR VAPOR INTRUSION MUST BE EVALUATED FOR ANY BUILDINGS DEVELOPED IN THE AREA NOTED ON FIGURE (X) AND ANY POTENTIAL IMPACTS THAT ARE IDENTIFIED MUST BE MONITORED OR MITIGATED;
- VEGETABLE GARDENS AND FARMING ON THE PROPERTY ARE PROHIBITED,
- IMPLEMENTATION OF A HEALTH AND SAFETY PLAN (HASP) AND AN EWP PRIOR TO ANY GROUND INTRUSIVE ACTIVITY INCLUDING UTILITY WORK, BORING COMPLETION, MONITORING WELL INSTALLATION, AND EXCAVATION;
- THE SITE OWNER OR REMEDIAL PARTY WILL SUBMIT TO NYSDEC A WRITTEN STATEMENT THAT CERTIFIES, UNDER PENALTY OF PERJURY, THAT: (1) CONTROLS EMPLOYED AT THE CONTROLLED PROPERTY ARE UNCHANGED FROM THE PREVIOUS CERTIFICATION OR THAT ANY CHANGES TO THE CONTROLS WERE APPROVED BY THE NYSDEC; AND , (2) NOTHING HAS OCCURRED THAT IMPAIRS THE ABILITY OF THE CONTROLS TO PROTECT PUBLIC HEALTH AND ENVIRONMENT OR THAT CONSTITUTE A VIOLATION OR FAILURE TO COMPLY WITH THE SMP.

ENVIRONMENTAL EASEMENT AREA ACCESS

THE DEC OR THEIR AGENT MAY ACCESS THE ENVIRONMENTAL EASEMENT AREA AS SHOWN HEREON THROUGH ANY EXISTING STREET ACCESS OR BUILDING INGRESS/EGRESS ACCESS POINT.

THE PURPOSE OF THIS MAP WAS TO PREPARE AN INDIVIDUAL MAP OF LOT 10. BASED ON ORIGINAL SURVEY ENTITLED "SURVEY FOR NATIONAL GRID AT VILLAGE OF SAG HARBOR – CERTIFIED SURVEY", PREPARED BY HOWARD W. YOUNG, N.YS.L.S NO. 45893, DATED 04-12-2012, AND WAS PREPARED TO ASSIST IN REGULATORY AGENCY REVIEW. NO RESEARCH OR FIELD SURVEYS WERE COMPLETED TO ASSIST IN THE PREPARATION OF THIS MAP.

CERTIFICATION

WE HEREBY CERTIFY TO (1) MARKETSPAN GAS CORPORATION N/K/A KEYSPAN GAS EAST CORPORATION. (2) THE PEOPLE OF THE STATE OF NEW YORK ACTING THROUGH THEIR COMMISSIONER OF THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION. (3) NATIONAL LAND TENURE COMPANY, LLC. (4) CHICAGO TITLE INSURANCE COMPANY TITLE #NLT-22314-S-11, THAT THIS SURVEY WAS PREPARED IN ACCORDANCE WITH THE CODE OF PRACTICE FOR LAND SURVEYORS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS.

THIS MAP HAS BEEN REVISED WITH THE BENEFIT OF TITLE REPORT COMMITMENT NO. NLT-22314-S-11, DATED 02-25-2013, PREPARED BY THE CHICAGO TITLE INSURANCE COMPANY.

REV: 12-09-13 PER REVIEW COMMENTS
REV: 08-13-13 PER REVIEW COMMENTS

SURVEY MAP FOR
NATIONAL GRID
DISTRICT 903 – SECTION 02 – BLOCK 02 – LOT 10
5 BRIDGE STREET
VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON
SUFFOLK COUNTY, NEW YORK
SITE NAME: SAG HARBOR MGP
SITE No.: 152159

KENNY D. KENNON, P.L.S.
NEW YORK PROFESSIONAL LAND SURVEYOR LICENSE NO. 50171
Kenny D. Kennon DATE: 12-09-13

KSS KENNON SURVEYING SERVICES INC.
5 POWDER HORN DRIVE, SUITE 4
P.O. BOX 4477
WARREN, NEW JERSEY 07059
PHONE 732-564-1818 CERTIFICATE OF AUTHORIZATION NO. 27944900 FAX 732-564-9999

04-05-13	1" = 30'	2412	1 OF 1

CC # : C15-17377

COUNTY CLERK'S OFFICE

STATE OF NEW YORK

COUNTY OF SUFFOLK

I, JUDITH A. PASCALE, Clerk of the County of Suffolk and the Court of Record thereof do hereby certify that I have compared the annexed with the original **EASEMENT** recorded in my office on **04/30/2015** under Liber **D00012815** and Page **397** and, that the same is a true copy thereof, and of the whole of such original.

In Testimony Whereof, I have hereunto set my hand and affixed the seal of said County and Court this **04/30/2015** .

SUFFOLK COUNTY CLERK

Judith A. Pascale

JUDITH A. PASCALE

SEAL

[redacted]

SUFFOLK COUNTY CLERK
RECORDS OFFICE
RECORDING PAGE

Type of Instrument: EASEMENT		Recorded:	04/30/2015
Number of Pages: 10		At:	10:08:58 AM
Receipt Number : 15-0057756			
TRANSFER TAX NUMBER: 14-24152		**LIBER:**	**D00012815**
		PAGE:	**397**

District:	Section:	Block:	Lot:
0903	002.00	02.00	011.000

EXAMINED AND CHARGED AS FOLLOWS

Deed Amount: $0.00

Received the Following Fees For Above Instrument

		Exempt			Exempt
Page/Filing	$50.00	NO	Handling	$20.00	NO
COE	$5.00	NO	NYS SRCHG	$15.00	NO
TP-584	$5.00	NO	Notation	$0.00	NO
Cert.Copies	$6.50	NO	RPT	$60.00	NO
Transfer tax	$0.00	NO	Comm.Pres	$0.00	NO
			Fees Paid	$161.50	

TRANSFER TAX NUMBER: 14-24152

THIS PAGE IS A PART OF THE INSTRUMENT
THIS IS NOT A BILL

JUDITH A. PASCALE
County Clerk, Suffolk County

1 2

Number of pages 10

This document will be public record. Please remove all Social Security Numbers prior to recording.

RECORDED
2015 Apr 30 10:08:58 AM
JUDITH A. PASCALE
CLERK OF
SUFFOLK COUNTY
L D00012815
P 397
DT# 14-24152

Deed / Mortgage Instrument	Deed / Mortgage Tax Stamp	Recording / Filing Stamps

3 FEES

Page / Filing Fee		
~~Handling~~	20.	00
TP-584	5-	
Notation		
EA-52 17 (County)		
EA-5217 (State)		
R.P.T.S.A.	60	
Comm. of Ed.	5.	00
~~Affidavit~~		
Certified Copy	Cr 6.50	
NYS Surcharge	15.	00
Other		

Sub Total

Sub Total

Grand Total 161.50

S

Mortgage Amt.		
1. Basic Tax		
2. Additional Tax		
Sub Total		
Spec./Assit.		
or		
Spec. /Add.		
TOT. MTG. TAX		

Dual Town _____ Dual County _____

Held for Appointment 0

Transfer Tax	0	
Mansion Tax		

The property covered by this mortgage is or will be improved by a one or two family dwelling only.

YES _____ or NO _____

If NO, see appropriate tax clause on page # _____ of this instrument.

4-8-15

4 Dist. 0903

2919600

0903 00200 0200 011000

Real Property Tax Service Agency Verification

R P T S A
DHO
28-APR-15

5 **Community Preservation Fund**

Consideration Amount $ 0

CPF Tax Due $

Improved _____

Vacant Land _____

TD _____

TD _____

TD _____

6 Satisfactions/Discharges/Releases List Property Owners Mailing Address

RECORD & RETURN TO:

Hiscock & Barclay
One Park Place
300 South State Street
Syracuse NY 13202

Mail to: Judith A. Pascale, Suffolk County Clerk
310 Center Drive, Riverhead, NY 11901
www.suffolkcountyny.gov/clerk

7 **Title Company Information**

Co. Name all state

Title # courtesy

8 Suffolk County Recording & Endorsement Page

This page forms part of the attached environmental easement made by:
(SPECIFY TYPE OF INSTRUMENT)

FRBI LLC

TO

People of the State of New York

The premises herein is situated in
SUFFOLK COUNTY, NEW YORK.

In the TOWN of Southampton
In the VILLAGE or HAMLET of Sag Harbor

BOXES 6 THRU 8 MUST BE TYPED OR PRINTED IN BLACK INK ONLY PRIOR TO RECORDING OR FILING.

12-0104..10/08kk

(over)

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 8th day of April, 2016 between Owner(s) FRB1 LLC, having an office at c/o Gale and Freddie Bernheim, 5709 North Ocean Boulevard, Ocean Ridge, Florida 33435 (collectively the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233.

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 11 Bridge Street in the Village of Sag Harbor, Town of Southampton, County of Suffolk and State of New York, known and designated on the tax map of the County Clerk of Suffolk as tax map parcel numbers: District: 903 Section: 02 Block: 02 Lot: 11, being the same as that property conveyed to grantor by deed dated June 15, 2010 and recorded in the Suffolk County Clerk's Office in Liber 12630 at page 628. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.69 +/- acres, and is hereinafter more fully described in the Land Title Survey dated April 05, 2013, signed and certified on September 17, 2013, and revised on December 9, 2013 prepared by Kennon Surveying Services Inc., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: D1-0002-98-11, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the 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;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining

contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) 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 this Environmental Easement.

B. The Controlled Property shall not be used for Residential or Restricted Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i) and (ii), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation

pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved b the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5 the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her 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

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: 152159
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Grantor: FRB1 LLC

By: Freddie Bernheim Freddie Bernheim

Print Name: Freddie Bernheim

Title: Sole Manager and Member Date: 2/5/15

Grantor's Acknowledgment

STATE OF ~~NEW YORK~~ Florida)
) ss:
COUNTY OF Palm Beach)

On the 5th day of February in the year 20 15 before me, the undersigned, personally appeared Freddie Bernheim, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Notary Public - State of ~~New York~~ Florida

ELIZABETH ANNE MARIACA
Notary Public - State of Florida
My Comm. Expires Mar 19 2016
Commission # EE 180858
Bonded Through National Notary Assn.

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: ______________________________
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 8th day of April, in the year 2015, before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2018

SCHEDULE "A" ENVIRONMENTAL EASEMENT PROPERTY DESCRIPTION

PROPERTY DESCRIPTION

DISTRICT 903 - SECTION 02 - BLOCK 02 - LOT 11
11 BRIDGE STREET
VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON
SUFFOLK COUNTY, NEW YORK

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE EASTERLY SIDE OF BRIDGE STREET AT THE SOUTHWESTERLY CORNER OF LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION, SAID POINT BEING SITUATE THE FOLLOWING FOUR COURSES AND DISTANCES AS MEASURED FROM INTERSECTION OF THE WESTERLY SIDE OF MEADOW STREET AND THE NORTHERLY SIDE OF NASSAU STREET:

1. SOUTH 19° 05' 37" EAST 30.01 FEET AS MEASURED ALONG THE WESTERLY SIDE OF MEADOW STREET,
2. SOUTH 68° 53' 53" WEST 89.78 FEET AS MEASURED THROUGH LAND NOW OR FORMERLY VILLAGE OF SAG HARBOR,
3. SOUTH 22° 11' 47" EAST 35.00 FEET AS MEASURED ALONG LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION,
4. SOUTH 69° 12' 13" WEST 248.23 FEET STILL ALONG LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION,

RUNNING THENCE FROM SAID POINT OF BEGINNING NORTH 69° 12' 13" EAST 198.00 FEET TO A MONUMENT FOUND AND LAND NOW OR FORMERLY VILLAGE OF SAG HARBOR;

RUNNING THENCE ALONG LAND NOW OR FORMERLY VILLAGE OF SAG HARBOR THE FOLLOWING TWO (2) COURSES AND DISTANCES:

1. SOUTH 21° 58' 07" EAST 165.46 FEET,
2. NORTH 67° 17' 43" EAST 30.29 FEET TO LAND NOW OR FORMERLY JOHN R. GEOFFROY;

RUNNING THENCE SOUTH 18° 53' 47" EAST ALONG LAND NOW OR FORMERLY JOHN R. GEOFFROY 53.20 FEET TO LAND NOW OR FORMERLY VILLAGE ROSE HOLDING, LLC;

RUNNING THENCE SOUTH 72° 32' 23" WEST ALONG LAND NOW OR FORMERLY VILLAGE ROSE HOLDINGS, LLC AND ALONG LAND NOW OR FORMERLY RICHARD J. RICHTER AND SUSAN H. RICHTER 97.70 FEET TO LAND NOW OR FORMERLY DRJ REALTY I, LLC;

RUNNING THENCE ALONG LAND NOW OR FORMERLY DJR REALTY 1, LLC AND ALONG LAND NOW OR FORMERLY TITO D. SAUBIDET & ANTONIETTE GAY THE FOLLOWING TWO (2) COURSES AND DISTANCES:

1. NORTH 19° 20' 47" WEST 100.04 FEET,
2. SOUTH 69° 55' 03" WEST 130.65 FEET TO THE EASTERLY SIDE OF BRIDGE STREET;

RUNNING THENCE NORTH 23° 01' 47" WEST ALONG THE EASTERLY SIDE OF BRIDGE STREET 110.35 FEET TO THE POINT OR PLACE OF BEGINNING.

CONTAINING AN AREA OF 0.6966 ACRES.

ENVIRONMENTAL EASEMENT

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND WITH THE BUILDINGS AND IMPROVEMENTS THEREON ERECTED, SITUATE, LYING AND BEING AT VILLAGE OF SAG HARBOR, TOWN OF SOUTHAMPTON, COUNTY OF SUFFOLK, AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE EASTERLY SIDE OF BRIDGE STREET AT THE SOUTHWESTERLY CORNER OF LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION, SAID POINT BEING SITUATE THE FOLLOWING FOUR COURSES AND DISTANCES AS MEASURED FROM INTERSECTION OF THE WESTERLY SIDE OF MEADOW STREET AND THE NORTHERLY SIDE OF NASSAU STREET:

1. SOUTH 19° 05' 37" EAST 30.01 FEET AS MEASURED ALONG THE WESTERLY SIDE OF MEADOW STREET,
2. SOUTH 68° 53' 53" WEST 89.78 FEET AS MEASURED THROUGH LAND NOW OR FORMERLY VILLAGE OF SAG HARBOR,
3. SOUTH 22° 11' 47" EAST 35.00 FEET AS MEASURED ALONG LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION,
4. SOUTH 69° 12' 13" WEST 248.23 FEET STILL ALONG LAND NOW OR FORMERLY MARKETSPAN GAS CORPORATION,

RUNNING THENCE FROM SAID POINT OF BEGINNING NORTH 69° 12' 13" EAST 198.00 FEET TO A MONUMENT FOUND AND LAND NOW OR FORMERLY VILLAGE OF SAG HARBOR;

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RUNNING THENCE SOUTH 18° 53' 47" EAST ALONG LAND NOW OR FORMERLY JOHN R. GEOFFROY 53.20 FEET TO LAND NOW OR FORMERLY VILLAGE ROSE HOLDING, LLC;

RUNNING THENCE SOUTH 72° 32' 23" WEST ALONG LAND NOW OR FORMERLY VILLAGE ROSE HOLDINGS, LLC AND ALONG LAND NOW OR FORMERLY RICHARD J. RICHTER AND SUSAN H. RICHTER 97.70 FEET TO LAND NOW OR FORMERLY DRJ REALTY I, LLC;

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1. NORTH 19° 20' 47" WEST 100.04 FEET,
2. SOUTH 69° 55' 03" WEST 130.65 FEET TO THE EASTERLY SIDE OF BRIDGE STREET;

RUNNING THENCE NORTH 23° 01' 47" WEST ALONG THE EASTERLY SIDE OF BRIDGE STREET 110.35 FEET TO THE POINT OR PLACE OF BEGINNING.

CONTAINING AN AREA OF 0.6966 ACRES.

APPENDIX B. EXCAVATION WORK PLAN (EWP)

This EWP will be implemented to address any intrusive activities prior to the final remedy or any portion of the final remedy at the Site. The property owner and tenants, consultants, and contractors are required to comply with this EWP. National Grid is only responsible for costs associated with MGP-related impacts. MGP-impacted areas are identified in Figure 9, note that these areas may not encompass the entire property or all tax parcels.

B-1 NOTIFICATION

At least 15 days prior to the start of any small-scale (limited[1]) excavation activity that is anticipated to encounter impacts on the Site or the off-Site areas, based on the data available, the property owner or their representative will notify the NYSDEC and National Grid in writing. Currently, this notification will be made to:

National Grid Project Manager:
Name: Michael Quinlan
Address: 175 E Old Country Road, Hicksville, New York 11801
Telephone: 516-220-4363
Email: michael.quinlan@nationalgrid.com

New York State Department of Environmental Conservation Project Manager:
Name: Matthew Ayers, P.G.
Address: New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau C
625 Broadway Albany, New York 12233-7014
Telephone: (518) 402-9662
Fax: (518) 402-9679
Email: matthew.ayers@dec.ny.gov

All intrusive activities must be approved by NYSDEC. Notification must be made to NYSDEC in accordance with Section 1.3 of the SMP.

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[1] Note that NYSDEC makes the determination of which excavations are small-scale (e.g. limited) and which are large-scale. To know with certainty that the proposed excavation is considered to be small-scale (e.g. limited) will require a prior notification to NYSDEC describing the work to be performed.

The property owner will generate the notification to NYSDEC via a 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 Site and/or off-Site areas re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of impacted soil to be excavated and any work that may impact the EC.
- Whether proposed activities will require dewatering, proposed containment of dewatering liquids and planned disposal options for dewatering liquids.
- 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 impacted media, and plans for any pre-construction sampling.
- A schedule for the work, detailing the start and completion of all intrusive work.
- A summary of the applicable components of this EWP.
- A statement from the party performing the work that the work will be performed in compliance with this EWP and 29 Code of Federal Regulations (CFR) 1910.120.
- A copy of the contractor's HASP, in electronic format, if it differs from the HASP provided in Appendix D of this SMP.
- Identification of disposal facilities for potential waste streams.
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

B-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g., photoionization detector) soil screening will be performed by a QEP or person under their supervision during all limited excavations into known or potentially-impacted material. Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work.

Based on previous environmental data and screening results, soils will be segregated into material that requires off-site disposal and material that requires testing to determine if the material can be reused as soil beneath a cover. Further discussion of off-site disposal of materials is provided in Section B-6 of this Appendix.

B-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. MGP-impacted water draining from the soils will be collected from inside the bermed area and disposed of off-site in an appropriate manner. Hay bales will be used as needed near catch basins, surface waters and other discharge points. Stockpiles will be located and sized to minimize potential for material or run-off to enter discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected, and damaged tarp covers will be promptly replaced. Stockpiles will be segregated on-site based on the soil/material type. These soil/material types will include impacted soils, reuse soil, and imported fill.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by the NYSDEC. Stockpiled material not being used will be removed within 30 days following disposal facility characterization.

B-4 MATERIALS EXCAVATION AND LOAD-OUT

A QEP or person under their supervision will oversee all invasive work at the Site and the excavation and load-out of all excavated material.

To the extent that they perform work under this EWP, the property owner(s) and their contractors are responsible for safe execution of all invasive and other work; including the structural integrity of excavations and structures, such as subsurface utilities and buildings that may be affected by excavations.

The presence of utilities and easements on the Site and the off-Site areas will be investigated. Based on this investigation, it will be determined whether a risk or impediment to the work planned under this EWP is posed by utilities or easements on the Site/off-site areas.

Loaded vehicles leaving the Site/off-Site areas will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and New York State Department of Transportation (NYSDOT) requirements (and all other applicable transportation requirements).

A truck wash will be operated Site or on off-Site areas, as appropriate. The QEP will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site/off-Site areas until the activities performed under this section are complete. Truck wash waters will be collected and disposed off-site in an appropriate manner.

Locations where vehicles enter or exit the Site/off-Site areas shall be inspected daily for evidence of off-site soil tracking.

The QEP will be responsible for ensuring that all egress points for truck and equipment transport from the Site/off-Site areas are clean of dirt and other materials derived from the Site/off-Site areas during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

B-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials 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.

Material transported by trucks exiting the Site/off-Site areas 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.

All trucks transporting residual MGP impacted soils will be decontaminated prior to leaving the project site. Decontaminated water, if any, will be collected and disposed of off-site in an appropriate manner.

The following truck transport routes are recommended for transporting residual MGP impacts:

- Trucks will be required to enter and exit the project site via County Route 79 in Sag Harbor.
- The entry truck route shall be as follows:
  - Traveling north on County Route 79
  - Left onto Spring Street
  - Right onto Bridge Street
  - Right off of Bridge Street into the project site.

- The exit truck route shall be as follows:
    - Head onto Long Island Avenue
    - Left onto Glover Street
    - Right onto County Route 79.

All trucks loaded with Site/off-Site areas materials will exit the vicinity of the Site/off-Site areas using only these approved truck routes. 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 areas.

Egress points for truck and equipment transport from the Site/off-Site areas will be kept clean of dirt and other materials during Site/off-Site areas remediation and development.

Queuing of trucks will be performed on-Site or on the off-Site areas in order to minimize off-site disturbance. Off-site queuing will be prohibited.

B-6 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the Site/off-Site areas will be treated as impacted and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of material from this Site/off-Site areas 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 this Site/off-Site areas will not occur without formal NYSDEC approval.

Regulated soils will be stockpiled and transported to a National Grid approved facility. Off-site disposal locations for excavated soils will be identified in the pre-excavation notification prepared by the owner and provided to National Grid for review and submittal to NYSDEC. This will include estimated quantities and a breakdown by class of disposal facility if appropriate. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the PRR. This documentation will include waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and impacted soils taken off-site and off the off-site areas will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted Use SCOs is prohibited from being taken to a NYS recycling facility (6NYCRR Part 360-16 Registration Facility).

B-7 MATERIALS REUSE ON-SITE

A Request to Import/Reuse Fill or Soil form, which can be found in Appendix H and at http://www.dec.ny.gov/regulations/67386.html, will be prepared by the owner and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Excluding perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), material that meets the Restricted Residential Use SCOs listed in Table 375-6.8(b)] of 6 NYCRR Part 375 meet the chemical criteria for on-Site reuse. Such will be sampled in accordance with the frequency requirements outlined in NYSDEC’s Soil Cleanup Guidance CP-51 (CP-51) Table 4. If PFOA or PFOS is detected in any sample at or above 1 ppb, then a soil sample must be tested by the Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed. If the SPLP results exceed 70 parts-per-trillion (ppt) combined PFOA/S, then the source of backfill must be rejected.

Prior to reuse, samples will be collected and analyzed by an ELAP-certified laboratory for:

- Total VOCs via USEPA Method 8260.
- Total SVOCs via EPA Method 8270C.
- Polychlorinated biphenyls (PCBs) via EPA Method 8082/8082A/8080.
- Total cyanide via EPA Method 9010/9014.
- Total Metals (RCRA+Cu, Ni, Zn, Va, Cn HexChrome) via EPA Method 6010B and 6010.
- Total mercury via EPA Method 7471.
- PFAS by USEPA method 1633 (and as noted above if results exceed 1 ppb).
- 1,4-Dioxane by USEPA Method 8270.

The QEP will ensure that procedures defined for materials reuse in this EWP are followed and that unacceptable material does not remain on-Site or on the off-Site areas. Impacted soil that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on- site or on the off-site areas will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-Site or on the off-Site areas will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site/off-Site areas will not be reused on-Site or on the off-Site areas.

B-8 FLUIDS MANAGEMENT

All impacted liquids to be removed from the Site/off-Site areas, including but not limited to, excavation dewatering, 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. Impacted liquids removed from the Site will be disposed of at a National Grid approved disposal facility. Dewatering, purge, and development fluids will not be recharged back to the land surface or subsurface of the Site/off-Site areas, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during construction activities to surface waters (i.e., a local pond, stream or river) will be performed under a State Pollutant Discharge Elimination System (SPDES) permit.

B-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the RAWP (AECOM, 2008).

The existing cover system varies by property is comprised of the soil mix wall, a composite cover system, or clean fill. The demarcation layer, consisting of orange snow fencing material, will be replaced to provide a visual reference to the top of the remaining impact zone, the zone that requires adherence to special conditions for disturbance of impacted soils defined in this EWP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining impacted soils. The property owner shall not change the type of cover system following excavation without prior written permission from National Grid. A figure showing the modified surface will be included in the subsequent PRR and in an updated SMP.

B-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site/off-Site areas will be approved by National Grid's QEP and will be in compliance with provisions in this EWP prior to receipt at the Site/off-Site areas.

A Request to Import/Reuse Fill or Soil form, which can be found in Appendix H and at http://www.dec.ny.gov/regulations/67386.html, will be prepared by the owner and submitted to the NYSDEC project manager by National Grid allowing a minimum of 5 business days for review. This will include analytical sampling of the borrow source or existing documentation of agency approvals of the source (i.e., NYSDOT virgin source certification and latest analytical sampling results). NYSDEC approval must be received before material is imported to the Site.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially impacted sites will not be imported to the Site/off-Site areas.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are listed in 6NYCRR Part 375 Table 6.8(b) - Restricted Use Residential SCOs. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site/off-Site areas, will not be imported onto the Site/off-Site areas without prior approval by NYSDEC. Solid waste will not be imported onto the Site/off-Site areas. All exposed surface soils must meet 6NYCRR Part 375 Unrestricted Use SCOs shown in 6NYCRR Part 375 Table 6.8(a).

Samples will be collected from imported fill in accordance with the analytical sampling requirements of DER-10 and the frequency requirements in NYSDEC's Soil Cleanup Guidance, CP-51. At a minimum, samples will be analyzed for Inorganics, Pesticides, PCBs, VOCs and SVOCs, PFAS and 1,4-dioxane. Excluding PFAS, the analytes will be compared to the Restricted Residential, Residential, or Commercial Use SCOs listed in Table 375-6.8(a) of 6 NYCRR Part 375 dependent on the planned use of the property. If PFOA or PFOS is detected in any sample at or above 1 ppb, then a soil sample must be tested by the SPLP and the leachate analyzed. If the SPLP results exceed 10 ppt (individually), then the source of backfill must be rejected unless a site-specific exemption is provided by NYSDEC. The frequency and type of the sampling (i.e., discrete or composite) will be based on the quantity of material imported in accordance with Table 4 of CP-51.

Trucks entering the Site 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 (Section B-3).

B-11 STORMWATER POLLUTION PREVENTION

For excavations less than 1 acre that are not part of a larger disturbance, the following stormwater management practices will be completed in accordance with the requirements in the NYS Stormwater Management Design Manual, latest revision.

Silt fencing and/or 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. Results of inspections will be recorded in a logbook and maintained at the Site/off-Site areas and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the silt fencing and/or hay bale check functional.

All 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 EWP 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.

In the event that the work on the property is part of a larger plan that disturbs more than 1 acre, the respective property owner must obtain coverage under the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity.

B-12 EXCAVATION CONTINGENCY PLAN

Identification of unknown or unexpected potentially impacted media identified by screening during invasive work will be promptly communicated by phone to National Grid and National Grid will notify NYSDEC’s Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the PRR.

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

In the event that potential impacts are encountered at unexpected depth or locations, Site/off-Site areas activities will be suspended, and National Grid will be notified and will evaluate the observed conditions in a manner and timeframe that does not interfere with the property owner’s(s’) construction schedule, to the extent reasonably feasible. National Grid may determine that laboratory testing is required to evaluate the observed conditions for concentrations and characteristics. If the encountered materials are determined to be MGP-impacted, then the encountered materials will be segregated and stockpiled for disposal at a National Grid approved facility.

Sampling will be performed on product, sediment, and surrounding soils, etc. 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; Target Compound List

(TCL) volatiles and semi-volatiles, pesticides and PCBs, and free cyanide). In the event that future sampling results provide a sufficient justification to limit the list of analytes a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

B-13 COMMUNITY AIR MONITORING PLAN

The CAMP will consist of a real-time monitoring and action level reporting system. The CAMP will be conducted during all intrusive activity on the Site. Air sampling station locations will be chosen based on generally prevailing wind conditions and adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations.

Exceedances of action levels listed in the CAMP (Appendix E of the SMP) will be reported to NYSDEC and NYSDOH Project Managers.

B-14 ODOR CONTROL PLAN

Odors which derive from Site impacts may cause a nuisance to some site workers and the surrounding community, even though the impacts are at levels well below the safety limits defined in the CAMP. Fugitive emissions can be generated from a variety of activities including excavation, drilling, and dewatering and/or from the temporary staging of materials for characterization, consolidation, and scheduling for transportation.

Due to the constituent of interest associated with the remedial activities at former MGP sites, fugitive emissions can take the form of VOCs, odor, and/or dust. Dust can be entrained with low levels of high molecular weight constituents, while VOCs can volatilize into ambient air. Odor emissions may result from the atmospheric exposure of MGP-impacted media. MGP-impacts may be present in soils and groundwater. The potential for odor generation from groundwater is less than that from solids. The constituent concentrations associated with these odors are typically less than the levels that potentially pose a health risk as the odor threshold of constituent of interest are typically less than health-based action levels.

This odor control plan is capable of controlling emissions of nuisance odors off-site. If nuisance odors are identified at the project 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 all nuisance odors have been abated.

NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the property owner's Remediation Engineer, and any measures that are implemented will be discussed in the PRR.

A three-tiered set of controls are proposed for this Plan:

- **Level I:** Built into the design of the Plan and includes proactive measures to minimize the effect of fugitive emissions. Level 1 includes air monitoring to ensure that levels of VOCs and dust are under Site-specific action levels.
- **Level II:** Procedures that are implemented in response to specific increases in fugitive emissions but are not likely to have a significant impact in the schedule of the project site activities.
- **Level III:** More aggressive procedures, also initiated in response to specific increases in fugitive emissions that are likely to have a more significant impact on production schedule and the project site activities.

The Site Manager will be required to progressively implement these options until emission sources are controlled and ambient concentrations no longer have the potential to pose a health risk.

Level I Controls

Level 1 Controls are built into the design of the field activities and involve physical controls, project site layout, and scheduling.

Physical Controls

The simplest form of physical control is the use of visual barrier cloth on the project site perimeter fencing. The resistance caused by the visual barrier will elevate the discharge point of emissions leaving the site to the top of the perimeter fence and will promote better mixing and dispersion. Another form of simple physical control is the required use of tarps on trucks that move, or transport impacted material.

All stockpiles of impacted material should be covered, if left inactive for a period of more than 2 hours.

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

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

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

All trucks used for off-site transport should have tarps in place to cover impacted material as detailed in Section A-3. On-site haul routes should be routinely wetted to control dust using a hose, sprinkler, or dedicated water truck.

Site Layout

The dispersion of fugitive emissions is controlled by meteorological conditions and their impact generally decreases with distance from the source. If possible, transfer/storage areas will be placed either downwind or significantly upwind of off-site receptors.

The height of the stockpiles should be lower than the top of the perimeter fencing (8 feet) to utilize the benefit of the barrier cloth. If stockpiles must be staged near the fence line (within 100 feet), they should be less than 8-feet in height.

Scheduling

Every effort should be made to minimize the amount of time that potentially MGP-impacted material is stored on-site. Appropriate strategies involve the in-place pre-characterization of soils to be excavated and the sampling of stockpiles as soon as they are placed. Efficient scheduling and coordination of operations can also limit the impact of active emission sources. Close coordination of excavation activities can decrease the surface area of disturbed material, thereby reducing the size of the emission source. A smaller source area can facilitate the implementation of additional controls, if required.

Level II Controls

Air monitoring will routinely be performed at the fence line of the project site as delineated in the CAMP during all work activities. The results will be compared to site-specific action levels for VOCs and total particulates.

Level II controls will be enacted if the exceedance is confirmed, or odors are detected at the fence line. If the action levels are exceeded, additional monitoring will be conducted to confirm the result. Level II controls will be enacted if the exceedance is confirmed. The Site Manager must then work through the applicable list of site controls until the fence line monitoring results for all parameters are determined to be less that their associated action levels. Specific Level II controls are discussed below.

Suppressing Agents

Several agents that can be applied over emissions sources have been determined to be effective in controlling emissions. These include odor suppressant foam for VOCs mitigation and water spray for dust suppression.

The following suppressing agents have been identified for use, but additional agents may be used or substituted for other proven agents such as odex, hydromulch, or ecosorb.

Odor suppressant foam can provide immediate, localized control of VOCs and odor emissions. The foam is created by the injection of air into a foam concentrate/water mixture using a Pneumatic Foam Unit. The foam is applied via a hose to cover source areas to a depth of three to six inches. Foam (Rusmar AC-600 or equivalent) is a short-term remedy and can be actively used to control VOCs and odor emissions from active excavations/stockpiles, and during the loading of trucks. It is shipped as a concentrate and diluted with water at the site. Under normal conditions, this foam can last for several hours. However, it has been observed to degrade quickly in direct sunlight or precipitation so it must be applied liberally and frequently to all areas that require odor control.

A spray of water can be used to minimize the amount of dust created. A water hose is effective for controlling dust over a small area, while lawn sprinklers or a dedicated water truck may be more efficient for extended control of large areas or on-site haul routes.

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

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

Tarps

Tarps can provide effective control for source areas that are likely to be inactive for extended periods of time. To be effective, the size of the source area should be controlled such that it can be covered using a single tarp. Rolls of 6-mil polyethylene will be used to cover inactive stockpiles. Tarps will also be used for covering exposed soils loaded into trucks. All trucks will be lined with 6 mil polyethylene sheeting, the liners will be large enough to overlap and fully cover the top of the load. Additional automatic mesh tarps will be used to secure the liners.

Portable Barriers

The placement of portable barriers close to small active source areas (excavations) can elevate the discharge point of emissions to facilitate dispersion and minimize the effect on downwind receptors. The barriers can be constructed using materials such as plastic “Jersey barriers”, or fence poles and visual barrier fabric/plastic. The barriers are placed as temporary two or three-sided structures around active excavation or other intrusive areas, oriented such that the barriers are placed on the upwind and downwind sides of the source. If only one side of the source can be accessed, then the barrier should be placed on the downwind side.

Level III Controls

Level III controls are to be implemented when Level II controls have been exhausted and ambient concentrations of emissions continue to exceed the site-specific action levels. Each of the control options listed in this subsection has the potential to significantly affect the schedule/production rate of site activities. These delays may be required periodically to ensure that acceptable levels of fugitive emissions are maintained and are preferable to a complete work cessation to control an emission event.

Production/Schedule

It may be necessary to reduce the excavation rate to reduce the surface area of disturbed media or slow the generation rate of stockpiles. These activities would result in smaller source areas that could be more effectively controlled using Level II techniques.

Meteorological Conditions

It may be necessary to limit certain activities to those periods when preferred meteorological conditions exist, such as wind direction or low temperatures are present.

Relocation of Activities

Another option is to cease work and move the remedial activities to lesser-impacted areas until adequate control measures can be implemented, or more favorable meteorological conditions return. Also, it may be beneficial to temporarily relocate material loading and transfer activity areas to other areas of the project site or within subsurface excavations to utilize the natural dispersion of emissions in the atmosphere, or shelter from the wind.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions 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.

B-15 DUST CONTROL PLAN

Dust which derives from Site impacts may cause a nuisance to some site workers and the surrounding community, even though the impacts are at levels well below the safety limits defined in the CAMP. A dust suppression plan that addresses dust management during invasive on-site and on off-site areas work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon 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 and off-site areas roads will be limited in total area to minimize the area required for water truck sprinkling.

In the event that complaints are received for dust, the contractor will take the appropriate response actions for dust suppression.

B-16 OTHER NUISANCES

The following items may be necessary depending on the type of wastes present, the location of the site and other site-specific concerns. These plans are generally not required for submission to the NYSDEC but are generally required as part of construction.

A plan for rodent control will be developed and utilized by the contractor prior to and during Site/off-Site areas clearing and Site/off-Site areas grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

APPENDIX C. MONITORING WELL CONSTRUCTION LOGS

TABLE 2-2
SAG HARBOR FORMER MGP SITE FINAL REMEDIAL INVESTIGATION

MONITORING WELL CONSTRUCTION SUMMARY

MONITORING WELL *	WELL DEPTH (feet bgs)	TOTAL DEPTH (feet bgs)	GROUND SURFACE ELEVATION (feet)	MEASURING POINT ELEVATION (feet) **	CASING DIAMETER (inches)	SCREEN DEPTHS (feet bgs)		ANNULAR FILLS (feet bgs)		
						INTERVAL	DESCRIPTION	INTERVAL	TYPE	MATERIALS
MW-01	7.32	7.50	5.09	4.88	2.00	1.50-7.32	Slotted PVC	0.00-0.25	Seal	Well Pad
								0.25-0.50	Seal	Bentonite
								0.50-7.32	Filter	Sand Pack
MW-02	7.25	7.30	4.48	4.21	2.00	0.50-7.25	Slotted PVC	0.00-0.25	Seal	Well Pad
								0.25-0.50	Seal	Bentonite
								0.50-7.30	Filter	Sand Pack
MW-03	10.17	12.00	4.59	4.30	2.00	2.17-10.17	Slotted PVC	0.00-1.17	Seal	Well Pad
								1.17-2.17	Seal	Bentonite
								2.17-12.00	Filter	Sand Pack
MW-04	6.81	6.85	4.13	3.98	2.00	1.25-6.81	Slotted PVC	0.00-0.33	Seal	Well Pad
								0.33-0.66	Seal	Bentonite
								0.66-6.85	Filter	Sand Pack
MW-05	7.46	7.50	5.07	4.58	2.00	2.46-7.46	Slotted PVC	0.00-0.75	Seal	Well Pad
								0.75-1.00	Seal	Bentonite
								1.00-7.46	Filter	Sand Pack
MW-06	7.47	11.00	5.38	5.18	2.00	2.47-7.47	Slotted PVC	0.00-0.50	Seal	Well Pad
								0.50-0.75	Seal	Bentonite
								0.75-7.47	Filter	Sand Pack
SHMW-01S ***	8.00	8.00	4.50	5.13	2.00	1.00-6.00	Slotted Schedule 40 PVC	0.00-0.50	Seal	Neat Cement/Bent Chips
								0.50-8.00	Filter	#2 Gravel Sand Pack
SHMW-01I	48.00	48.00	4.45	4.12	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-31.00	Backfill	Cement Bentonite Grout
								31.00-48.00	Filter	#2 Gravel Sand Pack
								31.00-31.00	Seal	Bentonite Slurry
SHMW-02I	48.00	48.00	5.22	4.63	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-31.00	Backfill	Cement Bentonite Grout
								31.00-48.00	Filter	#2 Gravel Sand Pack
								31.00-31.00	Seal	Bentonite Slurry
SHMW-02D	80.00	90.00	5.19	4.66	2.00	65.00-75.00	Slotted Schedule 40 PVC	0.00-62.00	Backfill	Cement Bentonite Grout
								62.00-80.00	Filter	#2 Gravel Sand Pack
								62.00-62.00	Seal	Bentonite Slurry
SHMW-03S	14.00	14.00	5.23	4.60	2.00	2.00-12.00	Slotted Schedule 40 PVC	1.00-1.50	Seal	Bentonite Chips/Neat Cement
								1.50-14.00	Filter	#2 Gravel Sand Pack
SHMW-03I	48.00	48.00	5.27	4.77	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-28.00	Backfill	Cement Bentonite Grout
								28.00-32.00	Seal	Bentonite Slurry
								32.00-48.00	Filter	#2 Gravel Sand Pack
SHMW-04S	13.00	13.00	5.58	5.13	2.00	2.00-12.00	Slotted Schedule 40 PVC	0.00-1.35	Seal	Bentonite Pellets
								1.35-13.00	Filter	#1 Gravel Sand Pack
SHMW-04I	47.50	47.50	5.60	5.02	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-33.00	Backfill	Cement Bentonite Grout
								33.00-47.50	Filter	#2 Gravel Sand Pack
								33.00-33.00	Seal	Bentonite Slurry
SHMW-05S	13.00	13.00	6.23	5.79	2.00	2.00-12.00	Slotted Schedule 40 PVC	0.00-1.20	Seal	Bentonite Pellets
								1.20-13.00	Filter	#1 Gravel Sand Pack
SHMW-05I	48.00	48.00	6.14	5.60	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-32.00	Backfill	Cement Bentonite
								32.00-48.00	Filter	#2 Gravel Sand Pack
								32.00-32.00	Seal	Bentonite
SHMW-06S	8.00	8.00	4.44	4.16	2.00	2.00-6.00	Slotted Schedule 40 PVC	0.50-1.00	Seal	Bentonite Chips
								1.00-8.00	Filter	#1 Gravel Sand Pack
SHMW-06I	48.00	48.00	4.43	4.15	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-28.00	Backfill	Cement Bentonite Grout
								28.00-31.00	Seal	Bentonite Slurry
								31.00-48.00	Filter	#2 Gravel Sand Pack
SHMW-07S	12.00	12.00	5.05	4.63	2.00	1.00-11.00	Perforated Schedule 40 PVC	0.00-0.66	Seal	Bentonite Pellets
								0.66-12.00	Filter	#1 Grade Sand Pack
SHMW-07I	48.00	48.00	5.00	4.72	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-32.33	Backfill	Cement Bentonite Grout
								32.33-48.00	Filter	#2 Grade Sand Pack
								32.33-32.33	Seal	Bentonite Seal
SHMW-08S	12.00	12.00	5.26	4.93	2.00	1.00-7.00	Slotted Schedule 40 PVC	0.00-0.50	Seal	Bentonite Chips
								0.50-12.00	Filter	#1 Gravel Sand Pack
SHMW-08I	48.00	48.00	5.08	4.85	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-30.00	Backfill	Cement Bentonite Grout
								30.00-33.00	Seal	Bentonite Slurry
								33.00-48.00	Filter	#2 Gravel Sand Pack

TABLE 2-2 (continued)
SAG HARBOR FORMER MGP SITE FINAL REMEDIAL INVESTIGATION

MONITORING WELL CONSTRUCTION SUMMARY

MONITORING WELL *	WELL DEPTH (feet bgs)	TOTAL DEPTH (feet bgs)	GROUND SURFACE ELEVATION (feet)	MEASURING POINT ELEVATION (feet) **	CASING DIAMETER (inches)	SCREEN DEPTHS (feet bgs)		ANNULAR FILLS (feet bgs)		
						INTERVAL	DESCRIPTION	INTERVAL	TYPE	MATERIALS
SHMW-09S	14.00	14.00	4.36	4.03	2.00	2.00-12.00	Slotted Schedule 40 PVC	0.50-1.50	Seal	Bentonite Chips
								1.50-14.00	Filter	#1 Gravel Sand Pack
SHMW-09I	48.00	48.00	4.41	3.72	2.00	35.00-45.00	Slotted Schedule 40 PVC	0.00-29.00	Backfill	Cement Bentonite Grout
								29.00-32.00	Seal	Bentonite Slurry
								32.00-48.00	Filter	#2 Gravel Sand Pack
SHMW-10S	15.00	17.00	5.91	5.69	1.00	5.00-15.00	Pre-Packed 20/40 mesh	0.00-2.00	Seal	Bentonite
								2.00-3.00	Seal	Bentonite Chips
								3.00-5.00	Filter	On-Morie Sand #1
								5.00-15.00	Filter	Pre-Packed Sand #00
SHMW-10I	45.50	47.50	5.89	5.69	1.00	35.50-45.50	Pre-Packed 20/40 mesh	0.00-28.00	Backfill	Cement Bentonite Grout
								28.00-30.00	Seal	Bentonite Chips
								30.00-35.50	Filter	On-Morie Sand #1
								35.50-45.50	Filter	Pre-Packed Sand #00
SHMW-11S	13.50	15.50	5.74	5.51	1.00	3.50-13.50	Pre-Packed 20/40 mesh	0.00-2.00	Seal	Bentonite Chips
								2.00-3.50	Filter	On-Morie Sand #1
								3.50-13.50	Filter	Pre-Packed Sand #00
SHMW-11I	45.00	47.00	5.79	5.57	1.00	35.00-45.00	Pre-Packed 20/40 mesh	0.00-31.00	Backfill	Cement Bentonite Grout
								31.00-33.00	Seal	Bentonite Chips
								33.00-35.00	Filter	On-Morie Sand #1
								35.00-45.00	Filter	Pre-Packed Sand #00
SHMW-12S	6.50	6.50	3.42	3.10	1.00	1.50-6.50	Pre-Packed 20/40 mesh	0.00-1.00	Seal	Cement Bentonite Grout
								1.00-1.50	Filter	On-Morie Sand #1
								1.50-6.50	Filter	Pre-Packed Sand #00
SHMW-12I	45.00	47.00	3.29	2.88	1.00	35.00-45.00	Pre-Packed 20/40 mesh	0.00-30.00	Backfill	Cement Bentonite Grout
								30.00-32.00	Seal	Bentonite Pellets
								32.00-35.00	Filter	On-Morie Sand #1
								35.00-45.00	Filter	Pre-Packed Sand #00
SHMW-13S	6.50	6.50	4.68	4.43	1.00	1.50-6.50	Pre-Packed 20/40 mesh	0.00-1.00	Seal	Cement Bentonite Grout
								1.00-1.50	Filter	On-Morie Sand #1
								1.50-6.50	Filter	Pre-Packed Sand #00
SHMW-13I	45.00	46.70	4.70	4.47	1.00	35.00-45.00	Pre-Packed 20/40 mesh	0.00-30.00	Backfill	Cement Bentonite Grout
								30.00-33.00	Seal	Bentonite
								33.00-35.00	Filter	On-Morie Sand #1
								35.00-45.00	Filter	Pre-Packed Sand #00

Notes

***** Construction details for MW-01 through MW-06 taken from Fluor Daniel GTI report,
monitoring well clusters SHMW-01 through SHMW-09 installed during initial field program,
and monitoring well clusters SHMW-10 through SHMW-13 installed during supplemental field program.

****** Top of casing elevation

******* Ground and/or casing elevation not valid (i.e. Flush mounted well)

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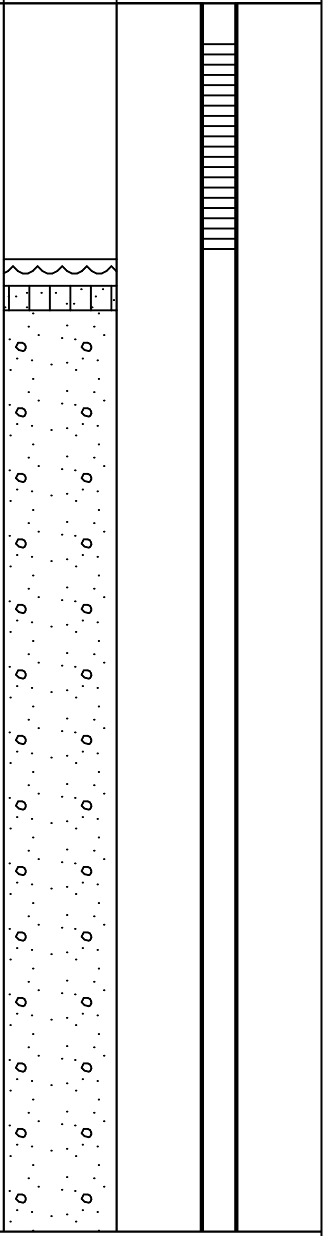
Site Id: SHMW-01I	
Date(s): 04/25/00 – 04/25/00	
Datum: Mean Sea Level	
Elevation: 4.47'	Measuring Point: 4.13'
Completed Depth: 48.00'	Total Depth: 48.00'
Location: Sag Harbor, Suffolk County, New York	
Purpose: Monitoring Well, Intermediate	
Logged By: Stahl/Diamond	
Drilling Method: 4 1/4" Hollow Stem Auger	
Borehole Dia.: 8.00in	
Contractor: Delta Well and Pump	

Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 1.00' to: 6.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

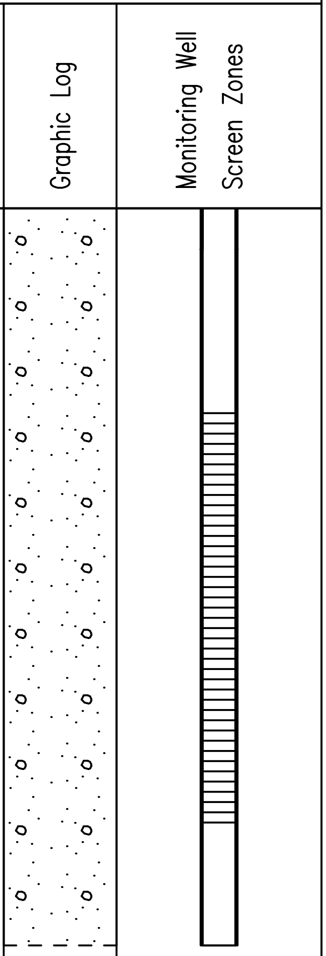
Remarks: Samples selected for analysis at 0.5–1.5' and 36–38'. Well boring initally drilled/logged to 38' on 3/22/00. Well defective, redrilled to 48'

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
		0–2'	0.0 ppm 0.6 ppm 3.2 ppm	Gravelly FILL, over bk/br m–f SAND, little silt, tr c sand/gravel, moist
		2–4'	38.1 ppm 261 ppm 117 ppm	Black to brown-grey, med–fine SAND, some silt, tr roots, odor, NAPL, sheen, loose, wet,
5		4–6'	46.2 ppm 86.4 ppm	Black, med–fine SAND, tr silt and coarse sand, NAPL, odor, irredescent sheen, trace roots in sample tip
		6–8'	26.8 ppm 35.1 ppm 38.4 ppm 21.1 ppm	Blk, med–fine SAND, tr c. sand and silt over brn PEAT/SILT, firm, wet
		8–10'	53.1 ppm	Brown, medium–fine SAND, trace silt, NAPL, odor, sheen, loose, wet
10		10–12'	23.6 ppm 35.1 ppm 16.2 ppm	Brown, med–fine SAND, trace silt and coarse sand, hydrocarbon–like odor, sheen, loose, wet
		12–14'	9.3 ppm 4.6 ppm 7.8 ppm	Brown, fine SAND, little silt, trace med–coarse sand, odor, wet
15		14–16'	8.1 ppm 7.2 ppm 5.6 ppm	Brown med–fine SAND tr silt, tr coarse sand, odor, loose, wet,
		16–18'	5.2 ppm 2.3 ppm 3.0 ppm	Brown, medium–fine SAND, trace silt, odor, loose, wet
		18–20'	5.4 ppm 3.1 ppm 4.6 ppm 5.7 ppm	Same as above, with trace coarse sand, no odor
20		20–22'	0.5 ppm 0.9 ppm 0.8 ppm	Same as above
		22–24'	0.8 ppm 1.2 ppm 0.9 ppm	Same as above
25		24–26'	0.4 ppm 0.2 ppm 0.2 ppm	Brown, med–fine SAND, little silt, trace coarse sand, med dense, wet
		26–28'	0.4 ppm 0.6 ppm 0.2 ppm 0.1 ppm	Same as above, but gray–brown
		28–30'	0.4 ppm 0.3 ppm	Same as above



Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-01I
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/25/00 – 04/25/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description
		30–32'	0.2 ppm 0.3 ppm	Brown, med–fine SAND, trace silt, trace coarse sand, med dense, wet
		32–34'	0.1 ppm 0.2 ppm	Brown, fine SAND, little medium sand, trace silt, medium dense, wet
		34–36'	0.1 ppm	Brown, fine SAND, little med sand, little silt, med dense, wet
35				
		36–38'	0.1 ppm	Same as above, trace medium sand, trace silt
40				Drillers reported running sands, could not obtain samples
45				
				Base of boring – 48'
50				
55				
60				
65				



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Site Id: SHMW-02D

Date(s): 04/18/00 - 04/18/00

Datum: Mean Sea Level

Elevation: 5.19'

Measuring Point: 4.66'

Completed Depth: 80.00'

Total Depth: 90.00'

Screens:

type	size	dia	fm	to
type: Slotted	size: 0.000in	dia: 2.00in	fm: 1.50'	to: 7.30'
type: Slotted	size: 0.020in	dia: 2.00in	fm: 35.00'	to: 45.00'
type: Slotted	size: 0.020in	dia: 2.00in	fm: 65.00'	to: 75.00'

Location: Sag Harbor, Suffolk County, New York

Purpose: Monitoring Well, Deep

Logged By: Schafer/Diamond

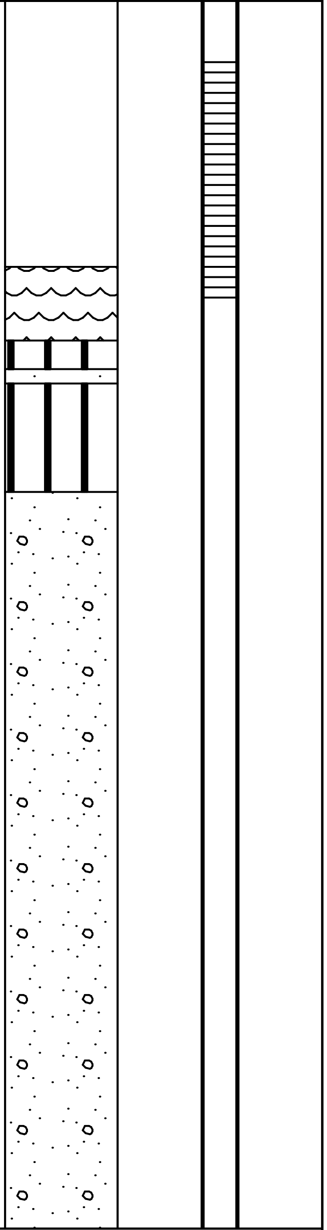
Drilling Method: 4 1/4" Hollow Stem Auger

Borehole Dia.: 6.50in

Contractor: Delta Well and Pump

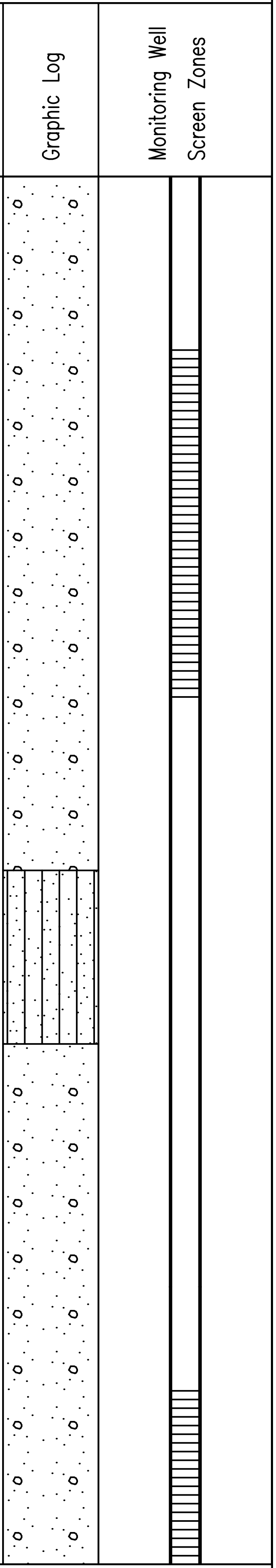
Remarks: 3'-30' log from SHSB-05. Geotech samples taken at 1-3', 35-46', 65-67'and 69-75'. Chemical sample collected from 88-90', labeled SHSB-02(88-90).

Depth (ft)	Sample Interval	Vapor	Material Description
	1-3'	0.0 ppm	Sandy, gravelly FILL with crushed bluestone, red brick fragment, decayed wood, oily sheen
			Br, c.-f. SAND, tr. f. sand and silt, loose,wet
5	4-8'	36.2 ppm 76.4 ppm 132.8 ppm 127.6 ppm 136.4 ppm 141.2 ppm	Blk-brn, med-fine SAND, little f. gravel, tr. silt, NAPL, loose, wet Black-brown, med-fine SAND, trace silt and coarse sand, NAPL-like odor, sheen, trace peat near sampler base, PID = 2.1 ppm in breathing zone
10	8-12'	36.3 ppm 62.8 ppm 41.6 ppm 38.2 ppm	Dark brown SILT, little peat, tr clay and med-fine sand. Thin seam med-fine SAND, trace coarse SAND near center of sample PID = 0.6pm in breathing zone
15	12-16'	9.6 ppm 12.4 ppm 26.2 ppm 31 ppm 21.9 ppm 26.8 ppm 32.1 ppm 10.6 ppm	Brown, med-fine SAND, trace silt, trace coarse sand, med dense, layered, wet PID = 0.0 in breathing zone
	16-20'	21.1 ppm 17.2 ppm 20.4 ppm 71.6 ppm 17.4 ppm 14.2 ppm 9.6 ppm 19.8 ppm	Brown, med-fine SAND, little coarse sand, trace fine gravel, med dense, layered, wet
20	20-24'	0.6 ppm 0.2 ppm 0.8 ppm 0.6 ppm 0.4 ppm 0.8 ppm 0.5 ppm 0.2 ppm	Gray-brown, med-fine SAND, trace coarse sand, trace silt, med dense, wet
25	24-28'	0.6 ppm 0.9 ppm 1.1 ppm 0.6 ppm 1.2 ppm 0.9 ppm 1.4 ppm 0.7 ppm	Same as above, no silt
	28-30'	0.2 ppm 0.5 ppm 0.4 ppm 0.6 ppm	Same as above, little coarse sand



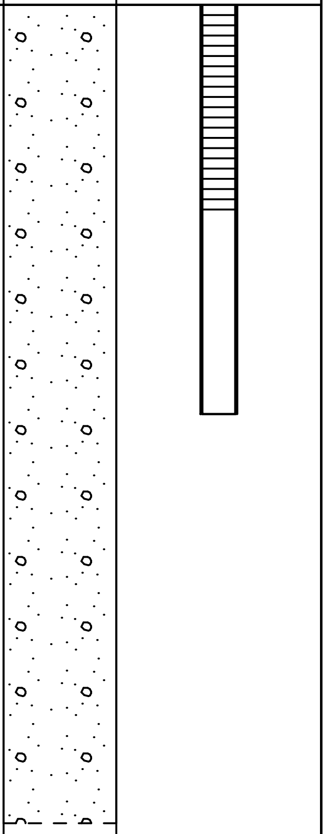
Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-02D
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/18/00 - 04/18/00
Purpose: Monitoring Well, Deep	Total Depth: 90.00'

Depth (ft)	Sample Interval	PID	Material Description
			Gray-brown, med-fine SAND, trace coarse sand, trace silt, med dense, wet
35	35-37'	0.0 ppm	Pale, yellowish-brown SAND, coarse-very coarse, some fine-med gravel
40	40-42'	0.0 ppm	Same as above
45	44-46'	0.0 ppm	Same as above
50	50-52'	5.3 ppm 35 ppm 30 ppm 127 ppm	Dark brown, NAPL saturated, silty fine SAND, heavy hydrocarbon-like odor, sheen, loose, wet
55	55-57'	5.0 ppm 11 ppm 34 ppm 45 ppm	Dark brown, NAPL stained fine-coarse SAND, tr silt, some fine gravel, hydrocarbon-like odor, sheen
60	60-62'	18 ppm 15 ppm 29 ppm 42 ppm	Same as above
65	65-67'	20 ppm 12 ppm 34 ppm 58 ppm	Same as above
	69-71'	19 ppm 25 ppm	Brown, fine-coarse SAND, trace silt, hydrocarbon-like odor, slight staining, sheen, loose, wet



Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-02D
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/18/00 - 04/18/00
Purpose: Monitoring Well, Deep	Total Depth: 90.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
			31 ppm 54 ppm			
		73-75'	15 ppm 36 ppm 36 ppm 42 ppm	Brown, fine-medium SAND, w/trace silt and coarse sand, hydrcarbon-like odor, slight staining, loose, wet		
75						
		78-80'	32 ppm 50 ppm	Brown, fine-coarse SAND, hydrocarbon-like odor, slight staining, wet, loose		
80						
85						
		88-90	11.6 ppm	Lt brown, fine-medium liquid SAND, naphthalene-like odor, sheen, floating brown NAPL, loose Composite sample collected Base of boring - 90'		
90						
95						
100						
105						



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Site Id: SHMW-03I

Date(s): 04/05/00 - 04/05/00

Datum: Mean Sea Level

Elevation: 5.43'

Measuring Point: 4.87'

Completed Depth: 48.00'

Total Depth: 48.00'

Location: Sag Harbor, Suffolk County, New York

Purpose: Monitoring Well, Intermediate

Logged By: Stahl/Diamond

Drilling Method: 4 1/4" Hollow Stem Auger

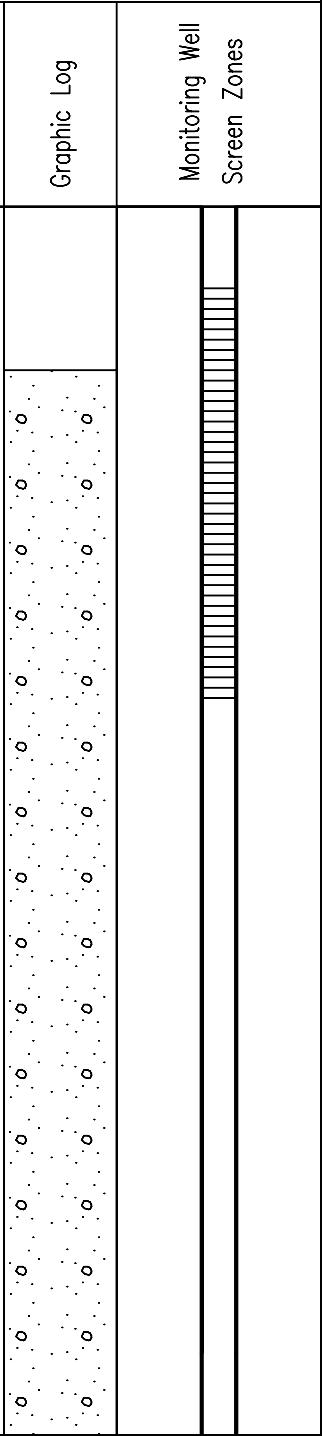
Borehole Dia.: 6.50in

Contractor: Delta Well and Pump

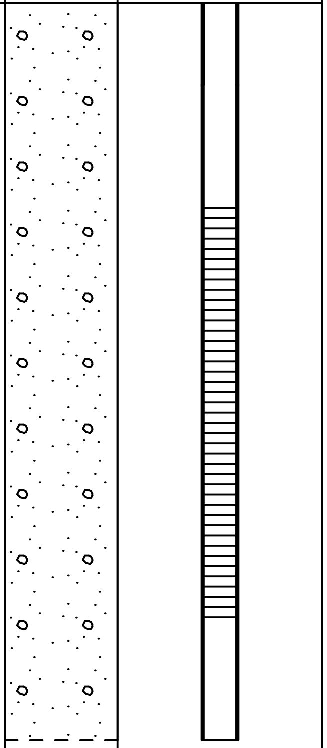
Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 2.00' to: 12.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

Remarks: Due to well's location in road divide and to minimize impact to traffic flow and health and safety, geologic materials were extrapolated

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
				ASPHALT
				Yellow-brown, sandy, gravelly FILL
				Dark to pale yellowish brown medium-coarse SAND w/some gravel
5				
10				
				Brown, medium-coarse SAND, staining
15				
				Brown, med-fine SAND, trace-little c. sand and silt, wet
20				
				Brown, coarse to fine SAND, trace-little fine gravel, wet
25				



Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-03I
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/05/00 - 04/05/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'



Depth (ft)	Recovery	Sample Interval	Vapor	Material Description	Graphic Log	Monitoring Well Screen Zones
				Brown, medium-fine SAND, trace silt, wet		
35						
				Brown fine SAND, trace-little silt, wet		
40						
				Brown coarse-fine SAND, trace medium gravel, wet		
45						
				Base of Boring - 48 ft.		
50						
55						
60						
65						

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Site Id: SHMW-04I

Date(s): 04/03/00 - 04/03/00

Datum: Mean Sea Level

Elevation: 5.71'

Measuring Point: 5.13'

Completed Depth: 47.50'

Total Depth: 47.50'

Location: Sag Harbor, Suffolk County, New York

Purpose: Monitoring Well, Intermediate

Logged By: Stahl/Diamond

Drilling Method: 4 1/4" Hollow Stem Auger

Borehole Dia.: 6.50in

Contractor: Delta Well and Pump

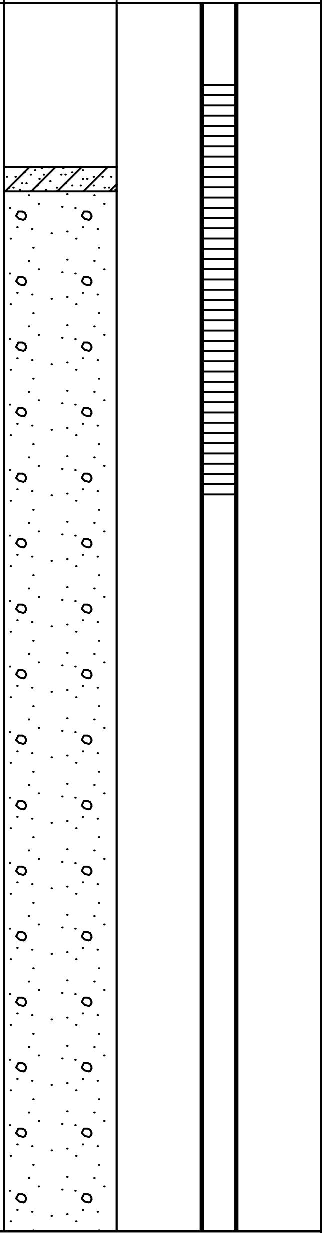
Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 2.00' to: 12.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

Remarks: Split spoon samples collected 4-12 feet bgs. The remaining depth descriptions were extrapolated from nearby borings SHSB-14 and SHSB-15

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
				ASPHALT
				Pale to dark yellow-orange sandy, gravelly FILL
		4-6'	0.0 ppm 0.0 ppm 99.5 ppm	Dk yellow brown/med gray, med-coarse SAND, some CLAY and med gravel
5				Pale brown coarse SAND, some fine-med gravel, NAPL staining
		6-8'	134 ppm 29.4 ppm 16.9 ppm 10.0 ppm	Pale brown coarse-v. coarse SAND w/fine-coarse gravel, NAPL staining, naphthalene-like odor
		8-10'	234 ppm 105 ppm 40.1 ppm 20.9 ppm	Same as above, but pale yellowish brown
10		10-12'	166 ppm 42.6 ppm 27.3 ppm	Same as above
				Gray brown fine-coarse SAND, some gravel, slight staining and odor
				Brown fine-coarse SAND, slight odor, loose, wet
				Brown, med-fine SAND, trace coarse sand and silt, loose, wet
15				
20				
				Brown, coarse-fine SAND, tr fine gravel-coarse sand, loose, wet
25				

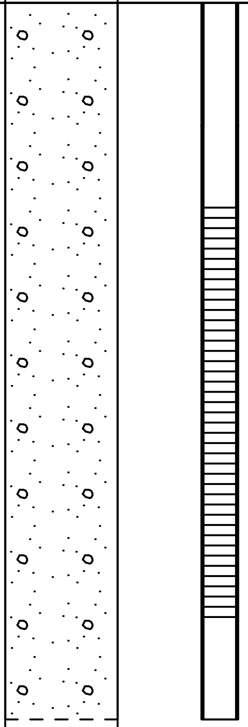
Graphic Log

Monitoring Well Screen Zones



Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-04I
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/03/00 - 04/03/00
Purpose: Monitoring Well, Intermediate	Total Depth: 47.50'

Depth (ft)	Recovery	Sample Interval	PID	Material Description
				Brown med-fine SAND, tr coarse sand and silt, loose, wet
				Brown med-fine SAND, trace silt, loose, wet
35				Brown fine SAND, trace-little silt, loose, wet
40				
				Grayish brown fine SAND, little silt, medium dense, wet
				Brown coarse-fine SAND, trace med-fine gravel, loose, wet
45				
				Base of Boring - 47.5 ft.
50				
55				
60				
65				



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Site Id: SHMW-05I

Date(s): 04/04/00 - 04/04/00

Datum: Mean Sea Level

Elevation: 6.14'

Measuring Point: 5.60'

Completed Depth: 48.00'

Total Depth: 48.00'

Location: Sag Harbor, Suffolk County, New York

Purpose: Monitoring Well, Intermediate

Logged By: J. Shafer

Drilling Method: 4 1/4" Hollow Stem Auger

Borehole Dia.: 6.50in

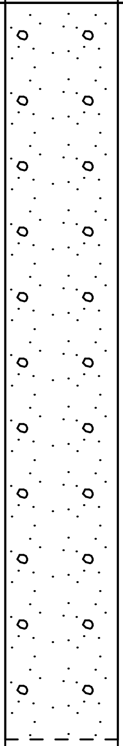
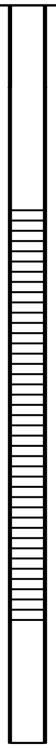
Contractor: Delta Well and Pump

Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 2.00' to: 12.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

Remarks: SHMW-05I data for 0-48' taken from SHSB-15I
Samples collected for analysis from 5-7', 16-18',
and 48-50' from SHSB-15I

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description	Graphic Log	Monitoring Well Screen Zones
		0-4'	1.4 ppm 0.8 ppm 1.2 ppm 0.9 ppm	Brown, silty fine SAND, loose, moist		
5		4-8'	22 ppm 264 ppm 210 ppm 58 ppm 51 ppm 64 ppm	Brown, fine-coarse SAND, loose, slight hydrocarbon-like odor, wet Brown, NAPL stained, fine-coarse SAND, loose, hydrocarbon-like odor, wet Gray-brown, fine-coarse SAND, hydrocarbon-like odor, intermittent brown staining, loose, wet		
10		8-12'	14.4 ppm 13.1 ppm 6.4 ppm 5.9 ppm 5.3 ppm 5.9 ppm 5.5 ppm	Gray-brown, fine-medium SAND, loose, slight hydrocarbon-like odor, wet Brown, peaty CLAY, soft, plastic, w/organic matter, moist Gray-brown, fine-med, silty SAND, loose, slight hydrocarbon-like odor, wet		
15		12-16'	5.5 ppm 6.6 ppm 7.6 ppm 4.4 ppm 4.2 ppm 14.6 ppm 3.5 ppm 3.7 ppm	Brown, fine-coarse SAND, trace silt, loose, wet Brown, fine-medium SAND, trace silt, loose, wet		
		16-20'	4.5 ppm 6.1 ppm 3.5 ppm 2.4 ppm 3.5 ppm 4.1 ppm 2.4 ppm 2.7 ppm	Same as above, medium dense		
20		20-24'	1.6 ppm 1.8 ppm 1.8 ppm 1.6 ppm 1.7 ppm 1.6 ppm 1.8 ppm 2.5 ppm	Brown, fine-med SAND, trace silt and coarse sand, med dense, wet Brown, fine-med, silty SAND, tr. coarse sand, dense-med dense, wet Brown, fine-coarse SAND, medium dense, wet		
25		24-28'	59.1 ppm 192 ppm 201 ppm 78 ppm 47.1 ppm 122.2 ppm 47.9 ppm	Brown, fine-coarse SAND, trace silt, dense, hydrocarbon-like odor, heavy staining, NAPL at 27.5', sheen, wet		
		28-32'	36.5 ppm	Light brown, fine-coarse SAND, loose, slight napthalene-like odor, slight sheen, wet		

Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-05I
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/04/00 – 04/04/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
35		32–36'	2.8 ppm 49.9 ppm 19.7 ppm 18.8 ppm 6.0 ppm 25.1 ppm 12.2 ppm 8.5 ppm	Light brown, fine–med SAND, loose, slight hydrocarbon–like odor, slight sheen, wet		
		36–38'	2.4 ppm	Brown, fine SAND, loose, wet		
		38–40'	0.7 ppm	Brown, fine–coarse SAND, loose, wet		
40		40–44'	5.3 ppm 6.9 ppm 1.3 ppm 1.3 ppm 1.1 ppm 0.9 ppm 1.2 ppm 0.9 ppm	Light brown, fine–coarse SAND, w/trace fine–coarse gravel, wet		
45		44–48'	2.6 ppm 0.9 ppm 3.7 ppm 3.5 ppm 1.9 ppm 2.6 ppm 1.4 ppm 1.2 ppm	Light brown, fine–coarse SAND, w/trace gravel, loose, wet		
			0.2 ppm	Base of boring – 48'		
50						
55						
60						
65						

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Site Id: SHMW-06I

Date(s): 04/10/00 – 04/11/00

Datum: Mean Sea Level

Elevation: 4.43'

Measuring Point: 4.15'

Completed Depth: 48.00'

Total Depth: 48.00'

Location: Sag Harbor, Suffolk County, New York

Purpose: Monitoring Well, Intermediate

Logged By: J. Shafer

Drilling Method: 4 1/4" Hollow Stem Auger

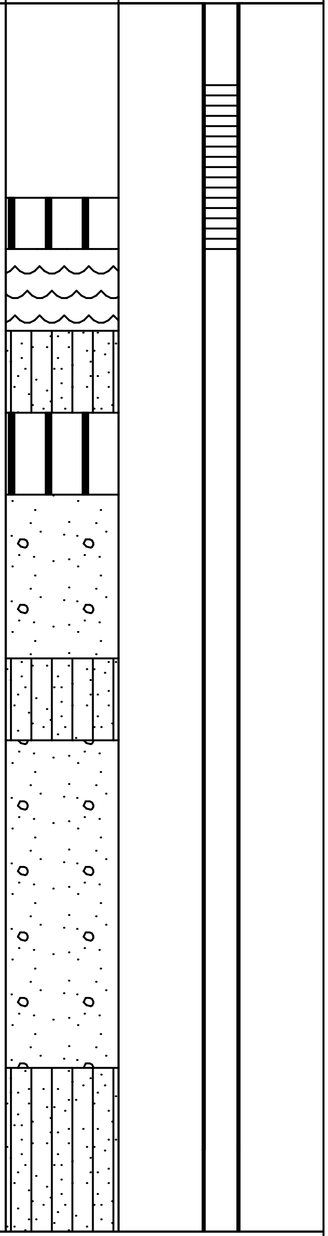
Borehole Dia.: 6.50in

Contractor: Delta Well and Pump

Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 2.00' to: 6.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

Remarks: 0–4' data obtained from a composite sample.

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description	Graphic Log	Monitoring Well Screen Zones
			0.0 ppm	Dark brown, silty fine SAND, trace c. gravel, loose, moist		
			4.2 ppm	Brown, fine–coarse SAND, fine–coarse gravel, loose, wet at 2.5'		
		4–6'	3.6 ppm	Brown, f.–c. SAND, hydrocarbon–like odor, brn staining, sheen, loose, wet		
5			23.2 ppm	Gray SILT, soft, slightly plastic, hydrocarbon–like odor, staining, sheen, wet		
		6–8'	99 ppm 45 ppm 56 ppm	Brown, clayey PEAT, soft, plastic, organic odor, moist Total H2S = 75 ppm		
		8–10'	21 ppm	Dk brown, sandy SILT, nonplastic, liquid, hydrocarbon–like odor, staining, sheen, wet Total H2S = 25 ppm		
10		10–12'	73 ppm 35 ppm	Same as above, not sandy Total H2S = 31 ppm		
		12–14'	16 ppm	Orange–brown, fine SAND, hydrocarbon–like odor, loose, wet Total H2S = 100+ ppm		
15		14–16'	0.0 ppm	Brown, fine SAND, tr silt and med–c sand, med dense, wet Total H2S = 11 ppm		
		16–18'	0.0 ppm 0.0 ppm 4.9 ppm 0.0 ppm	Brown, silty fine SAND, trace coarse sand, wet		
		18–20'	0.0 ppm 0.0 ppm 6.5 ppm 0.0 ppm	Brown, fine SAND, tr silt, dense, wet Total H2S = 2 ppm		
20		20–22'	0.0 ppm	Light brown fine–med SAND, med dense, wet Total H2S = 2 ppm		
		22–24'	0.0 ppm	Brown, fine SAND, trace silt and fine gravel, medium dense, wet Total H2S = 0 ppm		
25		24–26'	0.0 ppm	Light brown, fine SAND, trace silt and med sand, med dense, wet		
		26–28'	0.0 ppm	Light brown, silty fine SAND, medium dense, wet		
		28–30'	0.0 ppm	Light brown, fine SAND, some silt, tr med sand, med dense, wet		

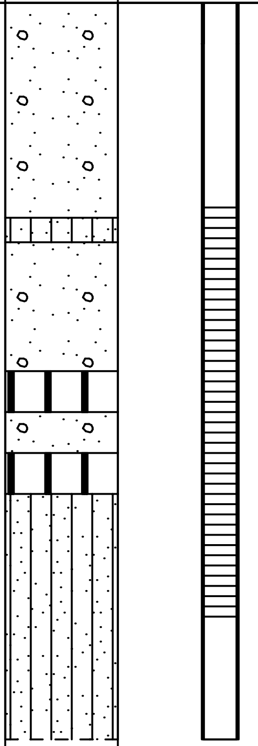


Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-06I
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/10/00 – 04/11/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description
		30–32'	0.0 ppm	Brown–light brown, fine–medium SAND, trace silt, wet, med dense
		32–34'	0.0 ppm	Same as above
35		34–36'	0.0 ppm	Same as above Brown, sandy SILT, semi–soft, non–plastic, wet
		36–38'	0.0 ppm	Lt brown, fine–med SAND, tr coarse sand and silt, med dense, wet
		38–40'	0.0 ppm	Light brown, fine–medium SAND, dense, wet Brown SILT, soft, slightly plastic, wet
40		40–42'	0.0 ppm	Light brown SAND, fine–medium, medium dense, wet Brown SILT, soft, plastic, wet
		42–44'	0.0 ppm	Brown, f. SAND, w/orange banding and thin silt lenses, med dense, wet
45		44–46'	0.0 ppm	Same as above
		46–48'	0.0 ppm	Same as above, no orange banding
				Base of Boring – 48'
50				
55				
60				
65				

Graphic Log

Monitoring Well Screen Zones



Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

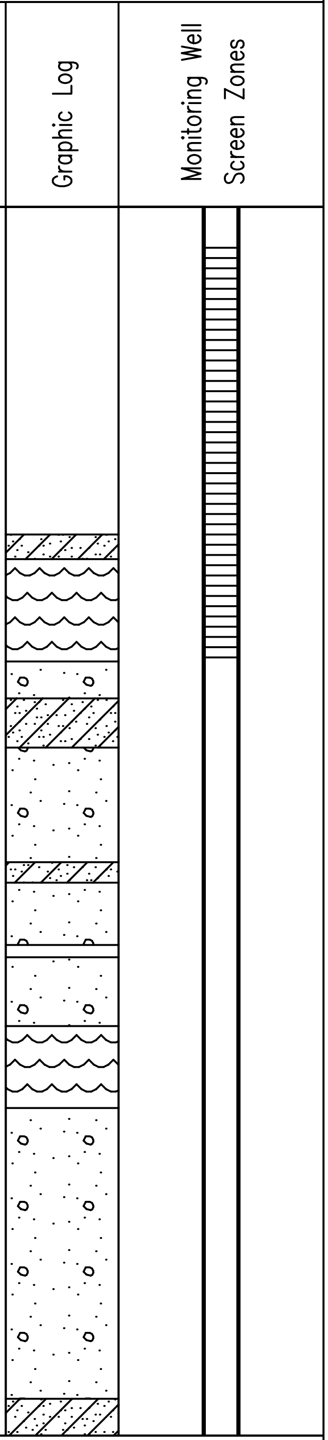
Site Id: SHMW-07I	
Date(s): 03/30/00 – 03/31/00	
Datum: Mean Sea Level	
Elevation: 5.00'	Measuring Point: 4.72'
Completed Depth: 48.00'	Total Depth: 48.00'

Location: Sag Harbor, Suffolk County, New York
Purpose: Monitoring Well, Intermediate
Logged By: Stahl/Diamond
Drilling Method: 4 1/4" Hollow Stem Auger
Borehole Dia.: 6.50in
Contractor: Delta Well and Pump

Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 1.00' to: 11.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

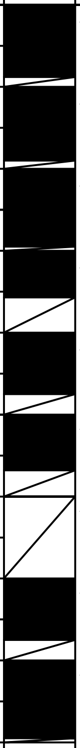
Remarks:

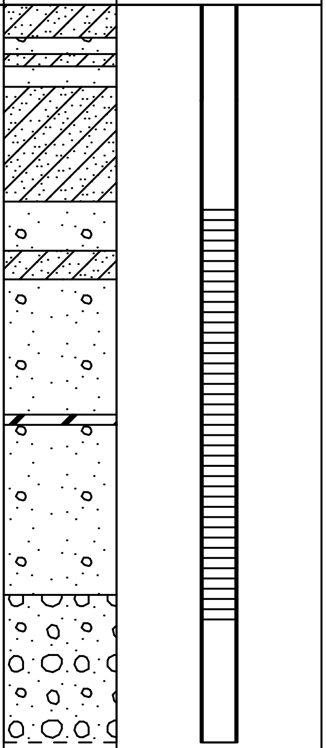
Depth (ft)	Sample Interval	Vapor	Material Description
	0–2'	0.0 ppm 0.0 ppm	ASPHALT
	2–4'	0.0 ppm 96.8 ppm 98.8 ppm	Yellow brown–brown, sandy, gravelly FILL, brick fragment at 2.75', wet Gry–blk, coarse–v coarse SAND, lens dk–gry soft CLAY, sheen, naphthalene–like odor
5	4–6'	90 ppm 89.7 ppm 239 ppm 22.4 ppm	Brn–gry, coarse–v coarse SAND, f–med gravel, NAPL–saturated, naphthalene–like odor Interbedded gray CLAY and f–med olive gray micaceous SAND, w/c. gravel
	6–8'	41.4 ppm 370 ppm 228 ppm 273 ppm	Dark gr, c–v coarse SAND, w/f–coarse gravel, odor, staining, NAPL
	8–10'	26.5 ppm 24.3 ppm	Moderate yellowish brn/gry/blk, c–v coarse SAND, w/some clay Grayish black and brownish black PEAT, w/clay and hydrogen sulfide–like odor
10	10–12'	160 ppm 240 ppm 46.5 ppm 18.1 ppm	Same as above Grayish brown, med–fine SAND, tr silt, slight hydrogen sulfide–like odor
	12–14'	16.4 ppm 16.2 ppm 15 ppm	Moderate brown, medium–fine, clayey SAND Moderate brown, medium–coarse SAND, hydrogen sulfide–like odor
15	14–16'	20.4 ppm 23.6 ppm 6.9 ppm 44.0 ppm	Moderate brown, med–coarse SAND, some fine–coarse gravel, tr mica, hydrogen sulfide–like odor
	16–18'	1.2 ppm 6.3 ppm 18.2 ppm 5.6 ppm	Yellow–br, med coarse–v coarse SAND, w/f.–med gravel, some clay, tr mica Same as above, no clay
	18–20'	0.0 ppm	Moderate–dark yellowish br, coarse–med SAND, w/thin layer of black peat
20	20–22'	68.5 ppm	Grayish black PEAT w/coarse gravel
	22–24'	0.0 ppm 0.1 ppm 0.0 ppm 0.0 ppm	Pale–yellow brown, coarse–very coarse SAND
25	24–26'	0.0 ppm	Pale yellow brown, medium– very coarse SAND
	26–28'	0.0 ppm	Pale–light yellow brown, medium–coarse SAND, trace mica and clay
	28–30'	0.0 ppm	Same as above, no mica or clay; grading to SAND with some CLAY



Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-07I
Location: Sag Harbor, Suffolk County, New York	Date(s): 03/30/00 - 03/31/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'

Depth (ft)	Sample Interval	PID	Material Description
	30-32'	2.2 ppm 0.5 ppm 1.9 ppm 0.6 ppm	Pale-yellow brn, med-fine SAND, tr mica, thin lens pale yel-brn, CLAYEY SAND Pale-yellow brown, coarse-very coarse SAND
	32-34'	0.0 ppm 2.1 ppm 0.3 ppm 0.0 ppm	Pale-yellow brown, medium-fine clayey SAND w/some mica Pale-yellow brown, medium-coarse SAND, w/some clay, fine gravel
35	34-36'		Gray-orange, coarse-very coarse SAND, w/fine-coarse gravel, trace mica
	36-38'	0.0 ppm	Same as above, w/pale yellowish brown, sandy CLAY lens
	38-40'	0.0 ppm	Pale yellow brown, coarse-v coarse SAND, w/fine-coarse gravel
40	40-42'	0.0 ppm	Same as above, w/thin lens brown, soft clay at top of sampler
	42-44'		No recovery (42-44')
45	44-46'	0.0 ppm	Pale brn/yellow brn/gray/orange, coarse-very coarse SAND, w/some fine to coarse gravel
	46-48'	0.0 ppm 0.0 ppm 3.3 ppm 0.0 ppm	Pale yellow brown, coarse-v coarse SAND, w/fine-coarse gravel Base of Boring - 48'
50			
55			
60			
65			





Dvirka and Bartilucci
CONSULTING ENGINEERS
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Site Id: SHMW-08I

Date(s): 04/12/00 – 04/13/00

Datum: Mean Sea Level

Elevation: 5.08'

Measuring Point: 4.15'

Completed Depth: 48.00'

Total Depth: 48.00'

Location: Sag Harbor, Suffolk County, New York

Purpose: Monitoring Well, Intermediate

Logged By: J. Shafer

Drilling Method: 4 1/4" Hollow Stem Auger

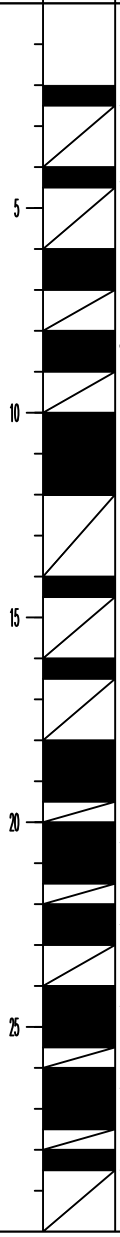
Borehole Dia.: 6.50in

Contractor: Delta Well and Pump

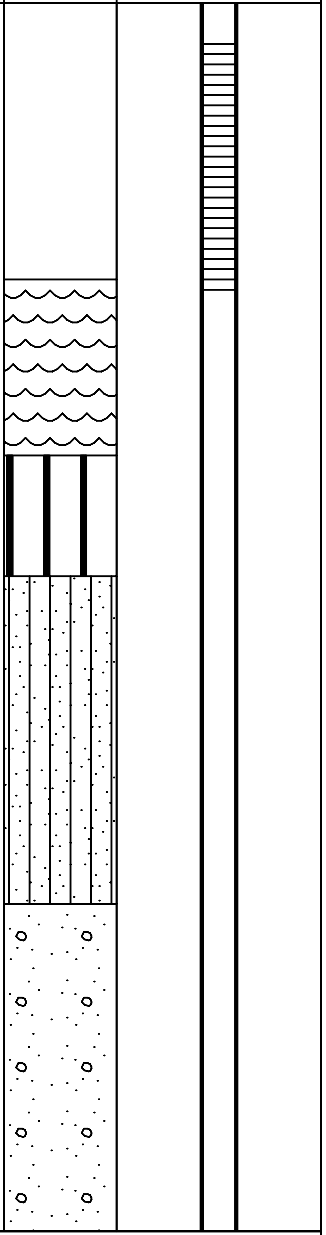
Screens:

type	size	dia	fm	to
Slotted	0.020in	2.00in	1.00'	7.00'
Slotted	0.020in	2.00in	35.00'	45.00'

Remarks: 0–2' data obtained from a composite sample

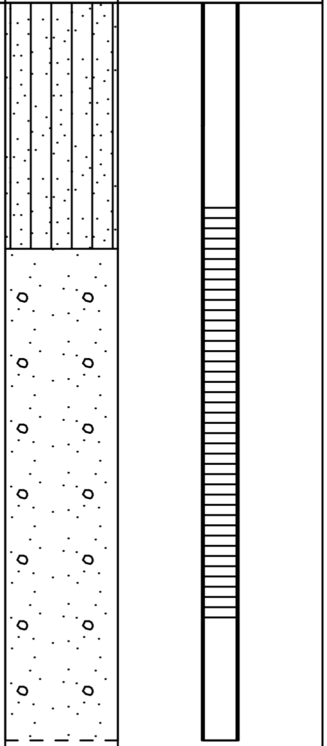


Depth (ft)	Sample Interval	Vapor	Material Description
		0.0 ppm	Brown, sandy silty FILL, w/cobbles and coarse gravel, wet at 1'
	2–4'	2.7 ppm	FILL, black vesicular slag, w/tar, naphthalene–like odor, sheen
	4–6'	0.0 ppm	Brown, silty fine SAND, loose, wet
5			
	6–8'	3.2 ppm	Gray, fine–coarse SAND, some f gravel, wet Total H_2S = 9 ppm
		30 ppm	Rich brown PEAT, soft, moist, organic odor
		100 ppm	Total H_2S = 17 ppm
	8–10'	71 ppm	Same as above (no H_2S measurement)
10	10–12'	70 ppm	Same as above, no odor
		69 ppm 54 ppm	Yellow–orange SILT, soft, plastic, organic odor, moist
		81 ppm	Total H_2S = 75 ppm
	12–14'		No Recovery (12–14')
	14–16'	0.0 ppm	Rich brown, silty fine SAND, organic odor, loose, wet
15			Total H_2S = 52 ppm
	16–18'	0.0 ppm	Gray–brown, silty fine SAND, medium dense, organic odor, wet
			Total H_2S = 51 ppm
	18–20'	0.0 ppm	Light brown to brown, fine–coarse SAND w/some silt, loose, wet
20	20–22'	0.0 ppm	Brown, fine–medium SAND, w/some silt, loose, wet
	22–24'	0.0 ppm	Light brown, fine SAND, w/some medium sand, loose, wet
25	24–26'	0.0 ppm	Light brown, fine–medium SAND, loose, wet
	26–28'	0.0 ppm	Light brown, fine–coarse SAND, trace fine gravel, loose, wet
	28–30'	0.0 ppm	Same as above, some fine gravel, orange banding


Graphic Log
Monitoring Well Screen Zones

Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-08I
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/12/00 - 04/13/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description
		30-32'	0.0 ppm	Brown, fine-coarse, silty SAND, w/fine gravel, loose, wet,
		32-34'	0.0 ppm	Brown, fine-coarse, silty SAND, loose, wet
35		34-36'	0.0 ppm	Brown, fine-coarse, silty SAND, w/fine-coarse gravel, loose, wet
		36-38'	0.0 ppm	Light brown, fine-coarse SAND, w/fine-coarse gravel, loose, wet
		38-40'	0.0 ppm	Brown, fine-coarse SAND, w/some fine-coarse gravel, loose, wet
40		40-42'		No recovery (40-42')
		42-44'	0.0 ppm	Brn, fine-coarse SAND, some f. gravel, tr c. gravel, loose, wet
		44-46'	0.0 ppm	Same as above
45		46-48'	0.0 ppm	Same as above
				Base of Boring - 48'
50				
55				
60				
65				



Dvirka and Bartilucci
CONSULTING ENGINEERS
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Site Id: SHMW-09I

Date(s): 04/07/00 – 04/07/00

Datum: Mean Sea Level

Elevation: 4.41'

Measuring Point: 3.72'

Completed Depth: 48.00'

Total Depth: 48.00'

Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 2.00' to: 12.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

Location: Sag Harbor, Suffolk County, New York

Purpose: Monitoring Well, Intermediate

Logged By: Stahl/Diamond

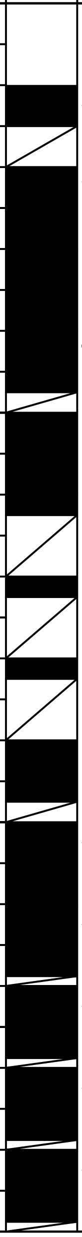
Drilling Method: 4 1/4" Hollow Stem Auger

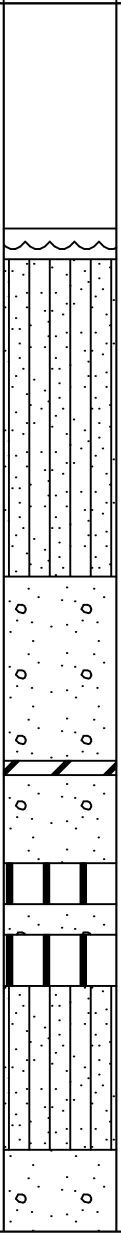
Borehole Dia.: 6.50in

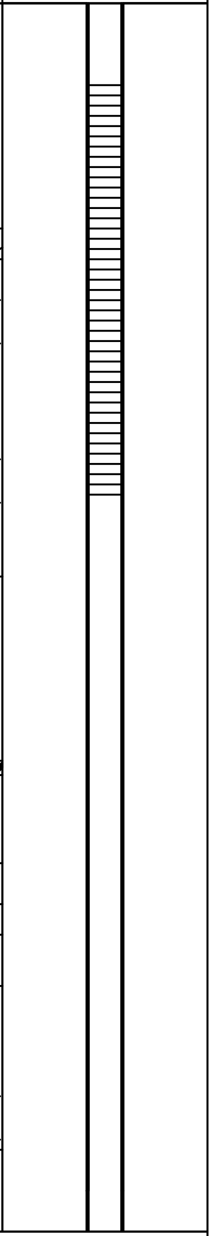
Remarks: A composite sample was obtained at 0–2'.

Contractor: Delta Well and Pump

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description	Graphic Log	Monitoring Well Screen Zones
				Brown, silty FILL, w/brick, crushed rock, medium–coarse gravel, moist		
		2–4'	0.0 ppm 0.0 ppm	Dark brown, fine, silty sandy FILL, w/some brick, loose, wet		
		4–6'	0.0 ppm 4.1 ppm	Brown, silty FILL, w/black coal, red brick, and medium gravel		
5			0.6 ppm 0.0 ppm	Brown, fine–medium SAND, loose, wet		
		6–8'	0.0 ppm 2.2 ppm	Brown, clayey PEAT, soft, plastic, hydrogen sulfide–like odor, moist		
			0.0 ppm 0.0 ppm	Brown, silty fine SAND, dense, wet		
		8–10'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, silty fine SAND, medium dense, wet		
10		10–12'		Same as above		
		12–14'	0.0 ppm	Dark brown, silty fine SAND, w/some coarse gravel, medium dense		
		14–16'	0.0 ppm	Brown, fine–medium SAND, loose, wet		
15		16–18'	0.0 ppm	Same as above		
		18–20'	0.0 ppm 0.0 ppm	Brown, fine–med SAND, hydrocarbon–like odor, brn staining, sheen, loose, wet		
			22.3 ppm	Brown CLAY, liquid, soft, hydrocarbon–like odor, sheen		
20		20–22'	0.0 ppm 0.0 ppm	Brown, fine–coarse SAND, sheen, loose, wet		
			0.0 ppm 10.3 ppm	Brn SILT, soft, slightly stiff, plastic, hydrocarbon–like odor, stained, sheen		
		22–24'	7.3 ppm 0.0 ppm	Brn, f.–c. SAND, slight hydrocarbon–like odor and staining, sheen, loose, wet		
			0.0 ppm	Brown SILT, soft–slightly stiff, plastic, sheen		
25		24–26'	0.0 ppm 5.2 ppm 0.0 ppm	Brn, f–med SAND, tr c. sand, some silt, slight hydrocarbon–like odor, sheen		
		26–28'	0.0 ppm 0.0 ppm 0.0 ppm	Brn, fine SAND, tr coarse sand, some silt, intermittent orange banding		
		28–30'	0.0 ppm 0.0 ppm 0.0 ppm	Brn, fine–medium SAND, loose–medium dense, intermittent orange banding		



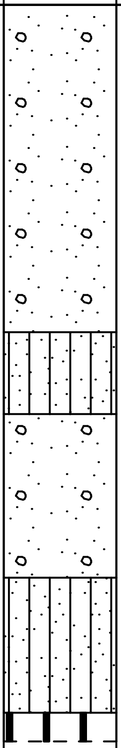




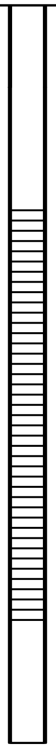
Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-09I
Location: Sag Harbor, Suffolk County, New York	Date(s): 04/07/00 - 04/07/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'

Sample Interval	PID	Material Description
30-32'	7.2 ppm 0.5 ppm 0.3 ppm 0.0 ppm	Brown, fine SAND, medium dense, wet
32-34'	0.0 ppm 0.0 ppm 0.0 ppm	Light brown, fine SAND, trace silt, medium dense, wet
34-36'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, fine-medium SAND, trace silt, medium dense, wet
36-38'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, fine SAND, trace silt, medium dense, wet
38-40'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, orange-banded, silty fine SAND, med dense-dense, wet
40-42'	0.0 ppm 0.0 ppm 0.0 ppm	Light brown, orange-banded, fine SAND, medium dense, wet
42-44'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, fine-medium SAND, medium dense, wet
44-46'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, very fine SAND, w/some silt, dense, wet
46-48'	0.0 ppm 0.0 ppm 0.0 ppm	Same as above Brown SILT, semi stiff, plastic, wet Base of boring - 48'

Graphic Log



Monitoring Well Screen Zones



APPENDIX D

ANALYTICAL METHODS AND DETECTION LIMITS

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: SHMW-10I	
Date(s): 05/07/02 – 05/07/02	
Datum: Mean Sea Level	
Elevation: 5.89'	Measuring Point: 5.69'
Completed Depth: 47.50'	Total Depth: 47.50'

Screens:
type: Slotted size: 0.010in dia: 1.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.010in dia: 1.00in fm: 35.50' to: 45.50'

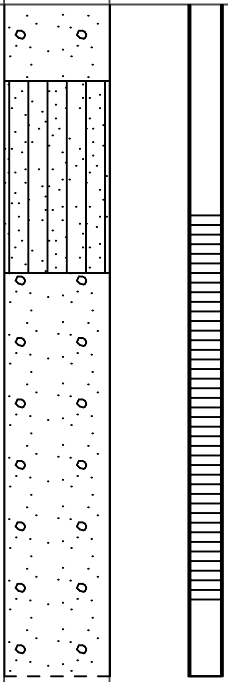
Location: Sag Harbor, New York
Purpose: Monitoring Well, Intermediate
Logged By: Innocent
Drilling Method: Geoprobe
Borehole Dia.: 3.00in
Contractor: Zebra Environmental

Remarks: Includes well screens for monitoring wells: SHMW-10S AND SHMW-10I.

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Screen Zones
		0-5'		Brown, medium-coarse, SAND w/little-some gravel, minor trace wood, brick debris		
5		5-8'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Gray, fine-medium, SAND w/little gravel, some wood debris, loose, decomposing vegetable/organic (H2S-like) odor, wet		
				Gray, fine SAND w/some silt, little clay, decomposing organic (H2S-like) odor		
10		8-12'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, medium-coarse SAND w/trace gravel, trace silt, loose, wet		
15		12-16'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, fine-medium SAND w/little silt, trace clay, loose, wet		
		16-20'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, medium-coarse SAND, loose, wet		
20		20-24'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, medium SAND, well sorted, loose, wet		
25		24-28'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, fine-medium SAND, loose, wet		
		28-32'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Same as above		

Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-10I
Location: Sag Harbor, New York	Date(s): 05/07/02 - 05/07/02
Purpose: Monitoring Well, Intermediate	Total Depth: 47.50'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Screen Zones
		32-36'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Silty SAND w/some clay, loose, wet		
35		36-40'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Same as above Brown, medium-coarse SAND, loose, reddish brown Fe-like staining, wet		
40		40-44'	0.0 ppm	Brown, medium SAND, loose, wet		
				Base of boring - 44'		
45						
50						
55						
60						
65						



Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: SHMW-11I

Date(s): 05/01/02 – 05/01/02

Datum: Mean Sea Level

Elevation: 5.79'

Measuring Point: 5.57'

Completed Depth: 47.00'

Total Depth: 48.00'

Location: Sag Harbor, New York

Purpose: Monitoring Well, Intermediate

Logged By: Matthew Bowman

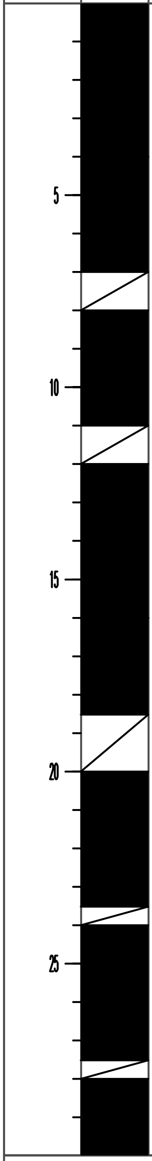
Drilling Method: 4 1/4" Hollow Stem Auger

Borehole Dia.: 4.25in

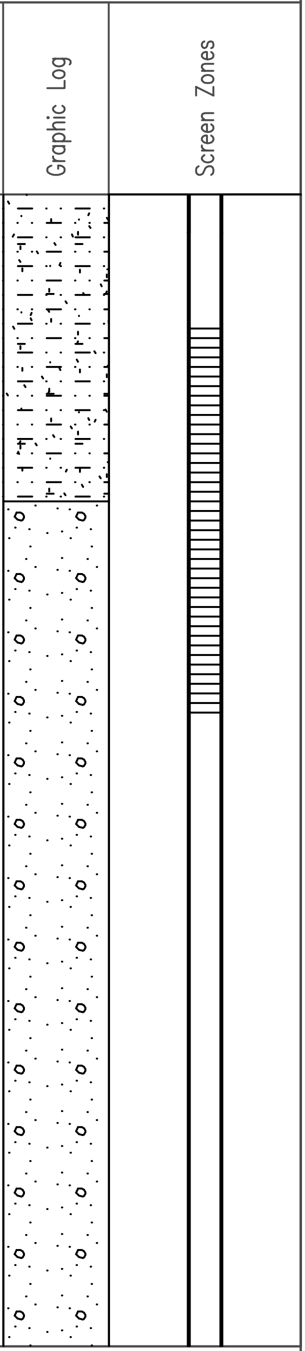
Contractor: Zebra Environmental

Screens:
type: Slotted size: 0.010in dia: 1.00in fm: 3.50' to: 13.50'
type: Slotted size: 0.010in dia: 1.00in fm: 35.00' to: 45.00'

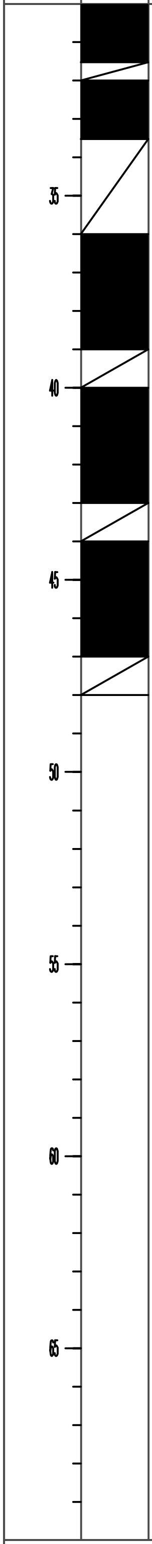
Remarks: Includes well screens for monitoring wells: SHMW-11S and SHMW-11I.



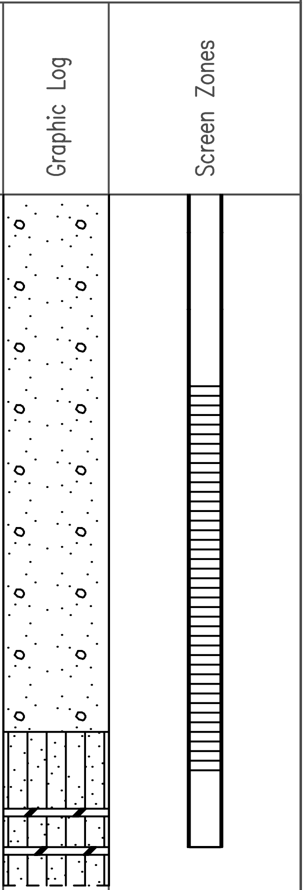
Sample Interval	PID	Material Description
0–4'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Asphalt paving over brown, coarse, sandy FILL w/coarse gravel concrete/brick debris, loose, moist-dry
4–8'		Brown, coarse, sandy FILL w/some gravel, glass, concrete debris, loose, wet
8–12'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, very fine SAND w/little silt, trace clay, loose, slight odor typical of decaying vegetable matter, wet
12–16'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, fine-medium SAND w/little silt, trace clay, loose, wet
16–20'		Brown, medium SAND, loose, wet
20–24'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, medium SAND, loose, well sorted, homogeneous, wet
24–28'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, medium-coarse SAND, loose, wet
28–32'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, medium-coarse SAND, loose, wet



Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-11I
Location: Sag Harbor, New York	Date(s): 05/01/02 - 05/01/02
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'



Sample Interval	PID	Material Description
	0.0 ppm 0.0 ppm	
32-36'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown, medium SAND, loose, wet
36-40'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, medium SAND, loose, wet
40-44'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Yellowish-brown, medium SAND, loose, tar-like staining, minor yellowish Fe staining, wet
44-48'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown-tan, fine-medium SAND w/some silt, loose, wet
		Brown, silty SAND w/some clay
		Base of boring - 48'



Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: SHMW-12I

Date(s): 05/06/02 – 05/06/02

Datum: Mean Sea Level

Elevation: 3.29'

Measuring Point: 2.88'

Completed Depth: 47.00'

Total Depth: 47.00'

Screens:
type: Slotted size: 0.005in dia: 1.00in fm: 1.50' to: 6.50'
type: Slotted size: 0.010in dia: 1.00in fm: 35.00' to: 45.00'

Location: Sag Harbor, New York

Purpose: Monitoring Well, Intermediate

Logged By: Innocent

Drilling Method: Geoprobe

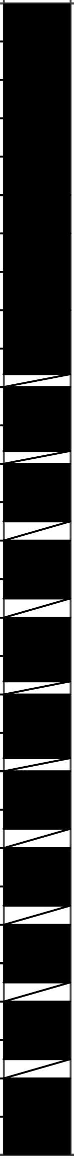
Borehole Dia.: 3.00in

Contractor: Zebra Environmental

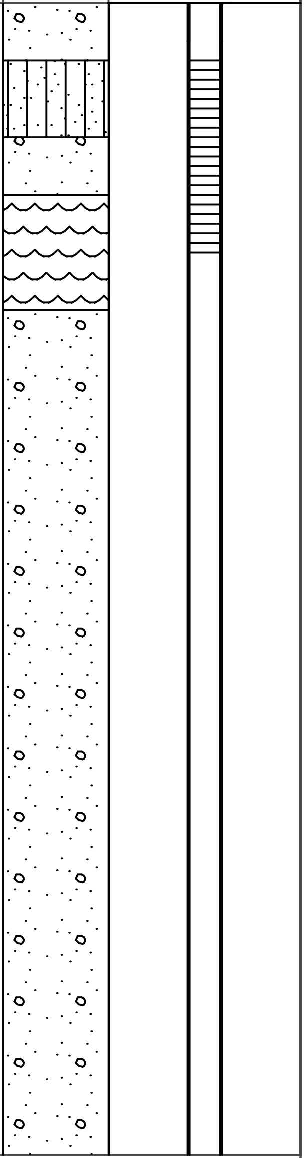
Remarks: Includes well screens for monitoring wells: SHMW-12S and SHMW-12I.

Depth (ft)	Sample Interval	PID	Material Description
	0–5'	0.0 ppm	
		0.0 ppm	Dark brown, medium SAND w/some small gravel, trace clay
		0.0 ppm	
		0.0 ppm	Black, silty fine–medium SAND w/some coarse sand and small pebbles
		0.0 ppm	
		0.0 ppm	Grayish brown, fine–medium SAND w/some pebbles
		0.0 ppm	
		0.0 ppm	
		0.0 ppm	
5		0.0 ppm	Brown, medium SAND w/some PEAT, soft, wet
	5–6'	0.0 ppm	
		0.0 ppm	Same as above to 6.33'
	6–8'	0.0 ppm	
		0.0 ppm	Brown–dark brown, PEAT, soft, organic (H2S–like) odor, moist
		0.0 ppm	
		3.2 ppm	Tan, fine–medium SAND, H2S–like odor, wet
	8–10'	0.5 ppm	
		1.7 ppm	Reddish brown, fine–medium SAND, organic (H2S–like) odor, wet
10		2.6 ppm	Same as above
	10–12'	0.0 ppm	
		2.1 ppm	
		5.3 ppm	Same as above
	12–14'	0.0 ppm	
		0.0 ppm	Brown, medium SAND w/some pebbles, slight organic (H2S–like) odor, wet
		0.0 ppm	
		0.0 ppm	Brown, medium SAND, wet
	14–16'	0.0 ppm	
15		0.0 ppm	
		0.0 ppm	Brown, fine–medium SAND, wet
	16–18'	0.0 ppm	
		0.0 ppm	
		0.0 ppm	Same as above
	18–20'		
		0.0 ppm	Tan, fine SAND w/some medium sand, mica particles
20		0.0 ppm	Same as above
	20–22'	0.0 ppm	
		0.0 ppm	
		0.0 ppm	Same as above
	22–24'	0.0 ppm	
		0.0 ppm	
		0.0 ppm	Tan, fine–medium SAND, wet
	24–26'	0.0 ppm	
25		0.0 ppm	
		0.0 ppm	Tan, medium SAND w/some fine sand, wet
	26–28'	0.0 ppm	
		0.0 ppm	
		0.0 ppm	Light brown–white, fine–medium SAND, loose, wet
	28–32'	0.0 ppm	
		0.0 ppm	
		0.0 ppm	

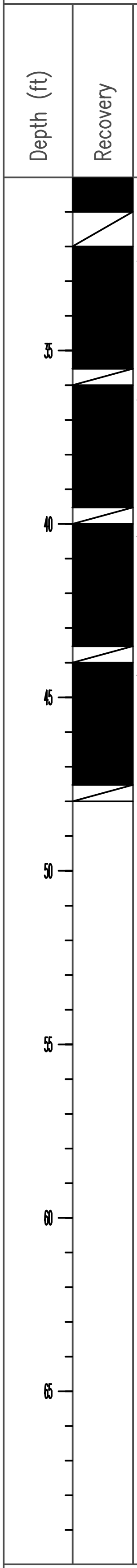
Recovery



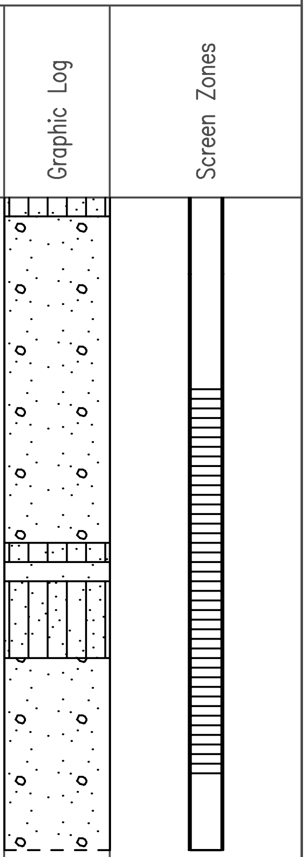
Graphic Log / Screen Zones



Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-12I
Location: Sag Harbor, New York	Date(s): 05/06/02 – 05/06/02
Purpose: Monitoring Well, Intermediate	Total Depth: 47.00'



Sample Interval	PID	Material Description
		Silty SAND
32–36'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown–white, fine–medium SAND, loose, wet
36–40'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Same as above w/little silt at 39–39.5'
40–44'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown–white, silty SAND, loose, wet Light brown–white, fine–medium SAND, loose, wet
44–48'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Light brown–white, fine–medium SAND, loose, wet
		Base of boring – 48'



Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: SHMW-13I

Date(s): 05/08/02 – 05/08/02

Datum: Mean Sea Level

Elevation: 4.70'
Measuring Point: 4.47'

Completed Depth: 52.00'
Total Depth: 52.00'

Location: Sag Harbor, New York

Purpose: Monitoring Well, Intermediate

Logged By: Matthew Bowman

Drilling Method: Geoprobe

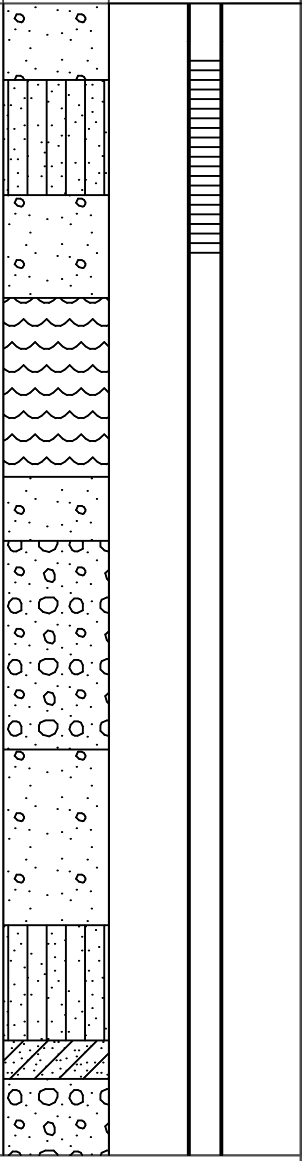
Borehole Dia.: 3.00in

Contractor: Zebra Environmental

Screens:

type	size	dia	fm	to
Slotted	0.005in	1.00in	1.50'	6.50'
Slotted	0.010in	1.00in	35.00'	45.00'

Remarks: Includes well screens for monitoring wells SHMW-13S and SHMW-13I.



Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Screen Zones
		0–5'	0.0 ppm 0.0 ppm 0.0 ppm	Br–dark br, f–m SAND w/pebbles and some organic matter, moist, wet at 2'		
			0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Dark brown, silty fine SAND w/clay, medium sand, and pebbles/stone fragments		
			0.0 ppm 0.0 ppm	Same as above		
5			0.0 ppm	Brown, fine SAND w/some medium–coarse sand and shell fragments		
		5–8'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm			
		8–10'	0.0 ppm	Dark brown, sandy fine PEAT, soft, moist		
10		10–12'	0.0 ppm	Dark brown, PEAT, soft, moderate organic (H2S–like) odor, moist		
		12–14'	15.2 ppm	Dark brown, PEAT, soft, organic (H2S–like) odor, moist		
			7.8 ppm	Dark reddish brown, fine SAND w/pebbles, organic (H2S–like) odor, wet		
15		14–16'	0.6 ppm 2.0 ppm	Reddish brown, gravelly fine SAND w/some medium–coarse sand, organic (H2S–like) odor, wet		
		16–18'	0.0 ppm 0.0 ppm 0.0 ppm	Light reddish brown, gravelly fine SAND, loose, faint organic (H2S–like) odor, wet		
		18–20'	0.0 ppm 0.0 ppm	Same as above		
			0.0 ppm	Tan, fine–medium SAND, wet		
20		20–22'	0.0 ppm	Same as above		
		22–24'	0.0 ppm	Same as above		
25		24–26'	0.0 ppm 0.0 ppm 0.0 ppm	Light brown, gravelly very fine–medium SAND w/some silt and clay, loose, wet		
		26–28'	0.0 ppm 0.0 ppm	Same as above		
			0.0 ppm	Light brown, fine–coarse SAND w/some clay		
		28–30'	0.0 ppm	Tan, gravelly fine–coarse SAND, wet		
				Same as above		

Consulting Firm: Dvirka & Bartilucci	Site Id: SHMW-13I
Location: Sag Harbor, New York	Date(s): 05/08/02 – 05/08/02
Purpose: Monitoring Well, Intermediate	Total Depth: 52.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Screen Zones
		30–32'	0.0 ppm			
35		32–36'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Tan, gravelly fine–coarse SAND, wet Pale brown–pink, coarse SAND w/some gravel, loose, wet		
		36–40'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Yellowish brown, coarse SAND w/some gravel, loose, wet		
40		40–44'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Yellowish brown, medium–coarse SAND w/little gravel		
45		44–48'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Pale brown, coarse SAND w/some coarse gravel		
50		48–52'	0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm 0.0 ppm	Brown, coarse SAND w/some gravel		
				Base or boring – 52'		
55						
60						
65						

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Sag Harbor MGP
CITY/STATE: Sag Harbor, NY
GEI PROJECT NUMBER: 093190-2-1204

BORING LOG
PAGE 1 of 3
SHSB-01

GROUND SURFACE ELEVATION (FT): 3.78
LOCATION: Onsite
NORTHING (FT): 308683 **EASTING (FT):** 1454145
TOTAL DEPTH (FT): 75.0
DRILLED BY: Zebra Environmental
DATUM VERT. / HORZ.:
LOGGED BY: Chris Anastasiou
DATE START / END: 10/25/2010
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	REMARKS	SOIL / BEDROCK DESCRIPTION
0	0			PID= 0.1 PID= 0.2			(0'- 1') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~25% gravel; brown, Hand cleared from 0-5 ft. (1'- 5') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~15% gravel, fine to coarse; brown.
-5	5	S1	60/50	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.2		Env. Sample ID= SHSB(8-10)	(5'- 6.5') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~20% gravel, fine to coarse; brown. (6.5'- 7.5') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to medium, ~5% fines; brown. (7.5'- 10') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, ~5% fines; wet, brown.
-10	10	S2	60/60	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.1 PID= 0.2 PID= 0.2			(10'- 10.83') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to medium, ~5% fines; wet, brown. (10.83'- 13.66') WIDELY GRADED SAND WITH SILT (SW-SM); ~80% sand, fine to coarse, ~10% gravel, fine to medium, ~10% fines; wet, brown, Bog like odor. (13.6'- 15') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to medium, ~5% fines; wet, brown, Bog like odor.
-15	15	S3	60/36	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(15'- 17.91') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to medium, ~5% fines; wet, brown, Bog like odor. (17.91'- 19') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~10% gravel, fine; wet, dark brown. (19'- 20') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown.
-20	20	S4	60/37	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(20'- 20.08') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, brown, brown/ red iron striations throughout. (21'- 25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; wet, light brown.

NOTES:

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REC = RECOVERY LENGTH OF SAMPLE
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IN. = INCHES
FT. = FEET
TSF = TONS PER SQUARE FOOT

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
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ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
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Q_P = POCKET PENETROMETER IN TSF
S_V = TORVANE PEAK IN TSF

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
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CLIENT: National Grid
PROJECT: Sag Harbor MGP
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GEI PROJECT NUMBER: 093190-2-1204

BORING LOG
PAGE 2 of 3
SHSB-01

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	REMARKS	SOIL / BEDROCK DESCRIPTION
-25	25	S5	60/16	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(25'- 30') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; wet, light brown.
-30	30	S6	60/30	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(30'- 31') NARROWLY GRADED SAND (SP); ~90% sand, fine, ~5% gravel, fine, ~5% fines; wet, light brown. (31'- 35') SILTY SAND (SM); ~85% sand, fine gravel, ~15% fines; wet, tan brown.
-35	35	S7	60/36	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(35'- 36.75') SILTY SAND (SM); ~85% sand, fine, ~15% fines; wet, tan brown. (36.75'- 38.25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; wet, light brown. (38.25'- 40') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to medium, ~5% fines; red orange.
-40	40	S8	60/21	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(40'- 41.75') SILTY SAND (SM); ~85% sand, fine, ~15% fines; wet, brown. (41.75'- 43.25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; wet, light brown. (43.25'- 50') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; wet, red orange.
-45	45	S9	60/25	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(45'- 50') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; wet, light brown, Iron (red) straitions from 13'-15'.
	50	S10	60/28	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(50'- 55') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, light brown.

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S_V = TORVANE PEAK IN TSF

GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	**CLIENT:** National Grid **PROJECT:** Sag Harbor MGP **CITY/STATE:** Sag Harbor, NY **GEI PROJECT NUMBER:** 093190-2-1204	**BORING LOG** **PAGE** 3 of 3 **SHSB-01**

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	REMARKS	SOIL / BEDROCK DESCRIPTION
-50							
	55	S11	60/20	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(55'- 60') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, light brown.
-55							
	60	S12	60/23	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(60'- 62.5') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; wet, light brown.
							(62.5'- 65') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, light brown.
-60							
	65	S13	60/16				(65'- 65.5') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, light brown. (65.5'- 66.5') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, red orange. (66.5'- 70') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, light brown.
-65							
	70	S14	60/10	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			(70'- 75') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to medium, ~5% fines.
-70							
	75						End of Boring at 75 feet.

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GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Sag Harbor MGP
CITY/STATE: Sag Harbor, NY
GEI PROJECT NUMBER: 093190-2-1204

BORING LOG

PAGE 1 of 3

SHSB-02

GROUND SURFACE ELEVATION (FT): 4.14
LOCATION: Onsite
NORTHING (FT): 308710 **EASTING (FT):** 1454242
TOTAL DEPTH (FT): 75.0
DRILLED BY: Zebra Environmental
DATUM VERT. / HORZ.:
LOGGED BY: Chris Anastasiou
DATE START / END: 10/26/2010
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
	0			PID= 0.0					(0'- 1') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~15% gravel, fine to coarse; wet, brown, Hand cleared 0-5 ft, rock (1/4"-2") brown fill.
				PID= 0.0					(1'- 5') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~15% gravel; wet, brown.
0									
	5	S1	60/28	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0				Env. Sample ID= SHSB-02(4-5')	(5'- 10') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, ~5% fines; wet, brown.
-5									
	10	S2	60/36	PID= 0.0 PID= 94.7 PID= 22.2					(10'- 12') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, ~5% fines; wet, brown.
				PID= 28.5		🟩	NLO	Env. Sample ID= SHSB-02(11-11.5')	(12'- 13') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, wet, Tar Stained.
				PID= 11.3			NLO		(13'- 15') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, red brown.
-10									
	15	S3	60/48	PID= 54.0 PID= 36.3 PID= 42.7 PID= 32.0 PID= 38.7			NLO		(15'- 17.5') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, wet, red brown.
				PID= 40.1 PID= 32.3 PID= 9.4			NLO		(17.5'- 20') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, brown.
-15									
	20	S4	60/30	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0				Env. Sample ID= SHSB-02(20-22')	(20'- 23') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown.
									(23'- 24') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine, ~10% fines; wet, light brown.

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GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Sag Harbor MGP
CITY/STATE: Sag Harbor, NY
GEI PROJECT NUMBER: 093190-2-1204

BORING LOG
PAGE 2 of 3
SHSB-02

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
									(24'- 25') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; light brown.
-25	25	S5	60/14	PID= 0.1 PID= 0.1					(25'- 30') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown.
-30	30	S6	60/24	PID= 126.6 PID= 26.6 PID= 0.6 PID= 0.5		🟩	NLO	Env. Sample ID= SHSB-02(30-30.5')	(30'- 31.25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, gray, gray stained, tar staining bands throughout. (31.25'- 35') SILTY SAND (SM); ~55% sand, fine, ~45% fines; wet, light brown.
-35	35	S7	60/21	PID= 10.2 PID= 48.8 PID= 20.4 PID= 10.4		🟩	NLO NLO		(35'- 36.5') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine to medium, ~15% gravel, fine, ~15% fines; moderate naphthalene-like odor, wet, gray, gray stained, 3-4" tar stained. (36.5'- 40') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, wet, light brown.
-40	40	S8	60/28	PID= 1.6 PID= 0.4 PID= 0.4 PID= 0.3 PID= 0.4					(40'- 45') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to medium, ~5% fines; wet, light brown.
-45	45	S9	60/29	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0					(45'- 49.5') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, light brown. (49.5'- 50') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, red orange.
	50	S10	60/28	PID= 0.1 PID= 0.4 PID= 0.0 PID= 0.0					(50'- 54') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, ~5%

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NM = NOT MEASURED

Q_P = POCKET PENETROMETER IN TSF
S_V = TORVANE PEAK IN TSF

IN. = INCHES
FT. = FEET
TSF = TONS PER SQUARE FOOT

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BORING LOG
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SHSB-02

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC IN./IN.	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
-50				PID= 0.0					fines; wet, light brown. (54'- 55') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~15% gravel, fine to coarse; wet, light brown, red band 1/4".
-55	55	S11	60/20	PID= 0.1 PID= 0.2 PID= 0.1 PID= 0.1			NLO		(55'- 60') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, wet, light brown, Sheen atop rock w/ NLO.
-60	60	S12	60/24	PID= 4.3 PID= 0.4 PID= 1.5 PID= 4.0			NLO NLO		(60'- 61.5') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, wet, light brown. (61.5'- 65') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, wet, orange brown.
-65	65	S13	60/16	PID= 0.0 PID= 0.0 PID= 0.0					(65'- 70') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, ~5% fines; wet, light brown.
-70	70	S14	60/20	PID= 0.3 PID= 0.4 PID= 0.3 PID= 0.2				Env. Sample ID= SHSB-02(70-72')	(70'- 75') WIDELY GRADED GRAVEL WITH SAND (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, ~5% fines; wet, light brown.
	75								End of Boring at 75 feet.

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BORING LOG
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SHSB-02A

GROUND SURFACE ELEVATION (FT):
LOCATION: Onsite
NORTHING (FT):
EASTING (FT):
TOTAL DEPTH (FT): 40.0
DRILLED BY: Zebra Environmental
DATUM VERT. / HORZ.:
LOGGED BY: Chris Anastasiou
DATE START / END: 10/28/2010
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

ELEV. FT.	DEPTH FT.	SAMPLE INFO			STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
		TYPE and NO.	PEN/REC IN./IN.	FIELD TEST DATA				
	0							Move 15 feet north of SHSB-02, collect sample from 30-40 feet for DNAPL check.
	5							
	10							
	15							
	20							

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BORING LOG

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SHSB-02A

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC IN./IN.	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	25							
	30	S1	60/29	PID= 5.0 PID= 5.4 PID= 450 PID= 19.7 PID= 6.0 PID= 2.0			NLO	(30'- 33.2') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, ~5% fines; moderate naphthalene-like odor, wet, light brown.
						🟩	NLO	(33.2'- 33.5') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; moderate naphthalene-like odor, wet, tar stained.
							NLO	(33.5'- 34') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, wet, light brown.
							NLO	(34'- 35') SILTY SAND (SM); ~50% sand, ~50% fines; slight naphthalene-like odor, wet, light brown.
	35	S2	60/35	PID= 4.0 PID= 1.8 PID= 1.1 PID= 1.4 PID= 0.8 PID= 0.5			NLO	(35'- 40') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight naphthalene-like odor, wet, light brown.
	40							End of Boring at 40 feet.

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BORING LOG

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SHSB-04

GROUND SURFACE ELEVATION (FT):
LOCATION:
NORTHING (FT): **EASTING (FT):**
TOTAL DEPTH (FT): 15.0
DRILLED BY: Zebra Environmental
DATUM VERT. / HORZ.:
LOGGED BY: Chris Anastasiou
DATE START / END: 10/26/2010
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

ELEV. FT.	DEPTH FT.	SAMPLE INFO			STRATA	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
		TYPE and NO.	PEN/REC IN./IN.	FIELD TEST DATA				
	0			PID= 0.0				(0'- 1') Hand cleared from 0-5 ft. Asphalt, rock.
				PID= 0.0				(1'- 3') Rock (1/4"-1), concrete.
				PID= 1.4				(3'- 5') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~10% gravel, fine; light brown.
	5	S1	60/60	PID= 22.3 PID= 17.9 PID= 21.3 PID= 22.5 PID= 21.3 PID= 19.8 PID= 20.7 PID= 21.3		NLO	Env. Sample ID= SHSB-04(6-8')	(5'- 10') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% gravel, fine; moderate naphthalene-like odor, moist, brown.
	10	S2	60/57	PID= 74.3 PID= 78.3 PID= 73.8 PID= 49.3 PID= 45.4 PID= 76.3 PID= 73.2 PID= 76.8		NLO	Env. Sample ID= SHSB-04 (13-15)	(10'- 15') WELL GRADED SAND (SW); ~95% sand, fine to coarse, ~5% gravel, fine; moderate naphthalene-like odor, wet, brown.
	15							End of Boring at 15 feet.

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BORING LOG

PAGE 1 of 1

SHSB-04A

GROUND SURFACE ELEVATION (FT): 4.43
LOCATION: 37 feet south of SHSB-04A
NORTHING (FT): 308748 **EASTING (FT):** 1454104
TOTAL DEPTH (FT): 15.0
DRILLED BY: Zebra Environmental
DATUM VERT. / HORZ.:
LOGGED BY: Chris Anastasiou
DATE START / END: 11/1/2010
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC IN./IN.	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
	0			PID= 0.0					(0'- 1') Hand cleared from 0-5 ft. Asphalt, rock 1/4-1".
				PID= 0.0	⁙				(1'- 4') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~15% gravel, fine to coarse, ~5% fines; light brown.
0				PID= 1.5	⁙		NLO		(4'- 4') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, moist.
	5	S1	60/44	PID= 47.4 PID= 60.2	░	🟩	NLO	Env. Sample ID= SHSB-04A(5-5.5')	(5'- 6') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to medium, ~5% fines; moderate naphthalene-like odor, tar stained.
				PID= 45.6	░		NLO	Env. Sample ID= SHSB-04A(6-9')	(6'- 6.25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to medium, ~5% fines; moderate naphthalene-like odor, gray, gray stained.
				PID= 54.4	░	🟩	NLO		(6.25'- 6.75') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to medium, ~5% fines; moderate naphthalene-like odor, wet, tar stained.
				PID= 62.2	░		NLO		(6.75'- 7.5') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, light gray, gray stained.
				PID= 51.3	░	🟩	NLO		(7.5'- 8') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~9% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, light gray, tar stained band.
-5				PID= 50.8 PID= 52.3	░	🟩	NLO		(8'- 10') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, light gray, tar stained DNAPL at 23-24", 26-27", 28-29", 33-34", 40-41".
-10	10	S2	60/48	PID= 24.8 PID= 91 PID= 36 PID= 19 PID= 21.2 PID= 23.2 PID= 19.5 PID= 18.7 PID= 16.8	░	🟧 🟩	NLO	Env. Sample ID= SHSB(10.5-13.5')	(10'- 15') NARROWLY GRADED SAND (SP); fine, ~95% sand, fine to medium, ~5% fines; moderate naphthalene-like odor, wet, light gray, tar bands at 3-4", 6-7", 11-12", sheen noted on soil throughout boring.
	15								End of Boring at 15 feet.

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BORING LOG

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SHSB-05

GROUND SURFACE ELEVATION (FT): 5.42
LOCATION:
NORTHING (FT): 308859 **EASTING (FT):** 1454270
TOTAL DEPTH (FT): 45.0
DRILLED BY: Zebra Environmental
DATUM VERT. / HORZ.:
LOGGED BY: Chris Anastasiou
DATE START / END: 10/27/2010 - 10/28/2010
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT):

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
5	0			PID= 0.0 PID= 0.0				(0'- 1') Hand cleared from 0-5 ft, asphalt, concrete, rock (1/4"-2"). (1'- 5') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~20% gravel, fine to coarse; brown black.
0	5	S1	60/53	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0			Env. Sample ID= SHSB-05(5-7')	(5'- 6.5') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, brown. (6.5'- 8.75') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; wet, light brown. (8.75'- 9.2') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; wet, dark brown. (9.2'- 10') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to medium, ~5% fines; wet, black.
-5	10	S2	60/46	PID= 14.5 PID= 0.5 PID= 1.5 PID= 0.4 PID= 0.3 PID= 0.2 PID= 1.0 PID= 1.2		NLO	Env. Sample ID= SHSB-05(10-10.5')	(10'- 10.5') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, wet, dark gray. (10.5'- 15') NARROWLY GRADED SAND (SP); ~90% sand, fine, ~10% fines; brown red, bog like material and odor.
-10	15	S3	60/40	PID= 1.0 PID= 0.4 PID= 1.7 PID= 0.7 PID= 0.4 PID= 1.2			Env. Sample ID= SHSB-05(15-16')	(15'- 20') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; wet, brown, bog like odor.
-15	20	S4	60/40	PID= 1.2 PID= 4.3 PID= 3.5 PID= 2.1 PID= 1.2 PID= 0.7 PID= 1.7 PID= 2.1				(20'- 25') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; wet, brown, bog like odor.

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SHSB-05

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
-20	25	S5	60/39	PID= 0.3 PID= 0.1 PID= 0.4 PID= 0.2 PID= 0.1 PID= 0.2 PID= 0.3				(25'- 30') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown brown.
-25	30	S6	60/14	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0				(30'- 35') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown.
-30	35	S7	60/26	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0				(35'- 40') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown, Lost macro in boring hole on 10/27/10. heavy rain and wind.
-35	40	S8	60/23	PID= 0.0 PID= 0.0 PID= 0.0			Env. Sample ID= SHSB-05(40-42')	(40'- 45') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown.
	45			PID= 0.0				End of Boring at 45 feet.

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BORING LOG

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SHSB-07

GROUND SURFACE ELEVATION (FT): 3.74
LOCATION:
NORTHING (FT): 308597 **EASTING (FT):** 1454329
TOTAL DEPTH (FT): 45.0
DRILLED BY: Zebra Environmental
DATUM VERT. / HORZ.:
LOGGED BY: Chris Anastasiou
DATE START / END: 11/1/2010
DRILLING DETAILS:
WATER LEVEL DEPTHS (FT):

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
	0			PID= 0.0					(0'- 1') gray, Hand cleared from 0-5 ft, grass, topsoil, loom.
				PID= 0.0					(1'- 3') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~10% gravel, fine to coarse; brown.
0				PID= 0.0					(3'- 5') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10% gravel, fine to coarse, ~5% fines; black, black organic sand, organic odor.
	5	S1	60/43	PID= 0.0 PID= 4.9 PID= 130			NLO	Env. Sample ID= SHSB-07(4-5')	(5'- 6.5') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~20% gravel, fine to coarse; moderate naphthalene-like odor, wet, black brown.
				PID= 160			NLO	Env. Sample ID= SHSB-07(6.5-8.5')	(6.5'- 7') moderate naphthalene-like odor, wet, brown, peat bog material, organic mix.
-5				PID= 112 PID= 65 PID= 23			NLO		(7'- 9.5') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, brown gray, Tar staining band 20-23", 29-30".
									(9.5'- 10') Bog material.
	10	S2	60/44	PID= 26.2			NLO		(10'- 10.2') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; moderate naphthalene-like odor, wet, gray, gray stained.
				PID= 21.3 PID= 22.4 PID= 17.9					(10.2'- 11.7') wet, brown, bog like material, organic odor.
				PID= 13.6					(11.7'- 12.2') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine, ~10% fines; wet, light brown, bog like odor.
				PID= 20.9					(12.2'- 13.2') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; wet, black brown, organic odor.
-10									(13.2'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine, ~10% fines; wet, orange, organic odor.
	15	S3	60/40	PID= 1.4 PID= 0.4 PID= 0.4 PID= 0.1				Env. Sample ID= SHSB-07(16-18)	(15'- 17') NARROWLY GRADED SAND (SP); ~85% sand, fine, ~10% gravel, ~5% fines; wet, light brown, 6-7" dark striation band, organic odor.
-15				PID= 0.2 PID= 0.3 PID= 0.4					(17'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; wet, light brown, slight organic odor, slight organic odor.
-20	20	S4	60/36	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0					(20'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine, ~10% fines; wet, light brown.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE) IN PARTS PER MILLION

IN. = INCHES
FT. = FEET
TSF = TONS PER SQUARE FOOT

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR
SeLO= SEWAGE LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED

Q_P = POCKET PENETROMETER IN TSF
S_V = TORVANE PEAK IN TSF

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Sag Harbor MGP
CITY/STATE: Sag Harbor, NY
GEI PROJECT NUMBER: 093190-2-1204

BORING LOG

PAGE 2 of 2

SHSB-07

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	SAMPLE INFO PEN/REC IN./IN.	SAMPLE INFO FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
-25	25	S5	60/29	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0					(25'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine, ~10% fines; wet, light tan brown.
-30	30	S6	60/19	PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0					(30'- 35') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; wet, light brown.
-35	35	S7	60/36	PID= 0.0 PID= 0.0 PID= 0.0 PID= .0 PID= 0.0					(35'- 35.8') SILTY SAND (SM); ~50% sand, ~50% fines; light brown. (35.8'- 40') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; wet, lgiht dark gray.
-40	40	S8	60/38	PID= 0.0 PID= 0. PID= 0.0 PID= 0.0 PID= 0.0 PID= 0.0					(40'- 44.2') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, light brown.
									(44.2'- 45') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, brown. End of Boring at 45 feet.
	45								

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE) IN PARTS PER MILLION

IN. = INCHES
FT. = FEET
TSF = TONS PER SQUARE FOOT

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR
SeLO= SEWAGE LIKE ODOR

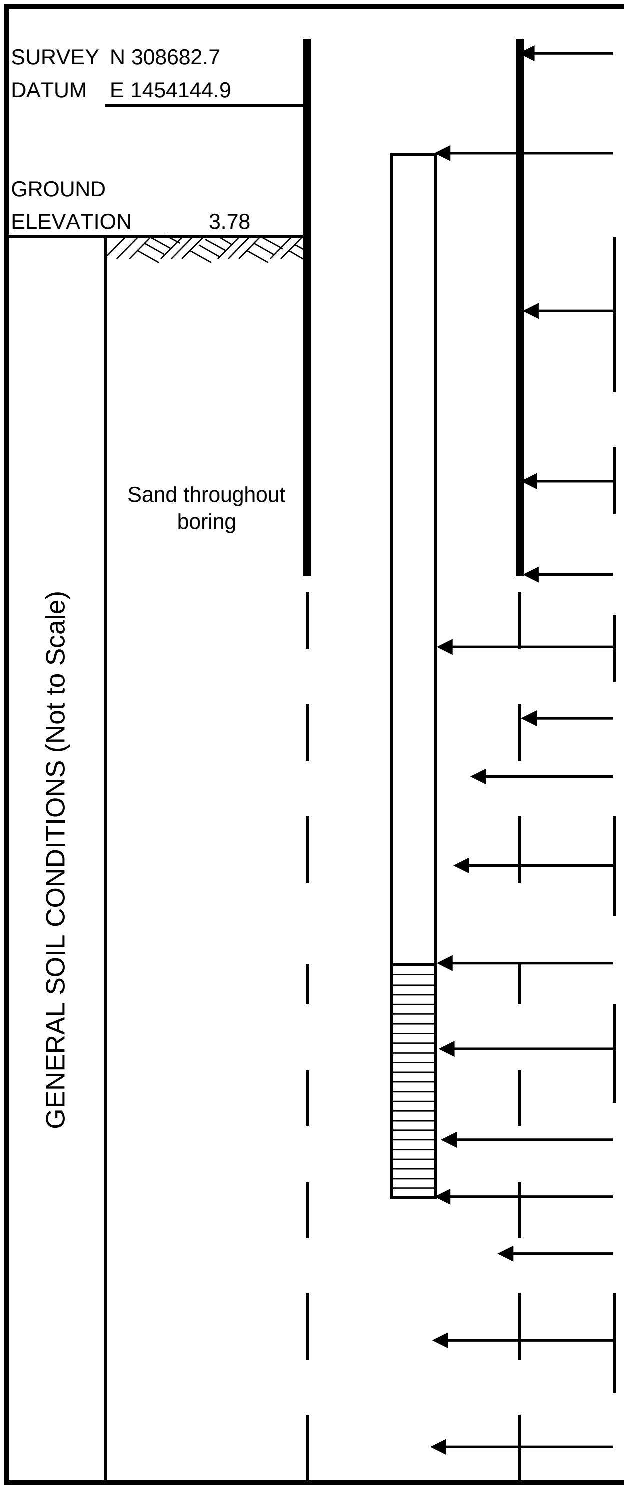
NA = NOT APPLICABLE
NM = NOT MEASURED

Q_P = POCKET PENETROMETER IN TSF
S_V = TORVANE PEAK IN TSF

GROUNDWATER OBSERVATION WELL REPORT

Project Sag Harbor former MGP Site
Location Sag Harbor, New York
Client National Grid
Contractor Zebra Environmental
Driller
Inspected by Chris Anastasiou
Date Started 10/27/10
Checked by Chris Morris
Date Completed 10/27/10

PG. 1 **OF** 1
Boring No. SHMW-01D
Location Onsite
Project No. 093190-2-1204



SURVEY DATUM N 308682.7
E 1454144.9

GROUND ELEVATION 3.78

Sand throughout boring

GENERAL SOIL CONDITIONS (Not to Scale)

LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	cement/bentonite grout
DEPTH TOP OF SEAL, IF ANY (FT)	61'
TYPE OF SEAL	
DEPTH BOTTOM OF SEAL (FT)	63'
DEPTH TOP OF PERVIOUS SECTION	65'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	75'
DEPTH BOTTOM OF SAND COLUMN (FT)	75'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

GEI Consultants

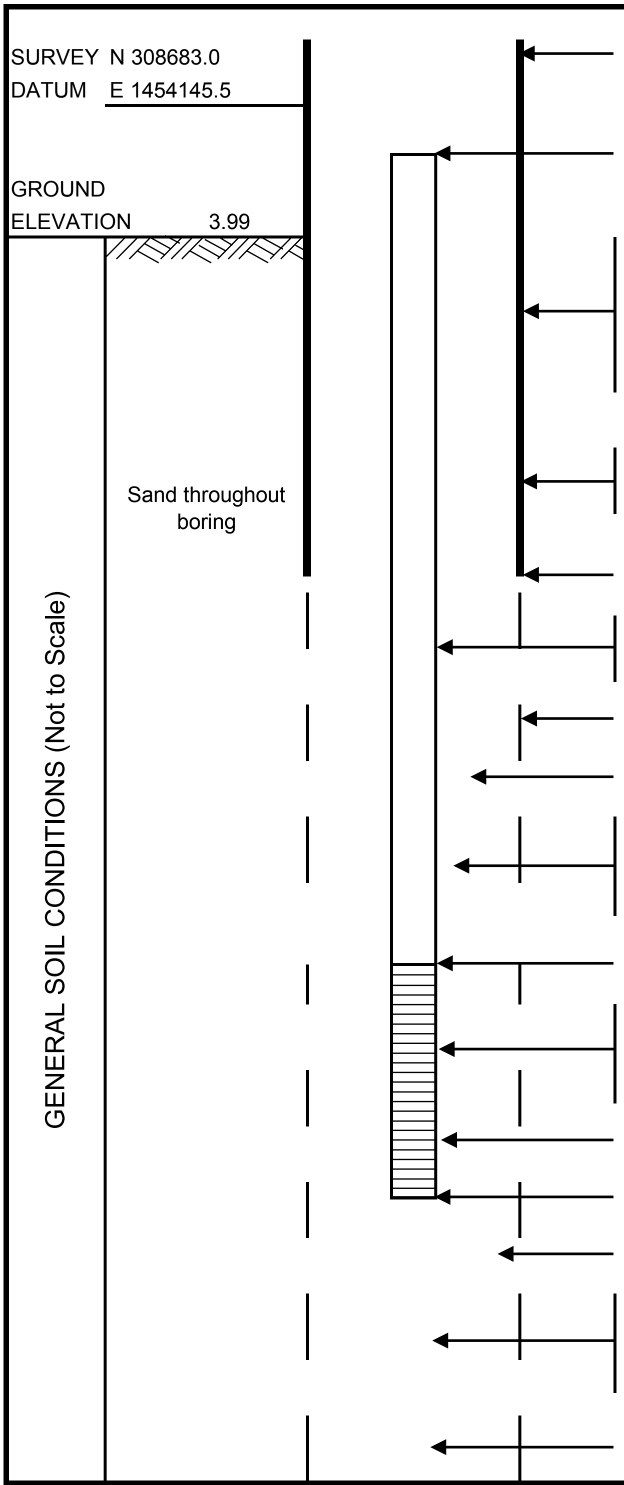
GROUNDWATER OBSERVATION WELL REPORT

Project Sag Harbor former MGP Site
Location Sag Harbor, New York
Client National Grid
Contractor Zebra Environmental
Driller
Inspected by Chris Anastasiou
Date Started 10/27/10
Checked by Chris Morris
Date Completed 10/27/10

PG. 1 **OF** 1
Boring No. SHMW-01SR
Location Onsite
Project No. 093190-2-1204

SURVEY DATUM N 308683.0
E 1454145.5

GROUND ELEVATION 3.99



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	sand
DEPTH TOP OF SEAL, IF ANY (FT)	none
TYPE OF SEAL	
DEPTH BOTTOM OF SEAL (FT)	none
DEPTH TOP OF PERVIOUS SECTION	1'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	6'
DEPTH BOTTOM OF SAND COLUMN (FT)	6'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

GEI Consultants

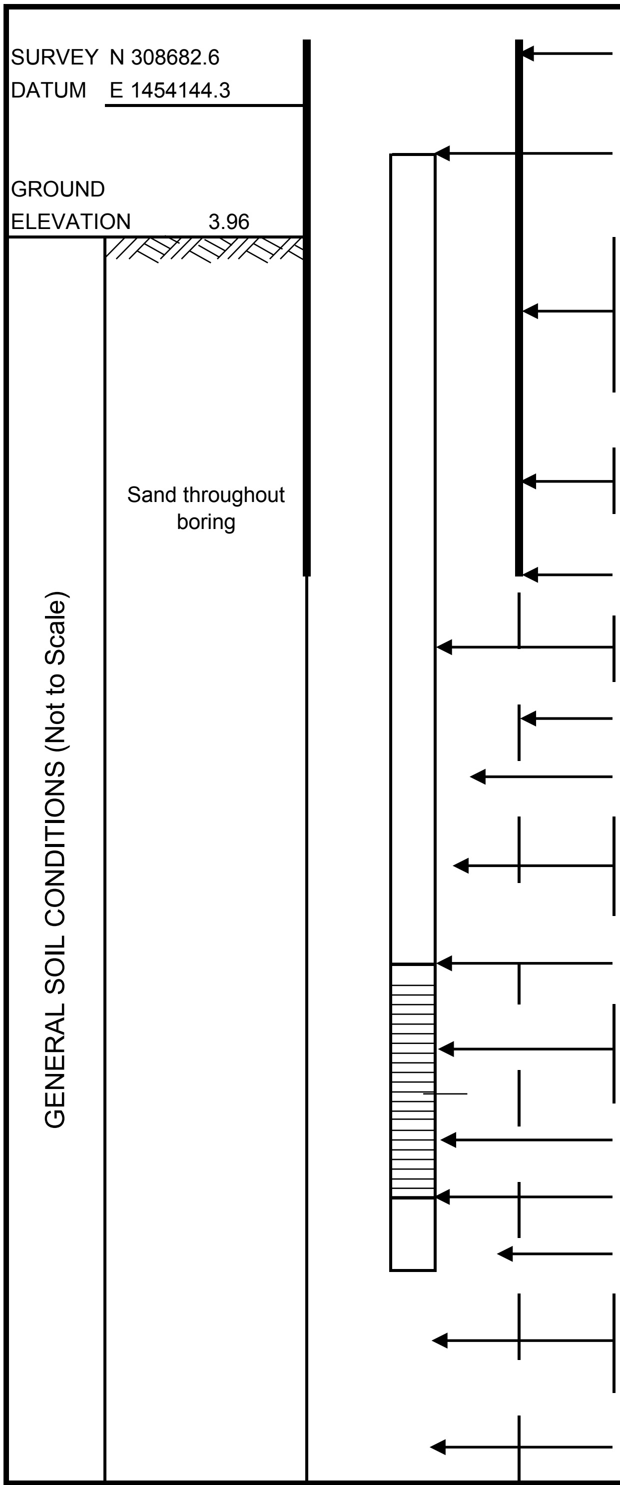
GROUNDWATER OBSERVATION WELL REPORT

Project: Sag Harbor former MGP Site
Location: Sag Harbor, New York
Client: National Grid
Contractor: Zebra Environmental
Driller:
Inspected by: Chris Anastasiou
Checked by: Chris Morris
Date Started: 11/1/10
Date Completed: 11/1/10

PG. 1 **OF** 1
Boring No.: SHMW-01IR
Location: Onsite
Project No.: 093190-2-1204

SURVEY DATUM: N 308682.6
E 1454144.3

GROUND ELEVATION: 3.96



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	1'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	cement/bentonite grout
DEPTH TOP OF SEAL, IF ANY (FT)	31'
TYPE OF SEAL	bentonite pellets
DEPTH BOTTOM OF SEAL (FT)	33'
DEPTH TOP OF PERVIOUS SECTION	35'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	45'
DEPTH BOTTOM OF SAND COLUMN (FT)	47'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	# 1 Sand

NOTES:

GEI Consultants

GROUNDWATER OBSERVATION WELL REPORT

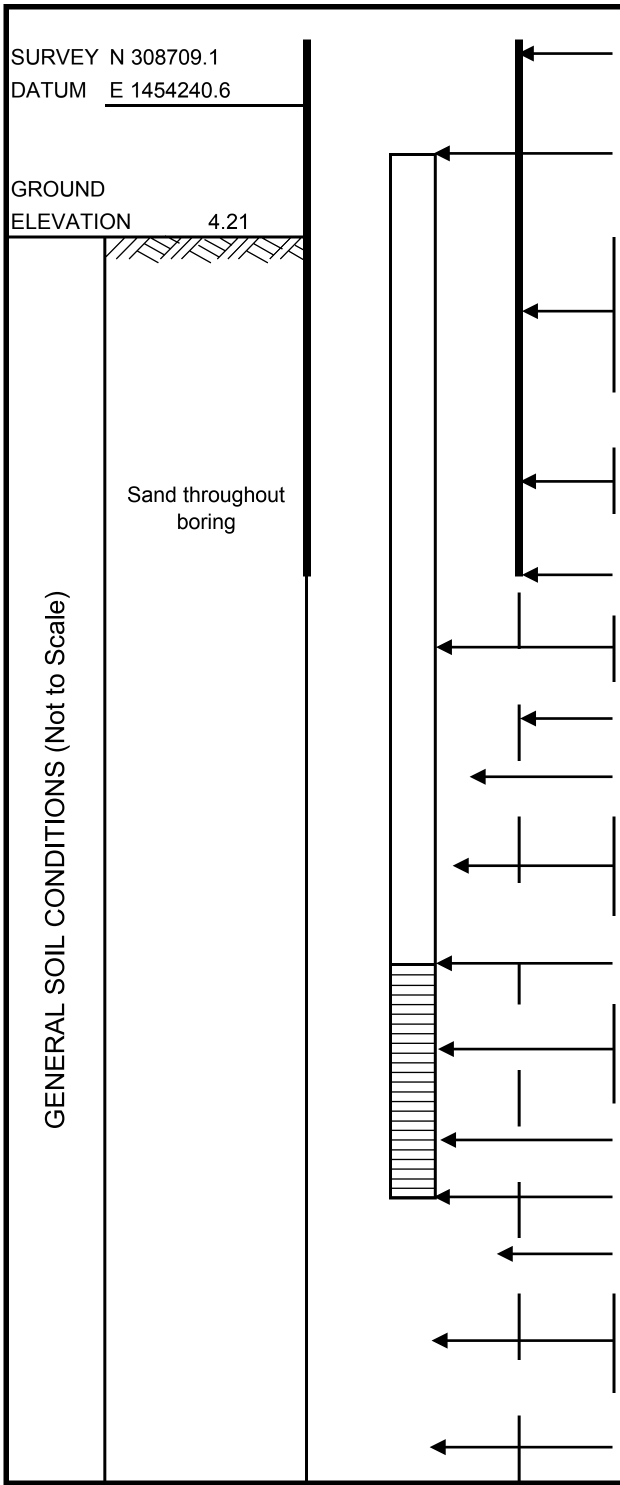
Project	Sag Harbor former MGP Site		
Location	Sag Harbor, New York		
Client	National Grid		
Contractor	Zebra Environmental	Driller	
Inspected by	Chris Anastasiou	Date Started	10/28/10
Checked by	Chris Morris	Date Completed	10/28/10

PG. 1 **OF** 1

Boring No.	SHMW-02S
Location	Onsite
Project No.	093190-2-1204

SURVEY DATUM N 308709.1 E 1454240.6

GROUND ELEVATION 4.21



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	sand
DEPTH TOP OF SEAL, IF ANY (FT)	none
TYPE OF SEAL	
DEPTH BOTTOM OF SEAL (FT)	none
DEPTH TOP OF PERVIOUS SECTION	1'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	6'
DEPTH BOTTOM OF SAND COLUMN (FT)	6'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

GEI Consultants

GROUNDWATER OBSERVATION WELL REPORT

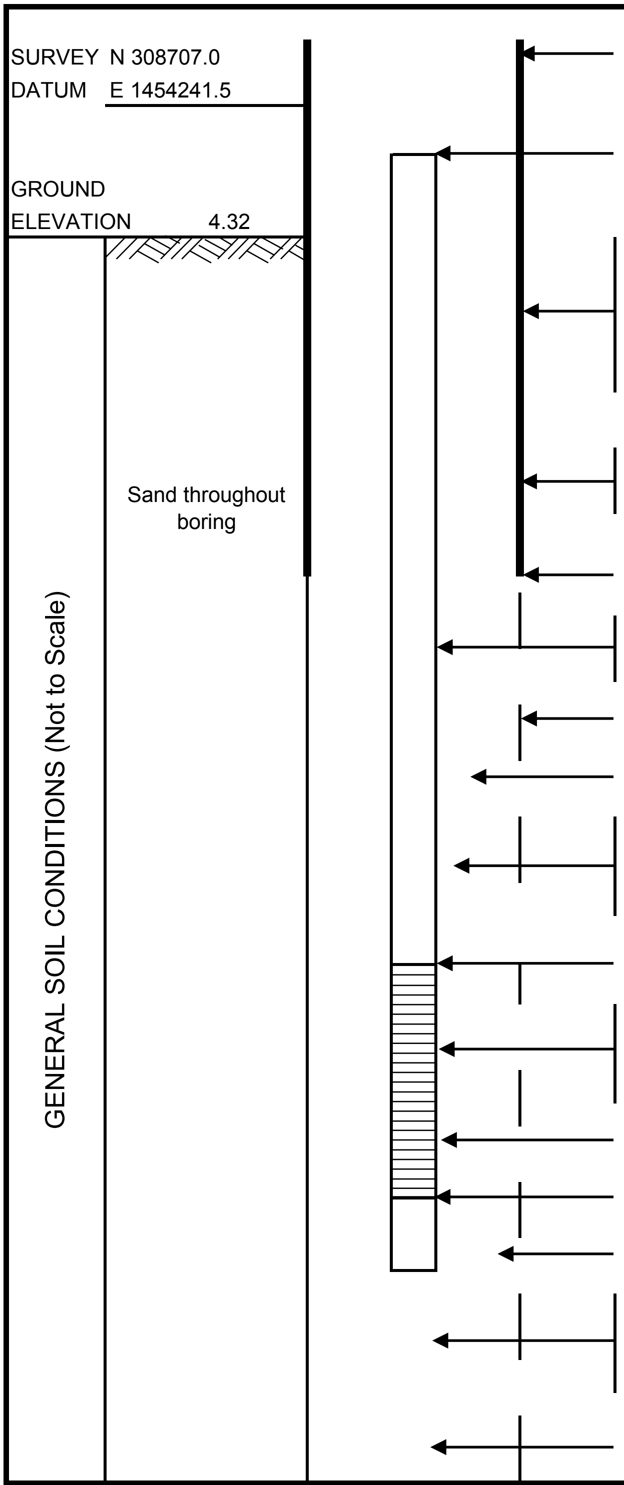
Project	Sag Harbor former MGP Site		
Location	Sag Harbor, New York		
Client	National Grid		
Contractor	Zebra Environmental	Driller	
Inspected by	Chris Anastasiou	Date Started	11/11/10
Checked by	Chris Morris	Date Completed	11/11/10

PG. 1 **OF** 1

Boring No.	SHMW-02IR
Location	Onsite
Project No.	093190-2-1204

SURVEY DATUM N 308707.0
E 1454241.5

GROUND ELEVATION 4.32



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	6.25"
TYPE OF BACKFILL AROUND RISER PIPE	cement/bentonite grout
DEPTH TOP OF SEAL, IF ANY (FT)	23
TYPE OF SEAL	bentonite pellets
DEPTH BOTTOM OF SEAL (FT)	25
DEPTH TOP OF PERVIOUS SECTION	27
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	37
DEPTH BOTTOM OF SAND COLUMN (FT)	39
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	# 1 Sand

NOTES: 2' Sump

GROUNDWATER OBSERVATION WELL REPORT

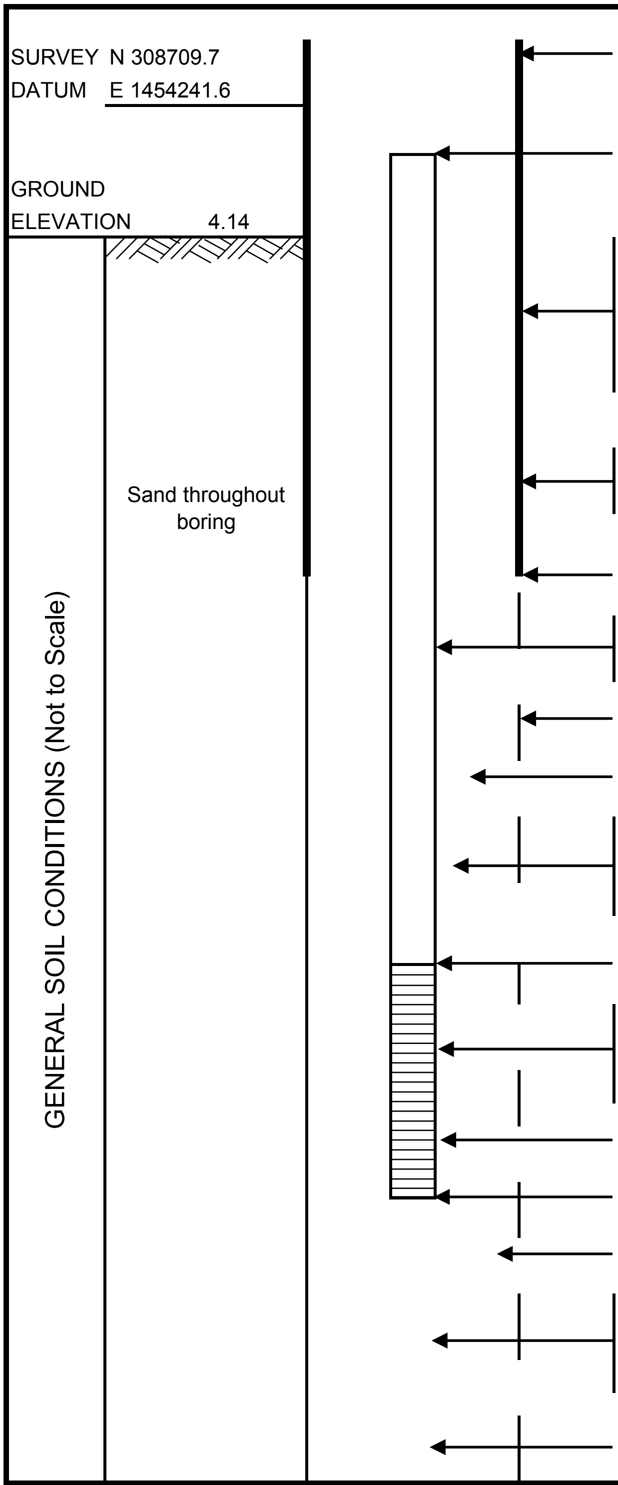
Project	Sag Harbor former MGP Site		
Location	Sag Harbor, New York		
Client	National Grid		
Contractor	Zebra Environmental	Driller	
Inspected by	Chris Anastasiou	Date Started	10/28/10
Checked by	Chris Morris	Date Completed	10/28/10

PG. 1 **OF** 1

Boring No.	SHMW-02DR
Location	Onsite
Project No.	093190-2-1204

SURVEY DATUM N 308709.7
E 1454241.6

GROUND ELEVATION 4.14



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	cement/bentonite grout
DEPTH TOP OF SEAL, IF ANY (FT)	61'
TYPE OF SEAL	
DEPTH BOTTOM OF SEAL (FT)	63'
DEPTH TOP OF PERVIOUS SECTION	65'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	75'
DEPTH BOTTOM OF SAND COLUMN (FT)	75'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

GEI Consultants

GROUNDWATER OBSERVATION WELL REPORT

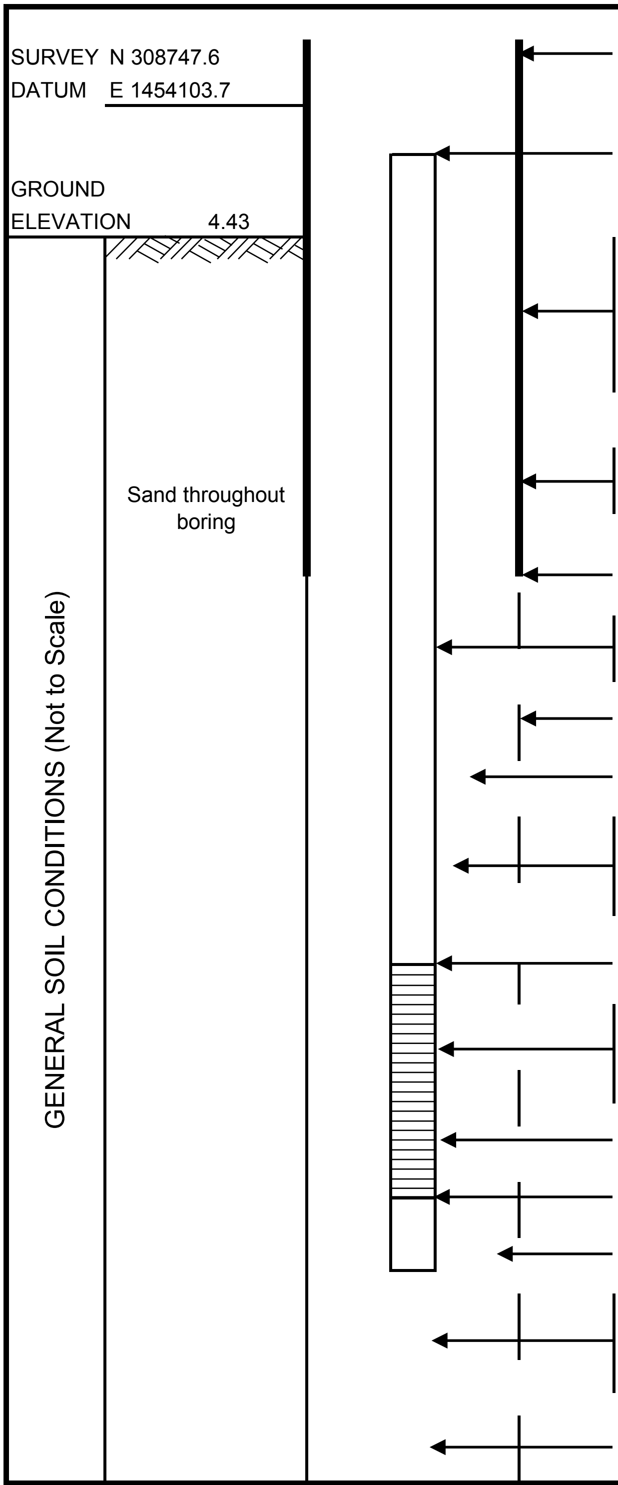
Project	Sag Harbor former MGP Site
Location	Sag Harbor, New York
Client	National Grid
Contractor	Zebra Environmental
Driller	
Inspected by	Chris Anastasiou
Date Started	11/2/10
Checked by	Chris Morris
Date Completed	11/2/10

PG. 1 **OF** 1

Boring No.	SHMW-04SR
Location	Offsite
Project No.	093190-2-1204

SURVEY DATUM N 308747.6
E 1454103.7

GROUND ELEVATION 4.43



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	6.25"
TYPE OF BACKFILL AROUND RISER PIPE	bentonite
DEPTH TOP OF SEAL, IF ANY (FT)	0.5
TYPE OF SEAL	bentonite pellets
DEPTH BOTTOM OF SEAL (FT)	1
DEPTH TOP OF PERVIOUS SECTION	2'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	12.0
DEPTH BOTTOM OF SAND COLUMN (FT)	14.0
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	# 1 Sand

NOTES: 2' Sump

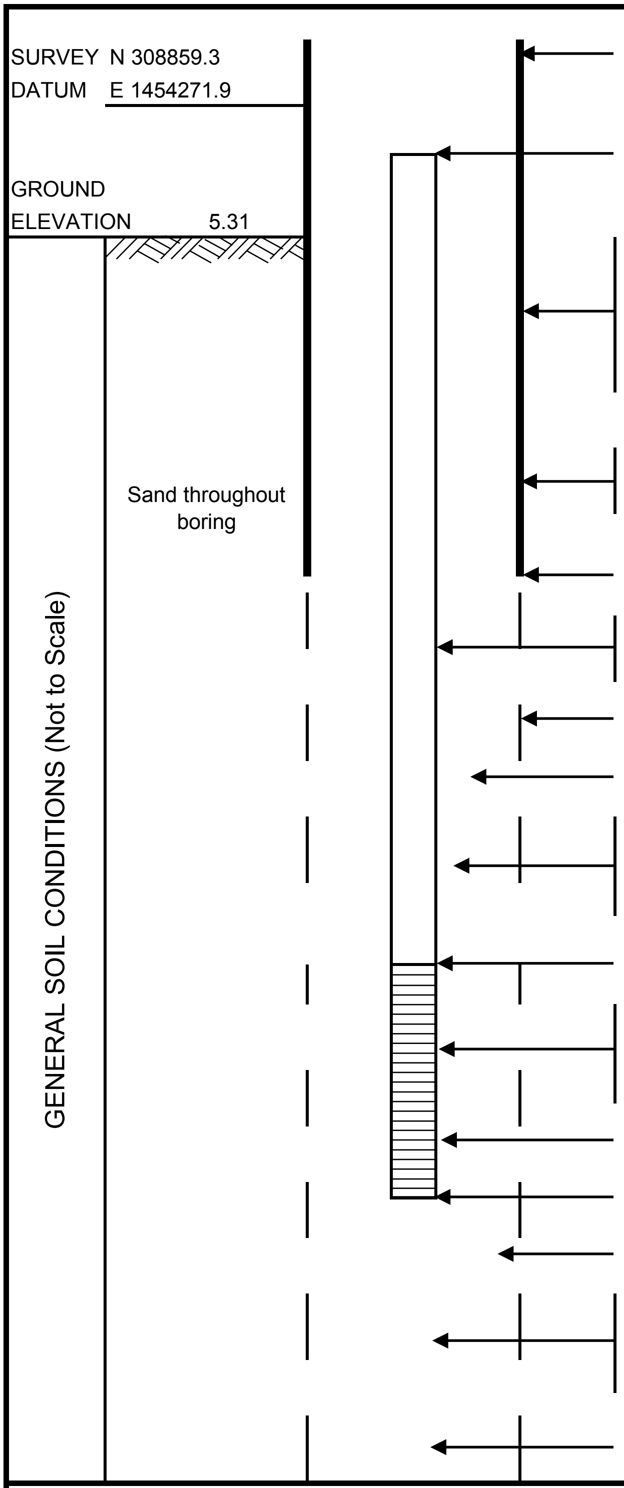
GEI Consultants

GROUNDWATER OBSERVATION WELL REPORT

Project	Sag Harbor former MGP Site	PG.	1 OF 1
Location	Sag Harbor, New York	Boring No.	SHMW-05SR
Client	National Grid	Location	Offsite
Contractor	Zebra Environmental	Driller	
Inspected by	Chris Anastasiou	Date Started	10/27/10
Checked by	Chris Morris	Date Completed	10/27/10
		Project No.	093190-2-1204

SURVEY DATUM N 308859.3
E 1454271.9

GROUND ELEVATION 5.31



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	sand
DEPTH TOP OF SEAL, IF ANY (FT)	none
TYPE OF SEAL	
DEPTH BOTTOM OF SEAL (FT)	none
DEPTH TOP OF PERVIOUS SECTION	2'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	12"
DEPTH BOTTOM OF SAND COLUMN (FT)	12'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

GEI Consultants

GROUNDWATER OBSERVATION WELL REPORT

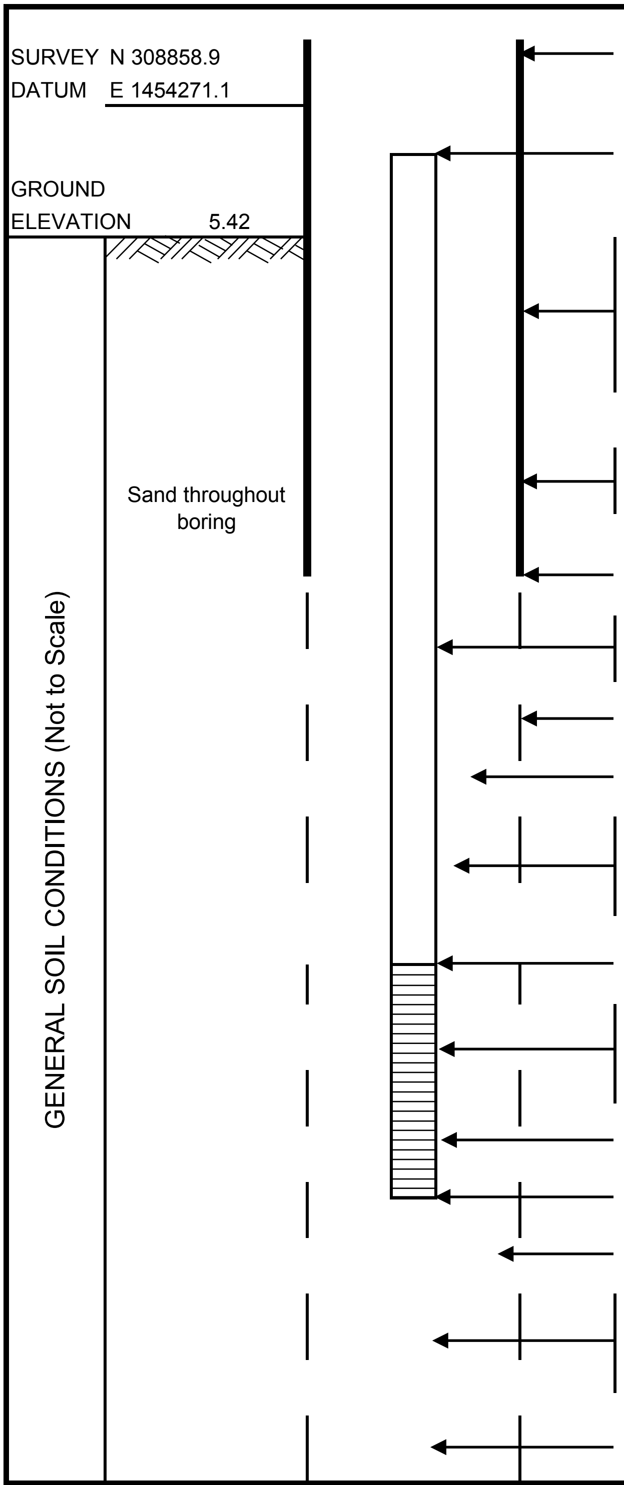
Project	Sag Harbor former MGP Site		
Location	Sag Harbor, New York		
Client	National Grid		
Contractor	Zebra Environmental	Driller	
Inspected by	Chris Anastasiou	Date Started	10/27/10
Checked by	Chris Morris	Date Completed	10/27/10

PG. 1 **OF** 1

Boring No.	SHMW-05IR
Location	Offsite
Project No.	093190-2-1204

SURVEY DATUM N 308858.9
E 1454271.1

GROUND ELEVATION 5.42



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	1'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	cement/bentonite grout
DEPTH TOP OF SEAL, IF ANY (FT)	31'
TYPE OF SEAL	bentonite pellets
DEPTH BOTTOM OF SEAL (FT)	33'
DEPTH TOP OF PERVIOUS SECTION	35'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	45'
DEPTH BOTTOM OF SAND COLUMN (FT)	45'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

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GROUNDWATER OBSERVATION WELL REPORT

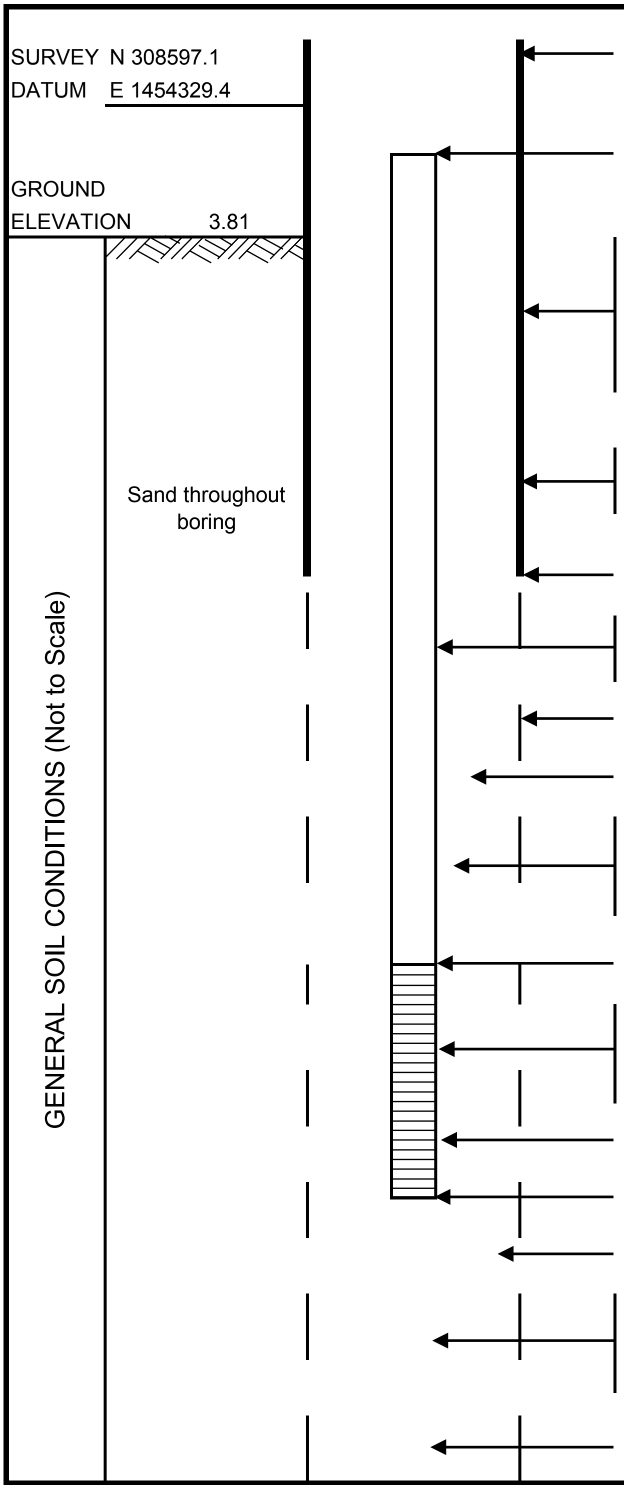
Project	Sag Harbor former MGP Site		
Location	Sag Harbor, New York		
Client	National Grid		
Contractor	Zebra Environmental	Driller	
Inspected by	Chris Anastasiou	Date Started	11/1/10
Checked by	Chris Morris	Date Completed	11/1/10

PG. 1 OF 1

Boring No.	SHMW-07SR
Location	Offsite
Project No.	093190-2-1204

SURVEY DATUM N 308597.1
E 1454329.4

GROUND ELEVATION 3.81



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	sand
DEPTH TOP OF SEAL, IF ANY (FT)	none
TYPE OF SEAL	
DEPTH BOTTOM OF SEAL (FT)	none
DEPTH TOP OF PERVIOUS SECTION	1'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	11'
DEPTH BOTTOM OF SAND COLUMN (FT)	11'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

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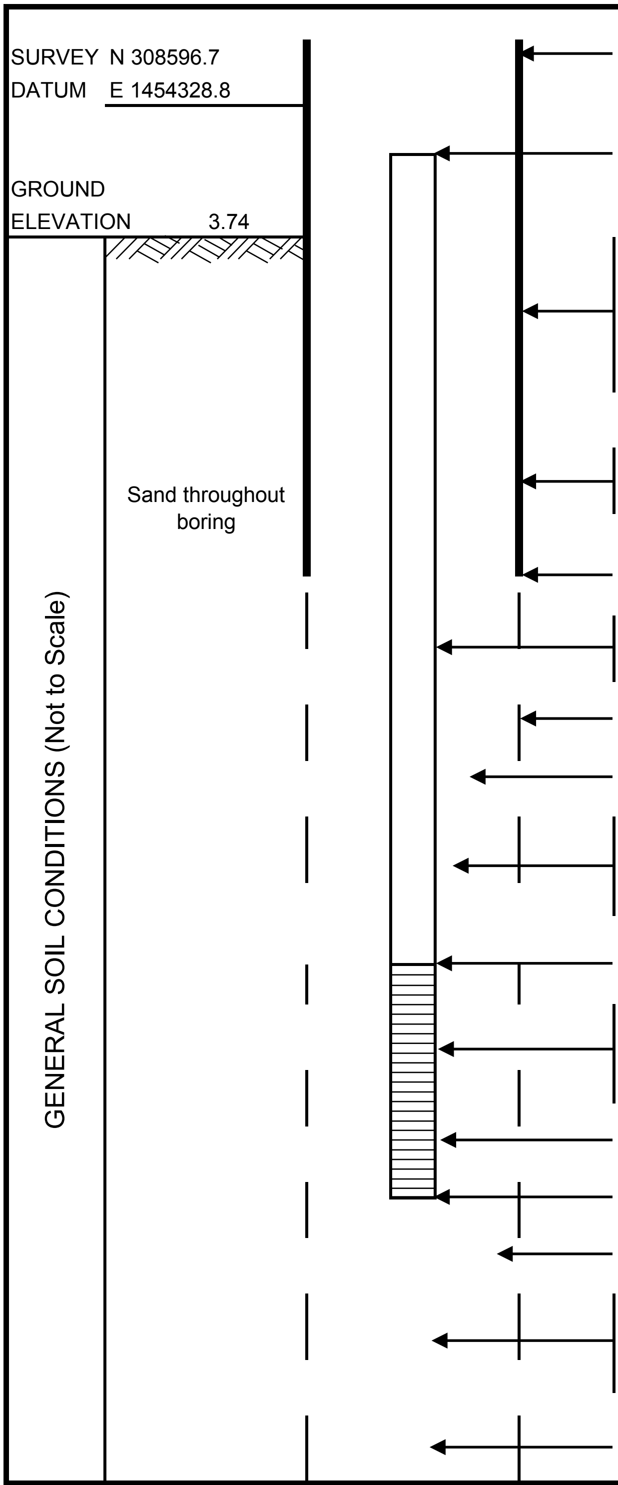
GROUNDWATER OBSERVATION WELL REPORT

Project	Sag Harbor former MGP Site	PG.	1 OF 1
Location	Sag Harbor, New York	Boring No.	SHMW-07IR
Client	National Grid	Location	Offsite
Contractor	Zebra Environmental	Driller	
Inspected by	Chris Anastasiou	Date Started	11/1/10
Checked by	Chris Morris	Date Completed	11/1/10
		Project No.	093190-2-1204

SURVEY DATUM N 308596.7
E 1454328.8

GROUND ELEVATION 3.74



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
LENGTH OF RISER PIPE ABOVE GROUND SURFACE (FT)	0.0 (flush-mounted)
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	1'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1'
RISER PIPE DIAMETER(IN)	1"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	3.25"
TYPE OF BACKFILL AROUND RISER PIPE	cement/bentonite grout
DEPTH TOP OF SEAL, IF ANY (FT)	31'
TYPE OF SEAL	bentonite pellets
DEPTH BOTTOM OF SEAL (FT)	33'
DEPTH TOP OF PERVIOUS SECTION	35'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	1"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	# 1 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	45'
DEPTH BOTTOM OF SAND COLUMN (FT)	45'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	none
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	none

NOTES:

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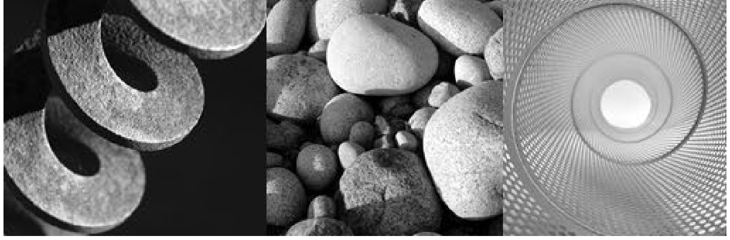
APPENDIX D. HEALTH AND SAFETY PLAN



GEI Consultants

Consulting
Engineers and
Scientists

Health and Safety Plan

Downstate OMM
Multiple Sites
Long Island and New York City Area

Prepared For:
National Grid
175 East Old Country Road
Hicksville, NY 11746

Submitted by:
GEI Consultants, Inc., P.C.
110 Walt Whitman Road
Huntington Station, NY 11746
631.760.9300

April 2018

Project No. 1702897

Christopher Morris
Project Manager

Jeena Sheppard
Regional Health and Safety Officer

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Tables

Appendices

Attachments

I:\Tech\Environmental Projects\National Grid\OMM Downstate\HASP\Downstate OMM HASP April 2018_gd.docx

1. Emergency Contact Information

Table 1. Emergency Information

Important Phone Numbers		Directions to Hospital
Local Police:	911	To Hospital and Occupational Health Clinic: See Attached Maps and Directions for each site in Appendices (A-M)
Fire Department:	911	
Ambulance:	911	
State Police or County Sheriff:	911	
For Site-Specific Hospital and Occupational Clinic information – see Appendices A through M		
Project Manager: Chris Morris Task Manager: Mike Quinlan	(631) 759-2967 office (631) 484-9152 cell (631) 708-8063 cell	
Corporate Health and Safety Officer Steve Hawkins	(860) 368-5348 office (860) 916-4167 cell	
Regional Health and Safety Officer Jeena Sheppard	(856) 291-5663 office (856) 298-7138 cell	
Client Contact: Sarah Aldridge	(516) 545-2568 office (860) 334-0554 cell	
Nearest Telephone Location: On-site cellular		

2. Background Information

2.1 General

Engineer	GEI Consultants, Inc., P.C. (GEI) 110 Walt Whitman Road, Suite 204 Huntington Station, NY 11746:
Project Name	Downstate OMM Multiple Address New York City & Long Island, New York

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the Downstate OMM sites located at Multiple Addresses within New York City and Long Island in New York. Site-specific information is provided in Appendices A through M. GEI personnel and Subcontractors are required to review and sign this HASP, acknowledging that they understand and will adhere to this HASP. Subcontractors will also prepare their own Site-specific HASP for the protection of their employees from the hazards associated with their work tasks and may use this document as a guide. GEI will verify that its subcontractor's HASP includes National Grid site-specific requirements, as outlined in this HASP.

Additionally, federal, state and local representatives, as well as National Grid employees may be required to sign and adhere to this HASP, depending on the nature of their presence onsite during activities conducted by GEI. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions. A copy of this HASP will be maintained on site for the duration of the work.

Included in Appendies A through M are routes to the nearest medical facility from the Site with directions and contact information. Safety data sheets (formerly known as Material Safety Data Sheets [MSDS]) specific to chemicals that may be encountered while working at the Site, are in Appendix N. Appendix O details the signs, symptoms, care and procedures to both heat and cold stress. Appendix P includes the Tailgate Safety Briefing form, the Project Safety Briefing form, the Accident/Incident Report Form and the Near Miss Reporting Form. Appendix Q contains the GEI Health and Safety (H&S) Standard Operating Procedures (SOPs) that apply to this project.

GEI and Subcontractor employees have the authority to stop work activities if an unanticipated hazard is encountered or a potential unsafe condition is observed. The

GEI employees should contact the Corporate Health and Safety Officer and the Project Manager to discuss the stop work conditions and potential control methods that can be implemented.

2.2 Project Description

The activities conducted at the thirteen formerly regulated environmental waste sites across National Grid's Downstate New York service territory: these sites include former manufactured gas plant sites, holder stations, and former or current electric substations. Many of these sites are not owned by National Grid.

Services required in the Program include the operation and maintenance of groundwater treatment systems, oxygen injection systems, site inspections, groundwater monitoring site activities, NAPL monitoring, annual site-wide inspections for each site, general maintenance and any reporting requirements. Specific activities for each of the sites are included in the site-specific Appendices A through M.

2.3 Site Description

See site-specific Appendices A through M.

3. Statement of Safety and Health Policy

GEI is committed to providing a safe and healthy work environment for its employees. To maintain a safe work environment, GEI has established an organizational structure and a Corporate Health and Safety Program to promote the following objectives:

- Reduce the risk of injury, illness, and loss of life to GEI employees.
- Maintain compliance with federal, state, and other applicable safety regulations; and minimize GEI employees' work exposure to potential physical, chemical, biological, and radiological hazards.

Safety policy and procedure on any one project cannot be administered, implemented, monitored, and enforced by any one individual. The total objective of a safe, accident free work environment can only be accomplished by a dedicated, concerted effort by every individual involved with the project from management down to all employees.

Each GEI employee must understand their value to the company; the costs of accidents, both monetary, physical, and emotional; the objective of the safety policy and procedures; the safety rules that apply to the safety policy and procedures; and what their individual role is in administering, implementing, monitoring, and compliance of their safety policy and procedures. This allows for a more personal approach to compliance through planning, training, understanding, and cooperative effort, rather than by strict enforcement. If for any reason an unsafe act persists, strict enforcement will be implemented.

4. Hazard/Risk Analysis

Physical hazards associated with heavy equipment operations may be present should the need arise to excavate, trench, or install or abandon groundwater monitoring wells, oxygen injection wells, or soil vapor points. These activities would require the use of heavy equipment such as a backhoe or drill rig. Some of the hazards associated with this equipment include bodily injuries, slipping, tripping, or falling, heavy lifting and electrical hazards associated with the substations.

Should intrusive activities be necessary, the selected Contractor should verify that electric, gas, water, steam, sewer, and other service lines are shut off, capped, or otherwise controlled, at or outside the building before demolition work is started. In each case, any utility company that is involved should be notified in advance by the selected Contractor, and its approval or services, if necessary, will be obtained.

Smoking is prohibited at or in the vicinity of hazardous operations or materials. Where smoking is permitted, safe receptacles will be provided for smoking materials. The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

4.1 Personal Safety

Field activities have the potential to take employees into areas which may pose a risk to personal safety. The following website (source) has been researched to identify potential crime activity in the area of the project:

- www.city-data.com/crime.com: Provides average crime rates for cities.

The crime rates (average number of crimes per 100,000 people) for each of the sites is listed below by category.

Very Low (<50) – Halesite, Glenwood Landing, and Oyster Bay

Low (50 – 199) – East Garden City and Sag Harbor

Average (200 – 449) – Arverne, Rockaway Park, Bay Ridge, Clifton, Coney Island, Far Rockaway, and Flatbush

To protect yourself, take the following precautions:

- If deemed necessary by the Project Manager (PM), use the buddy system (teams of a minimum of two persons present);

- Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave;
- Call in regularly;
- Pay attention to what is going on around you; and
- If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely.

Employees must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If employees encounter hostile individuals or a confrontation develops in the work area, suspend work activities, immediately leave the area of concern, and contact local 911 for assistance. Notify the SSO and Corporate Health and Safety Officer (CHSO) of any incidents once you are out of potential danger.

In the event of an emergency, prompt communications with local emergency responders is essential. At least one charged and otherwise functioning cell phone to facilitate emergency communications will be on-site. Confirmation of cellular phone operation will be confirmed at the start of each working day.

4.2 Activity Hazard Analysis

The potential hazards for this project associated with site conditions and activity hazards associated with GEI on-site activities have been identified in Table 2. General hazards and control measures that are applicable to all site activities are identified in the General Hazards section. The site-specific tasks, potential hazards, and control measures established to reduce the risk of injury or illness are identified in the Activity Hazard section of the site-specific Appendices A through M. Health and Safety SOPs for routine hazards and common site conditions are referenced in the table below and included in Appendix Q.

Table 2. Activity Hazard Analysis

General Hazards **These Hazards Apply to All Site Activities**	**Control Measure**
Inclement Weather	• Listen to local forecasts for warnings about specific weather hazards such as tornados, thunder storms, and flash floods. • If the storms produce thunder and/or lightning, leave the work area immediately and move to a safe area. • Discuss an action plan prior to the severe weather. • Wear appropriate PPE for the type of weather that could be encountered. • Stop work until conditions are suitable. Take cover in vehicles or shelter as appropriate. • See SOP HS-010
Cold Stress – Hypothermia, Frostbite	• Take breaks in heated shelters when working in extremely cold temperatures. • Drink warm liquids to reduce the susceptibility to cold stress. • Wear protective clothing (recommended three layers: an outside layer to break the wind, a middle layer to provide insulation, and an inner layer of cotton of synthetic weave to allow ventilation). • Wear a hat and insulated boots. • Keep a change of dry clothing available in case clothes become wet. • Do heavy work during the warmer parts of the day and take breaks from the cold. • If possible, shield work areas from drafts of wind and use insulating material on equipment handles when temperatures are below 30°F. • Watch for symptoms of cold stress. (See Appendix O in HASP)
Heat stress – Fainting, Fatigue, Heat Stroke	• Increase water intake while working. • Increase number of rest breaks and/or rotate workers in shorter work shifts. Rest in cool, dry areas. • Watch for signs and symptoms of heat exhaustion and fatigue. • Plan work for early morning or evening during hot months. • Use ice vests when necessary. • In the event of heat stroke, bring the victim to a cool environment and initiate first aid procedures. • See Appendix O of the HASP

General Hazards **These Hazards Apply to All Site Activities**	**Control Measure**
Vehicular Traffic – Struck by injury, crushing	• Increase visibility of the work area to others by using cones, flags, barricades, proper lighting and caution tape to define work area. • Use a "spotter" to locate oncoming vehicles. • Use vehicle to block work area. • Engage police detail for all work conducted in appropriate areas. • Wear high-visibility, reflective vest at all times. • Maintain minimum DOT defined distances to other traffic lanes. • See SOP HS-016
Utilities – Shock, Electrocution, Fire, Explosion	• A thorough underground utility survey must be conducted prior to intrusive activities. Coordination with utility locating services, property owner(s) or utility companies must be conducted. • Utilities are to be considered live or active until documented otherwise. • For overhead utilities within 50 feet, determine with the utility company the appropriate distance. Minimum distance for clearance is based on voltage of the line. • If exposing a utility, proper support and protection must be provided so that the utility will not be damaged. • If a gas line is contacted, the contractor must notify police, fire, and emergency personnel, and evacuate employees according to the site evacuation procedures. No attempt should be made to tamper with or correct the damaged utility. • See SOP HS-014

General Hazards **These Hazards Apply to All Site Activities**	**Control Measure**
Driving	• Employees must wear their safety belt while in a moving vehicle. • Vehicle accidents will be reported in accordance with GEI's accident reporting procedures. • Vehicles will be properly maintained and safely operated (refer to GEI's Fleet Maintenance Program). • Employees will follow safe driving behaviors, which include limiting distractions such as manipulating radios or other equipment that may cause a distraction. Employees should not exceed the posted speed limit and should maintain a safe distance between other vehicles. • Use defensive driving techniques. • Driving distance and time after a 12-hour shift should not exceed 30 miles or 30 minutes (whichever is greater). • See SOP HS-004
Insects – Bites, Stings, Allergic Reactions	• Apply insect repellent prior to performing field work and as often as needed throughout the work shift. • Wear proper protective clothing (work boots, socks and light colored clothing). • Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many insects are most active (between dawn and dusk). • When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible. • Field personnel who may have insect allergies should have bee sting allergy medication on site and should provide this information to the SSO and the CHSO prior to commencing work. • Field personnel should perform a self-check at the end of the day for ticks. • See SOP HS-001

General Hazards **These Hazards Apply to All Site Activities**	**Control Measure**
Physical Injury – Slips, Trips and Falls	• Wear PPE that properly fits, is in good condition and appropriate for the activities and hazards. • Maintain good visibility of the work area. • Avoid walking on uneven, steeply sloped or debris ridden ground surfaces. • Plan tasks prior to preforming them including an activity hazard analysis. • Keep trafficked areas free from slip/trip/fall hazards. • Maintain weed growth in sampling areas, especially on slopes. • Wear shoes with traction. • Avoid traversing steep areas in slippery conditions. • Do not carry heavy objects to sampling areas, on steeply sloped areas, or where steep areas must be traversed to arrive at sample points.
Poisonous Plants – Poison Ivy, Poison Oak, and Poison Sumac	• Avoid areas infested with poisonous plants. • Use a barrier cream to provide some protection. • Wash exposed clothing separately in hot water with detergent. • After use, clean tools, and soles of boots with rubbing alcohol or soap and lots of water. • Immediately wash with soap and water any areas that come into contact with poisonous plants. • If exposed to a poisonous plant, wash with soap and water or a product such as TechnuTM. First aid kits are available in company vehicles. • See SOP HS-001
Repetitive Motion Injury – Standing, Squatting, and Bending Over	• Take regular breaks and do not work in unusual positions for long periods of time. • Walk and stretch between tasks. • See SOP HS-025

Personal Protective Equipment (PPE) is the initial level of protection based on the activity hazards and Site conditions which have been identified. Upgrades to respiratory protection may be required based on the designated Action Levels found in Section 9. General on-site provisions will include: extra nitrile, leather, and/or Kevlar gloves, extra protective coveralls (e.g. Tyvek®) with boot covers, drinking water and electrolyte fluids, reflective vest, first aid kit, fire extinguisher, hearing protection, and washing facilities.

If Site conditions suggest the existence of a situation more hazardous than anticipated, the Site personnel will evacuate the immediate area. The hazard, the level of precautions, and the PPE will then be reevaluated with the assistance and approval of the CHSO and the Project Manager (PM) Chris Morris.

4.2.1 Handling Drums and Containers

Regulations for handling drums and containers are specified by Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(j). Potential hazards associated with handling drums include vapor generation, fire, explosions, and possible physical injury. Handling of drums/containers during the OM&M activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with applicable regulations.

4.2.2 Electrical Hazards

4.2.2.1 Electric Substations

Electrical hazards are typically the most serious physical hazards associated with working on or **near an electric substation**. The following sites contain substations: Arverne, East Garden City, Halesite, Oyster Bay, and Rockaway. All staff working within substations must have completed PSEG Long Island Substation Awareness training. Measures to mitigate exposure to overhead and subsurface electrical transmission and distribution lines should still be considered:

- Contact Dig-Safely New York for mark out of underground public utilities.
- Obtain the most recent as-built drawings of the transmission/distribution line layout from utility owner.
- Mark out of underground transmission/distribution lines by utility owner's survey/mark out personnel.
- Conduct work under the supervision of a National Grid Health and Safety representative.
- Use hand digging tools specifically designed for use on substation property (i.e., insulated digging bar, long-handled spoon shovel, etc.). In addition, rubber gloves and Fire-Resistant clothing are required if hand digging in a substation in/or around energized conductors, which is not anticipated to be the case.
- Use insulated lineman's gloves.
- Electrical Hazard (EH)-rated footwear is required when working on or around electrical equipment over 50 volts, or in an area of expected downed wires.

- Avoid carrying tools/equipment above waist height if overhead electric hazards exist.
- Ground vehicles or equipment using 4-aught gauge grounding cable.
- Maintain a minimum clearance of 16 feet from bus bars, transformer/capacitor electrodes, and overhead transmission/distribution lines.
- Maintain a minimum offset of 3 feet from marked underground transmission/ distribution lines.
- Avoid working on substation in conditions of high humidity or rain or thunderstorms.
- Stop work immediately and vacate the work area in the event lightning is observed.

4.2.2.2 Utilities

The Sites may have shallow, buried utilities and overhead utilities in certain areas. It will be necessary for parties disturbing the existing ground surface and conducting operations with heavy equipment having high clearances to exercise caution in performing project-related work with respect to the presence of utilities. Utility companies with active, buried lines in the Site area will be asked by the Contractor performing intrusive activities to mark their facilities. Employees will use these data to choose work locations.

4.2.2.3 Underground Utilities

No excavating, drilling, boring, or other intrusive activities will be performed until an underground utility survey, conducted by knowledgeable persons or agencies, has been made. This survey will identify underground and in-workplace utilities such as the following:

- Electrical lines and appliances;
- Telephone lines;
- Cable television lines;
- Gas lines;
- Pipelines;
- Steam lines;
- Water lines;
- Sewer lines; and/or
- Pressurized air lines.

The location of utilities will be discussed with GEI employees and subcontractors during a Site Safety Briefing. Identified utilities should be marked or access otherwise restricted to avoid chance of accidental contact.

Even when a utility search has been completed, drilling, boring, and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. Utilities will be considered "live" or active until reliable sources demonstrate otherwise.

4.2.2.4 Overhead Utilities

Overhead transmission and distribution lines will be carried on towers and poles which provide adequate safety clearance over roadways and structures. Clearances will be adequate for the safe movement of vehicles and for the operation of construction equipment.

Overhead or above-ground electric lines should be considered active until a reliable source has documented them to be otherwise. Elevated work platforms, ladders, scaffolding, man-lifts, and drill or vehicle superstructures will be erected a minimum of 20 feet (the actual distance is dependent upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded, or shielded so arcing cannot occur between the work location or superstructure.

4.2.3 Precautions for Working in Confined Spaces

Work in confined spaces will be performed in accordance with 29 CFR 1910.146 (effective April 15, 1993), and GEI Permit Required Confined Space Entry program. The PM will work with the CHSO to address confined space issues as applicable prior to the start of the project. A confined space entry number will be obtained from the CHSO before entering space. The PM will contact local emergency responders to make arrangements for potential rescue. This correspondence will be documented and submitted to the CHSO. Copies of the standards will be kept on file in GEI's main office. Confined space work will not be performed without first notifying and receiving approval from the CHSO.

4.2.4 Excavations and Trenches

The safety requirements for excavations and trenches must be determined by a competent person who is capable of identifying existing and predictable hazards and work conditions that are unsanitary, hazardous, or dangerous to GEI employees. The competent person must also have the authorization to take prompt corrective measures to eliminate unsatisfactory conditions. GEI employees will not enter trenches.

The following are general requirements for work activities in and around excavations:

- Prior to initiation of excavation activity (or ground intrusive activity, such as drilling), the location of underground installations will be determined. The Dig-Safely New York center will be contacted by the Contractor/Subcontractor a minimum of 72 hours prior to excavation activities. It may also be necessary to temporarily support underground utilities during excavation. When excavations approach the estimated location of underground installations, the exact location of the underground installations will be determined by means that are safe for GEI employees, i.e., hand dig, test pits, etc.
- Excavations should be inspected daily by the excavating company's competent person prior to commencement of work activities. Evidence of cave-ins, slides, sloughing, or surface cracks or excavations will be cause for work to cease until necessary precautions are taken to safeguard employees.
- Excavated and other materials or equipment that could fall or roll into the excavation, and vehicular traffic and heavy equipment will be placed at least 5 feet from the edge of the excavation.
- Excavation operations will cease immediately during hazardous weather conditions such as high winds, heavy rain, lightning, and heavy snow.

Employees will refer to GEI's Excavation Safety SOP for further information.

4.2.5 Fire and Explosion

When conducting excavating activities, the opportunity for encountering fire and explosion hazards exists from contamination in soil and the possibility of free product in underground structures and pipelines. Additionally, the use of diesel-powered excavating equipment could present the possibility of encountering fire and explosion hazards.

4.2.6 Heat Stress

Employees may be exposed to the hazards associated with heat stress when ambient temperatures exceed 70ºF. Employees should increase water intake while working in conditions of high heat. Enough water should be available so that each employee can consume 1 quart of water per hour. In addition, they should increase number of rest breaks and/or rotate employees in shorter work shifts. Employees should rest in cool, dry, shaded areas for at least 5 minutes. Employees should not wait until they feel sick to cool down. Watch for signs and symptoms of heat exhaustion and fatigue. In the event of heat stroke, bring the victim to a cool environment, call for help, and initiate first aid procedures

The procedures to be followed regarding avoiding heat stress are provided in Appendix O – Heat Stress Guidelines and in GEI's Heat Stress program.

4.2.7 Cold Stress

Employees may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia, as well as slippery surfaces, brittle equipment, and poor judgment. The procedures to be followed regarding avoiding cold stress are provided in Appendix O – Cold Stress Guidelines and in GEI's Cold Stress program.

4.2.8 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. Employees who will perform suspected or established high noise tasks and operations for short durations (less than 1-hour) will wear hearing protection. If deemed necessary by the SSO, the CHSO will be consulted on the need for additional hearing protection and the need to monitor sound levels for Site activities. Other employees who do not need to be in proximity of the noise should distance themselves from the equipment generating the noise.

4.2.9 Hand and Power Tools

In order to complete the various tasks for the project, personnel may use hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Work gloves, safety glasses, and hard hats will be worn by the operating personnel when using hand and power tools and Ground Fault Indicator (GFI)-equipped circuits will be used for power tools.

4.2.10 Slips, Trips, and Falls

Working in and around the Site may pose slip, trip, and fall hazards due to slippery and uneven surfaces. Excavation at the Site may cause uneven footing in trenches and around the soil piles. Steep slope and uneven terrain conditions at the Site are also a primary concern. GEI employees will wear proper foot gear and will employ good work practice and housekeeping procedures to minimize the potential for slips, trips, and falls.

4.2.11 Manual Lifting

Manual lifting of objects and equipment may be required. Failure to follow proper lifting technique can result in back injuries and strains. Employees should use a buddy system and/or power equipment to lift heavy loads whenever possible and should evaluate loads before trying to lift them (i.e., they should be able to easily tip the load and then return it to its original position). Carrying heavy loads with a buddy and proper lifting techniques include: 1) make sure footing is solid; 2) make back straight with no curving or slouching; 3) center body over feet; 4) grasp the object firmly and as close to your body as possible; 5) lift with legs; and 6) turn with your feet, don't twist.

4.2.12 Projectile Objects and Overhead Dangers

Overhead dangers, including but not limited to falling debris and equipment, can occur while operating drill rigs. GEI employees will maintain a minimum distance from large overhead operations and to maintain proper communication with heavy equipment operators and their handlers, should work necessitate their presence beyond the minimum safety distance. Proper PPE will be worn during these types of activities including steel-toed/shank boots, safety vests, and hard hats.

4.2.13 Cuts and Lacerations

The core sampling program may require employees to use powered cutting tools (circular saw or shears) or a hooked knife to cut open the sample liner. Safety box cutters will be utilized for routine operations such as opening boxes of supplies or cutting rope or string. When using cutting tools, follow the safety precautions listed below:

- Keep free hand out of the way.
- Secure work if cutting through thick material.
- Use only sharp blades; dull blades require more force that results in less knife control.
- Pull the knife toward you; pulling motions are easier to manage.
- Do not put the knife in your pocket.
- Wear leather or Kevlar® gloves when using knives or blades, or when removing sharp objects caught or dangling in sampling gear.

4.2.14 Fall Protection

A Fall Protection Plan must be developed when GEI employees are working at heights above 5 feet. The Fall Protection Plan template can be found on the Health and Safety page of the GEI intranet. This plan must be submitted to the CHSO for approval and will be attached to this HASP as an appendix.

4.2.15 Working Near Water

The following sites are located near water bodies: Halesite, Rockaway Park, Far Rockaway, Coney Island, Glenwood Landing, and Sag Harbor. The buddy system will be used when working near water, in which two persons operate as a single unit in order to monitor and assist each other in performing tasks. Personnel must be attired in a United States Coast Guard (USCG)-approved Type III or Type V work vest. The vest must be properly sized for the individual and must be secured. A throwable rescue device (Type IV personal flotation device [PFD] flotation aid) along with whatever equipment (i.e., ladders, lifting gear, or rescue boat) necessary will be immediately available to recover an individual from the water.

Waders may not be worn when working along, over, or in moving waters; or in waters influenced by tides or acted upon by waves when water depths exceed knee height unless specifically approved by the CHSO. Waders may be worn in still waters and in water depths up to the waist, if bottom conditions are firm and well understood. Waders should never be worn aboard a watercraft.

Take special care on slippery rocks along shorelines, lakeshores, riverbanks, and creeks. Always look ahead at the ground when walking around the water's edge and avoid stepping on stones that have algal growth, especially those in intertidal areas, as these are extremely slippery. Employees should limit access to areas where these slip/fall hazards exist, especially in locations containing tidal water flow.

4.2.16 Boating Safety

As part of the tri-annual sampling event conducted at the Coney Island MGP Site, surface water and sediment samples are to be collected from Coney Island Creek. The sediment samples will be collected from eight locations within the creek from a vessel operated by GEI. The vessel will be relatively small (approximately 12-feet in length) and will be manually operated using oars with oar locks.

A bathymetric survey of the Creek will also be conducted by vessel within the Creek. This portion of the work will be done by a subcontractor. GEI will oversee the work from shore.

A soil boring program within the Creek will also be conducted by a vessel within the Creek. The barge and drilling rig will be operated by a subcontractor. GEI will oversee the work and collect samples from the vessel.

4.2.16.1 Person Overboard

If someone falls overboard, the remaining personnel on the vessel will:

- Immediately throw anything that floats overboard to mark the position of the person.
- Throw a life ring (Type IV PFD) overboard as close to the person as possible.
- Notify the captain "Man Overboard" and on which side of the vessel.

- Post a lookout to keep the person in sight. This person should try to make their way to the captain to assist him in bringing the vessel to the person in the water.
- Maneuver the vessel to pick up the person in the water.
- Have the life ring with line attached ready to throw near the person so they may be pulled to the boat.
- If the person is not located immediately, radio the USCG and other vessels in the area.

4.2.16.2 Severe Weather

If severe weather is approaching, the decision to return to a pier or secure location at the shore of the creek will be made in a manner as to allow adequate time for the boat to return and personnel to evacuate. The location where the boat will dock is to be determined by its location in the body of water and the severity of the weather. The person in command of the vessel will make the final decision regarding movement of the boat. Equipment will be lashed securely to the deck of the boat and personnel will evacuate the boat to a place of safety. The vessel captain will make the final decision for actions taken due to changing weather conditions.

The field leader and captian are responsible for:

- Keeping bilges dry to prevent loss of stability.
- Keeping passengers seated and evenly distributed.
- Clearing deck drains and securing lines from washing overboard.

4.2.16.3 Abandon Ship

The field leader, or captain, and SSO:

- NEVER abandon ship unless actually forced to do so.
- In the event the vessel has to be abandoned the field leader, or captian, and SSO will insure that nearby boats and the USCG have been contacted with the locations.
- Life jackets are distributed throughout the vessel in plain view.
- If near or after dark, attach water lights to rafts and life rings.

4.3 Chemical Hazards

The characteristics of the compounds that may be encountered at most of the sites in the program varies and are discussed below for information purposes. However, it is unlikely that these compounds would be encountered at the sites in which the only activity included in the scope of work is a site inspection, namely, Arverne, Oyster Bay, Hempstead-Clinton, and Glenwood Landing. Volatile organic chemicals (VOCs) and Semi-volatile organic compounds (SVOCs) could be encountered at the each of the remaining sites. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below.

4.3.1 Volatile Organic Compounds

Volatile organic chemicals (VOCs), such as benzene, toluene, ethyl benzene, and xylene (BTEX) are present as soil and groundwater contaminants, and in some cases chemical components in non-aqueous phase liquids (NAPL) such as such as oil or tar within soils and underground structures. These compounds are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. These compounds generally have a depressant effect on the Central Nervous System (CNS), may cause chronic liver and kidney damage, and some are suspected human carcinogens. Benzene is a known human carcinogen. Acute exposure may include headache, dizziness, nausea, and skin and eye irritation. The primary route of exposure to VOCs is through inhalation and therefore respiratory protection is the primary control against exposure to VOCs.

4.3.2 Semi-Volatile Organic Compounds

Semi-volatile organic compounds (SVOCs) usually consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluorethene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)peryline, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphththalene, phenanthrene, phenols, and pyrene.

These SVOCs may be present at each of the sites within impacted soil and groundwater. They may also be present as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former manufactured gas plant (MGP) structures, and abandoned pipelines at several sites including Halesite, Rockaway Park, Clifton, Coney Island, and Sag Harbor.

These compounds are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. SVOCs such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling, and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Many SVOCs are considered to be very toxic, if ingested. High levels of exposure to SVOCs, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney, and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever, anemia, liver damage, vomiting, convulsions, and coma. Poisoning may occur by ingestion of large doses, inhalation, or skin absorption.

The major route of entry for the work activities to be conducted at this Site is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

4.3.3 Coal Tar and Coal Tar Products

Coal tar products, which are semi-volatile organic compounds (SVOCs) consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluorethene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)peryline, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphththalene, phenanthrene, phenols, pyrene.

Coal tar products and other SVOCs may be present at each of the sites within impacted soil and groundwater. They may also be present as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former manufactured gas plant (MGP) structures, and abandoned pipelines at several sites including Halesite, Rockaway Park, Clifton, Coney Island, and Sag Harbor. Coal tar products such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling, and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Coal tar is considered to be very toxic, if ingested. High levels of exposure to coal tar, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney, and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever, anemia, liver damage, vomiting, convulsions, and coma. Poisoning may occur by ingestion of large doses, inhalation, or skin absorption.

The major route of entry for the work activities to be conducted at these Sites is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

4.3.4 Heavy Metals

Each of the sites may contain low levels of metals. The sites at which metals are currently monitored for include Bay Ridge, Clifton, Coney Island, Far Rockaway, and Flatbush.

Exposure to high concentrations of arsenic can cause dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, and hyper pigmentation of skin. Chronic exposure to arsenic has resulted in lung cancer in humans.

Exposure to high concentrations of barium may cause acute symptoms such as irritated eyes, nose, upper respiratory system, and benign pneumoconiosis (baritosis).

Exposure to high concentrations of cadmium can cause acute symptoms such as pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness and pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; loss of the sense of smell), mild anemia; and is considered a potential occupational carcinogen.

Exposure to chromium can cause acute symptoms such as irritation of the eyes, nose and throat as well as wheezing and coughing. Chronic effects include nosebleeds, nasal congestion, dermatitis, and loss of sight.

Exposure to lead may cause acute symptoms such as eye irritation, weakness, weight loss, abdominal pain, and anemia. Chronic exposure to lead may result in kidney disease, effects to the reproductive system, blood forming organs, and CNS.

Lead and arsenic are regulated by specific OSHA standards. They are 29 CFR 1910.1025/1926.52 and 29 CFR 1910.1018/1926.1118, respectively. These standards include specific requirements for air monitoring, signs and labels, training and medical surveillance.

Exposure to high concentrations of selenium can cause mucous membrane irritation, coughing, sneezing, shortness of breath, chills, headaches, hypotension, and CNS depression. Chronic exposure to selenium could cause bronchial irritation, gastrointestinal distress, excessive fatigue, and skin discoloration.

Exposure to mercury can cause dizziness, salivation nausea, vomiting, diarrhea, constipation, emotional disturbance, and kidney injury. Chronic exposure to mercury can cause CNS damage.

These metals are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. As with SVOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

4.3.5 Asbestos-Containing Materials

These Sites are not known to contain asbestos containing materials (ACM).

4.3.6 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) have previously been encountered during MGP site investigations at other sites. PCBs have historically been used from a number of sources including, but not limited to; electrical systems, hydraulic oils, lubricants, cutting oils, printer's ink, and asphalt. Exposure to PCBs can occur through unbroken skin without immediate pain or irritation. PCBs detected at the site are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. Acute effects of exposure to high concentrations of PCB can include eye, skin, nose, and throat irritation. Chronic effects of PCB exposure can include skin swelling and redness, gastro-intestinal disturbances, and neurological effects such as headache, dizziness, nervousness, and numbness of extremities. PCBs are suspected human carcinogens that can cause liver cancer. PCBs can accumulate in fatty tissues and result in health effects after the initial exposure has occurred. The primary route of exposure for PCBs is inhalation, dermal contact, and ingestion. PCBs are not currently monitored at any of the program sites.

4.3.7 Cyanide

Cyanide compounds are common by-products of manufactured gas production. Hydrogen cyanide is toxic because it is a chemical asphyxiate. It replaces the oxygen in the blood and thereby suffocates the cells. Ferro cyanides are not considered toxic because the hydrogen cyanide ion is bound too tightly to the iron and cannot therefore replace the oxygen. It takes a great amount of heat and/or acid to release cyanide gas from the ferro cyanide molecule; therefore, hydrogen cyanide is not a concern at this Site. However, it is National Grid policy to monitor for hydrogen cyanide during earth-disturbing activities at sites where MGP-related contaminants have been found. The sites being specifically monitored for cyanide include: East Garden City, Rockaway, and Clifton.

4.3.8 Hydrogen Sulfide

Hydrogen sulfide is another common by-product of manufactured gas production. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. These symptoms usually go away in a few weeks. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Breathing very high levels (> 800 parts per million [ppm]) of hydrogen sulfide can cause death within just a few breaths. The primary route of exposure is through inhalation and therefore respiratory protection is the primary control against exposure to hydrogen sulfide. Hydrogen sulfide is not currently monitored at any of the program sites.

4.3.9 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when PPE must be upgraded or changed. Action Levels for VOCs and associated contingency plans for the work zone are discussed within Section 9 of this HASP.

Exposure to organic vapors will be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photoionization detector (PID) or a flame ionization detector (FID).
- When possible, engineering control measures will be utilized to suppress the volatile organic vapors. Engineering methods can include utilizing a fan to promote air circulation, utilizing volatile suppressant foam, providing artificial ground cover, or covering up the impacted material with a tarp to mitigate volatile odors.
- When volatile suppression engineering controls are not effective and organic vapor meters indicate concentrations above the action levels, then appropriate respiratory protection (i.e., air purifying respirator with organic vapor cartridge) will be employed.

4.3.10 Evaluation of Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of proper hygiene practices, PPE, and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves, safety glasses) as described in Section 5 will be worn for activities where contact with potential contaminated media or materials are expected.

SDSs for decontamination chemicals and laboratory reagents that may be used on Site are included in Appendix N. Specific chemical hazards information from the occupational health sources are summarized in Table 3.

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3 A.L. .005mg/m3	Inhalation Skin Absorption Ingestion Skin Contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 ppm TWA 5 ppm STEL	Inhalation Skin Absorption Ingestion Skin Contact	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea; staggering gait, fatigue, anorexia, weakness, dermatitis, bone marrow depression, potential carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12° F IP: 9.24 eve LEL: 1.2% UEL:7.8% VP: 75 mm
Chromium (Chromic Acid and Chromates)	1333-82-0	0.05 mg/m^3	0.1 mg/m^3	Inhalation Ingestion Skin Contact	Irritates respiratory system, nasal, septum perforation, liver and kidney damage, leucocytosis (increased blood leucocytes), leukopenis (reduced blood leucocytes), moncytosis (increased monocytes), Eosinophilia, eye injury, conjunctivitis, skin ulcer, sensitivity dermatitis, potential carcinongen	Blood, respiratory system, liver, kidney, eyes, skin, lung cancer	FP:NA IP:NA VP: Very Low LEL: NA UEL: NA
Copper (as a fume)	1317-38-0	NIOSH REL: TWA 0.1 mg/m3	TWA 0.1 mg/m3	Inhalation, skin and/or eye contact	Irritation eyes, upper respiratory system; metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough, lassitude (weakness, exhaustion); metallic or sweet taste; discoloration skin, hair	Eyes, skin, respiratory system (increased risk with Wilson's disease)	Finely divided black particulate dispersed in air FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Ethylbenzene	100-41-4	100 ppm	100 ppm	Inhalation Ingestion Skin Contact	Eye, skin, mucous membrane irritation; headache; dermatitis, narcosis; coma	Eyes, skin, respiratory system, CNS	FP: 55° F IP: 8.76 eV LEL: 0.8% UEL:6.7% VP: 7 mm

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Hydrogen cyanide	74-90-8	4.7 ppm (5 mg/m^3) STEL [skin]	10 ppm (11 mg/m^3) [skin]	Inhalation Ingestion Absorption Skin/Eye Contact	Asphyxia; weakness, headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes	CNS, CVS, thyroid, blood	Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. VP: 630 mmHg IP: 13.60 eV
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/Eye Contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, CNS	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm IP: 10.46 eV
Iron	1309-37-1	Iron oxide dust and fume (Fe_2O_3) as Fe: 5 mg/m3 (TWA);	Iron oxide dust and fume: 10 mg/m3	Inhalation, ingestion, eye contact	Respiratory tract irritation, coughing, shortness of breath, overdose of iron may cause vomiting, abdominal pain, bloody diarrhea, vomiting blood, lethargy, and shock; acidity in the blood, bluish skin discoloration, fever, liver damage, and possibly death; eye and cornea irritation and discoloration	Eyes, respiratory system, GI tract, liver	Reddish brown solid FP: NA LEL: NA UEL: NA VP: 0 mmHg

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m3	Inhalation Ingestion Skin Contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, CNS, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Manganese	7439-96-5	TWA 1 mg/m^3 ST 3 mg/m^3	C 5 mg/m^3	Inhalation, ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	Respiratory system, central nervous system, blood, kidneys	A lustrous, brittle, silvery solid. FP: NA LEL: NA UEL: Na VP: 0 mmHg
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m3	Inhalation Ingestion Skin Contact Skin Absorption	Irritates eyes and skin, chest pain, cough, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, Gastrointestinal disturbance, weight loss, proteinuria	Eyes, skin, respiratory tract, central nervous system	Silver-white, heavy odorless liquid FP: NA IP:? LEL: NA UEL:NA VP: 0.0012 mm

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Naphthalene	91-20-3		10 ppm (50 mg/m^3) TWA	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	FP: 174 F IP: 8.12 eV, LEL: 0.8% UEL:6.7%, VP: 0.08 mm
Sodium	7440-23-5		None	Skin absorption, inhalation, ingestion	Skin contact (irritant), of eye contact (irritant). Hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin	Skins, eyes, lungs	Boiling Point: 881.4°C (1618.5°F) Melting Point: 97.8°C (208°F) Critical Temperature: Not available. Specific Gravity: 0.97
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Ingestion Skin Contact	Irritant to eyes, skin, nose and throat, visual disturbance, headache, chills, fever, breathing difficulty, bronchitis, metallic taste, garlic breath, GI disturbance, dermatitis, eye and skin burns,	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amphorous or crystalline, red to gray solid FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Thallium		NIOSH REL: TWA 0.1 mg/m3 [skin]	OSHA PEL: TWA 0.1 mg/m3 [skin]	Inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eyes, respiratory system, central nervous system, liver, kidneys, gastrointestinal tract, body hair	Properties vary depending upon the specific soluble thallium compound.

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Toluene	108-88-3	50 ppm	200 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, nose irritation; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, tearing of eyes; nervousness, muscle fatigue, insomnia, tingling in limbs; dermatitis	Eyes, skin, respiratory system, CNS, liver, kidneys	FP: 40° F IP: 8.82 eV LEL: 1.1% UEL:7.1% VP: 21 mm
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion, Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; incoordination, staggering gait; corneal damage; appetite loss, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, Central Nervous System, GI tract, blood, liver, kidneys	FP: 90° F LEL: 0.9% UEL: 6.7% VP: 9 mm
Zinc	1314-13-2	5 mg/m3 (TWA), 10 mg/m3 (STEL) for zinc oxide fume	10 mg/m3 (TWA), for zinc oxide fume	Inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Respiratory system	Colorless liquid FP: NA? IP: 11 eV LEL: 7.5% UEL: 12.5% VP: 100 mmHg

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Nickel	7440-02-0 (Metal)	NIOSH REL*: Ca TWA 0.015 mg/m3 [*Note: The REL does not apply to Nickel carbonyl.]	TWA 1 mg/m3 [*Note: The PEL does not apply to Nickel carbonyl.]	Inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Nasal cavities, lungs, skin **Cancer Site:** **[lung and nasal cancer]**	Metal: Lustrous, silvery, odorless solid FP: none LEL:N/A UEL: N/A VP: 0 mm

Abbreviations:

°F = degrees Fahrenheit
ACGIH = American Conference of Industrial Hygienists
A.L. = Action Level
atm = atmosphere
C = ceiling limit, not to be exceeded
CAS # = chemical abstract services number
CNS = Central Nervous System
CTPV = Coal Tar Pitch Volatiles
CVS = Cardiovascular System
eV = electron volt
f/cc = fibers per cubic centimeter
FP = Flash point
IP = Ionization Potential
LEL = Lower explosive limit
mg/m^3 = micrograms per cubic meter
min = minute
mm = millimeter
mmHg = millimeters of mercury
N/A = not applicable
OSHA = Occupational Safety and Health Administration
PAH = Polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyls
PEL = Permissible exposure limit
ppm = parts per million

Table 3. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data

GI = Gastro-intestinal
H2S = Hydrogen Sulfide
HCN = Hydrogen Cyanide
hr = hour

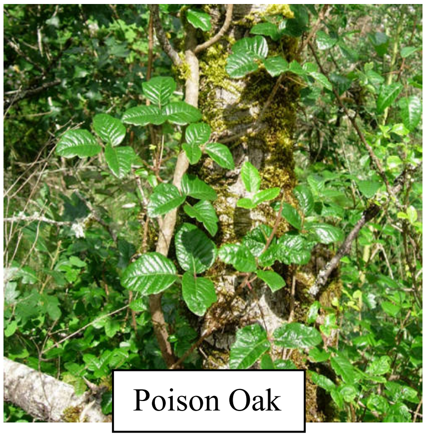
Skin = significant route of exposure
STEL = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure approximately 68°F in mm Hg

4.4 Biological Hazards

Areas of the Sites may be wooded, surrounded with brush, or landscaped. Therefore, employees working on this project should be aware of the potential biological hazards at this Site. Each is discussed in detail below:

4.4.1 Poisonous Plants

Persons working on the Site should be aware of the possible presence of poisonous plants and insects. Poison ivy is a climbing plant with leaves that consist of three glossy, greenish leaflets. Poison ivy has conspicuous red foliage in the fall. Small yellowish-white flowers appear in May through July at the lower leaf axils of the plant. White berries appear from August through November. Poison ivy is typically found east of the Rockies. Poison oak is similar to poison ivy but its leaves are oak-like in form. Poison oak occurs mainly in the south and southwest. Poison sumac typically occurs as a small tree or shrub and may be 6 to 20 feet in height. The bark is smooth, dark and speckled with darker spots. Poison sumac is typically found in swampy areas and east of the Mississippi. The leaves have 7 to 13 smooth-edged leaflets and drooping clusters of ivory-white berries that appear in August and last through spring.



Poison Oak

Poison Ivy

Poison Sumac

The leaves, roots, stems and fruit of these poisonous plants contain urushiol. Contact with the irritating oil causes an intensely itching skin rash and characteristic, blister-like lesions.

The oil can be transmitted on soot particles when burned and may be carried on the fur of animals, equipment, and apparel.

Proper identification of these plants is the key to preventing contact and subsequent dermatitis. Wear long sleeves and pants when working in wooded areas. In areas of known infestation, wear Tyvek® coveralls and gloves. Oils are easily transferred from one surface to another. If you come in contact with these poisonous plants, wash exposed areas immediately with cool water to remove the oils. Some commercial products such as Tecnu's Poison Oak-n-Ivy Cleanser claim to further help with the removal of oils.

4.4.2 Ticks

4.4.2.1 Lyme Disease

Ticks are bloodsuckers, attaching themselves to warm-blooded vertebrates to feed. Deer ticks are associated with the transmission the bacteria that causes Lyme disease. Female deer ticks are about ¼-inch in length and are black and brick red in color. Males are smaller and all black. If a tick is not removed, or if the tick is allowed to remain for days feeding on human blood, a condition known as tick paralysis can develop. This is due to a neurotoxin, which the tick apparently injects while engorging. This neurotoxin acts upon the spinal cord causing incoordination, weakness, and paralysis.

The early stages of Lyme disease, which can develop within a week to a few weeks of the tick bite, are usually marked by one or more of these signs and symptoms:

- Tiredness
- Chills and fever
- Headache
- Muscle and/or join pain
- Swollen lymph glands
- Characteristic skin rash (i.e. bullseye rash)

4.4.2.2 Rocky Mountain Spotted Fever

Rocky Mountain spotted fever is spread by the American dog tick, the lone-star tick, and the wood tick, all of which like to live in wooded areas and tall, grassy fields. The disease is most common in the spring and summer when these ticks are active, but it can occur anytime during the year when the weather is warm.

Initial signs and symptoms of the disease include sudden onset of fever, headache, and muscle pain, followed by development of a rash. Initial symptoms may include fever, nausea, vomiting, severe headache, muscle pain, and/or lack of appetite.

The rash first appears 2 to 5 days after the onset of fever and is often not present or may be very subtle. Most often it begins as small, flat, pink, non-itchy spots on the wrists, forearms, and ankles. These spots turn pale when pressure is applied and eventually become raised on the skin. Later signs and symptoms include rash, abdominal pain, joint pain, and/or diarrhea.

The characteristic red, spotted rash of Rocky Mountain spotted fever is usually not seen until the 6th day or later after onset of symptoms, and this type of rash occurs in only 35% to 60% of patients with Rocky Mountain spotted fever. The rash involves the palms or soles in as many as 50% to 80% of patients; however, this distribution may not occur until later in the course of the disease.

4.4.2.3 Prevention

Tick season lasts from April through October; peak season is May through July. You can reduce your risk by taking these precautions:

- During outside activities, wear long sleeves and long pants tucked into socks. Wear a hat, and tie hair back.
- Use insecticides to repel or kill ticks. Repellents containing the compound n,n-diethyl-meta-toluamide (DEET) can be used on exposed skin except for the face, but they do not kill ticks and are not 100% effective in discouraging ticks from biting. Products containing permethrin kill ticks, but they cannot be used on the skin -- only on clothing. When using any of these chemicals, follow label directions carefully.
- After outdoor activities, perform a tick check. Check body areas where ticks are commonly found: behind the knees, between the fingers and toes, under the arms, in and behind the ears, and on the neck, hairline, and top of the head. Check places where clothing presses on the skin.
- Remove attached ticks promptly. Removing a tick before it has been attached for more than 24 hours greatly reduces the risk of infection. Use tweezers, and grab as closely to the skin as possible. Do not try to remove ticks by squeezing them, coating them with petroleum jelly, or burning them with a match. Keep ticks in a zip-lock baggie in case testing needs to be performed.
- Report any of the above symptoms and all tick bites to the PM and CHSO for evaluation.

4.4.3 Mosquito- Borne Disease – West Nile Virus

West Nile encephalitis is an infection of the brain caused by the West Nile virus, which is transmitted by infected mosquitoes. Following transmission from an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal CNS functioning and causes inflammation of the brain tissue. However, most infections are mild and symptoms include fever, headache, and body aches. More severe infections may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and rarely, death. Persons over the age of 50 have the highest risk of severe disease.

Prevention centers on public health action to control mosquitoes and on individual action to avoid mosquito bites. To avoid being bitten by the mosquitoes that cause the disease, use the following control measures:

If possible, stay inside between dusk and dark. This is when mosquitoes are most active. When outside (between dusk and dark), wear long pants and long-sleeved shirts. Spray exposed skin with an insect repellent, preferably containing DEET.

4.4.4 Wasps and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer, or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once while wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers. Some people may develop an allergic reaction (i.e. anaphylactic shock) to a wasp or bee sting. If such a reaction develops, seek medical attention at once. If a GEI employee is allergic to bees or wasps notify the SSO and if, needed, the location of the epi pen.

4.4.5 Sun Exposure

Employees are encouraged to liberally apply sunscreen, with a minimum sun protection factor (SPF) of 15, when working outdoors to avoid sunburn and potential skin cancer, which is associated with excessive sun exposure to unprotected skin. Additionally, employees should wear safety glasses that offer protection from ultraviolet A and B (UVA/UVB) rays.

5. Personal Protective Equipment

The PPE specified in Table 4 represents PPE selection required by 29 CFR 1910.132, and is based on the Activity Hazard Analysis of Section 4 (Table 2). Specific information on the selection rationale activity can be found in the GEI Health and Safety Manual.

The PPE program addresses elements, such as PPE selection based on Site hazards, use and limitations, donning and doffing procedures, maintenance and storage, decontamination and disposal, training and proper fitting, inspection procedures prior to / during / and after use, evaluation of the effectiveness of the PPE program, and limitations during temperature extremes, heat stress, and other appropriate medical considerations. A summary of PPE for each level of protection is in Table 4.

Table 4. Site-Specific PPE

Task	PPE Level	Site-Specific Requirements	Respirator
Mobilization/Demobilization			
Reconnaissance	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Mobilization/Demobilization of Equipment and Supplies	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D – None
Establishment of Site Security, Work Zones, and Staging Area	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Construction			
Drilling, Groundwater Well Installation, Excavation, Digging Test Pits, Backfilling, Grading Observation, Sampling	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed, personal floatation device (PFD) as needed.	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)
Groundwater Treatment Systems			
Inspections, Maintenance and sampling if needed	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	D - None
NAPL			
Gauging, recovery, sampling	D	Hard hat, safety glasses, steel toe/shank safety boot with overboots reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek and face shield.	D - None

Demolition/Remediation Observation			
Observe Contractor Activities	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	D - None

Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the Site and this HASP will be revised with oversight of the CHSO or GEI personnel will not re-enter the Site until conditions allow.

For most work conducted at these sites, Level D PPE will include long pants, hard hats, safety glasses with side shields, and steel toe/shank or EH-rated safety boots. When work is conducted in areas where non-aqueous phase liquid (NAPL) or tar-saturated soil is anticipated, employees will wear, at a minimum, Level D PPE, which can also include Tyvek® coveralls and safety boots with overboots.

5.1 OSHA Requirements for PPE

Personal protective equipment used during the course of this field investigation must meet the following OSHA standards:

Table 5. OSHA Standards for PPE

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1 1968
Respiratory	29 CFR 1910.134	ANSI Z88.1 1980
Head	29 CFR 1910.135	ANSI Z89.1 1969
Foot	29 CFR 1910.136	ANSI Z41.1 1999 or ASTM F-2412-2005, and ASTM F-2413-2005

CRF = Code of Federal Regulations
ANSI = American National Standards Institute
ASTM = American Society For Testing and Materials

On-site GEI personnel who have the potential to don a respirator must have a valid fit test certification and documentation of medical clearance. The CHSO will maintain such information on file for on-site personnel. The PM will obtain such information from the subcontractor's site supervisor prior to the initiation of such work. Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.134). Air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency (less than 20.7%).
- Imminent Danger to Life and Health (IDLH) concentrations.
- If contaminant levels exceed designated use concentrations.

GEI personnel accessing an energized electrical substation on National Grid sites will adhere to the following PPE requirements:

Personnel working within the National Grid substation property, or conducting intrusive work on site, will wear flame resistant clothing as outlined in OSHA standards: "Apparel which meets the flame-resistant clothing requirements of ASTM F1506-1994, is acceptable under flame and electric arc hazard conditions for compliance with the paragraph 1910.269(l)(6)(iii) standard." This includes long pants and long-sleeved shirts to provide protection from burns in the case of coming in contact with electrical arcing. Clothing worn should have a designation citing this ASTM Standard, or be labeled as meeting "NFPA 70E," which meets the ASTM standard. Additionally, EH-rated safety boots must be worn.

6. Key Project Personnel/Responsibilities and Lines of Authority

6.1 GEI Personnel

Chris Morris	GEI Project Manager
Dan Kopcow	GEI Project Engineer
TBD	GEI Site Safety Officer
Mike Quinlan	GEI Task Manager
Numerous	Field Personnel
Steve Hawkins	GEI Corporate Health and Safety Officer
Jeena Sheppard	Regional Health and Safety Officer

The implementation of health and safety at this project location will be the shared responsibility of the PM, the CHSO, the SSO, other GEI personnel implementing the proposed scope of work.

6.1.1 GEI Project Manager

The PM, Chris Morris, is responsible for confirming that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Conducting and documenting the Project Safety Briefing for GEI project employees and forwarding the signed form (Appendix D) to the Health and Safety Committee;
- Verifying that the GEI staff selected to work on this program are sufficiently trained for Site activities;
- Assuring that personnel to whom this HASP applies, including subcontractor personnel, have received a copy of it;
- Providing the CHSO with updated information regarding conditions at the Site and the scope of Site work;
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of necessary safety procedures;
- Supporting the decisions made by the SSO and CHSO;
- Maintaining regular communications with the SSO and, if necessary, the CHSO;

- Verifying that the subcontractors selected by GEI to work on this program have completed GEI environmental, health and safety requirements and has been deemed acceptable for the proposed scope of work; and
- Coordinating the activities of GEI subcontractors and confirming that they are aware of the pertinent health and safety requirements for this project.

6.1.2 GEI Corporate Health and Safety Officer

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

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

6.1.3 GEI Site Safety Officer

GEI field staff are responsible for implementing the safety requirements specified in this HASP. However, one person will serve as the SSO. For this program, due to the numerous sites, one of the staff members working on site will serve as the SSO. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO’s specific responsibilities include:

- Conducting/attending the Project Safety Briefing prior to beginning work, and subsequent safety meetings as necessary;
- Conduct daily Safety Tailgate meeting in accordance with National Grid requirements (can be combined with “pre-entry”) briefing for Site-related work;

- Verifying that personnel to whom this HASP applies have attended and participated in the Project Safety Briefing and subsequent safety meetings that are conducted during the implementation of the program;
- Maintaining a high level of health and safety consciousness among employees implementing the proposed activities;
- Procuring the air monitoring instrumentation required and performing air monitoring for investigative activities;
- Procuring and distributing the PPE and safety equipment needed for this project for GEI employees;
- Verifying that PPE and health and safety equipment used by GEI is in good working order;
- Verifying that the selected contractors are prepared with the correct PPE and safety equipment and supplies;
- Notifying the PM of noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Monitoring and controlling the safety performance of personnel within the established restricted areas to confirm that required safety and health procedures are being followed;
- Stopping work in the event that an immediate danger situation is perceived; and
- Reporting accident/incident and preparing accident/incident reports, if necessary.

6.1.4 GEI Field Personnel

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

- Reading and signing the HASP in its entirety prior to the start of on-site work;
- Attending and actively participating in the required Project Safety Briefing prior to beginning on-site work and any subsequent safety meetings that are conducted during the implementation of the program;
- Stopping work in the event that an immediate danger situation is perceived;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the SSO, prior to the start of work;

- Reporting accidents, injuries, and illnesses, regardless of their severity, to the SSO, CHSO, and HR; and
- Complying with the requirements of this HASP and the requests of the SSO.

6.1.5 Lines of Authority will be as follows:

On Site – GEI will have responsibility for safety of its employees during the work performed at the Sites within the Downstate OMM program. GEI's field representative will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. GEI's field representative will be available for communication with the GEI PM and with the National Grid representative.

GEI and Subcontractor employees have the authority to stop work activities if an unanticipated hazard is encountered or a potential unsafe condition is observed. The GEI employee should contact the Corporate Health and Safety Officer and the Project Manager to discuss the stop work conditions and potential control methods that can be implemented.

6.2 Subcontractors

GEI has subcontracted the following firms to assist in performing work on this project:

Barrier Environmental, LLC	PO Box 748 Patchogue, New York 11772 Contact: Patrick Condon (631) 803-8422
Island Pump & Tank	40 Doyle Court, East Northport, NY 11731 Contact: Matt Schieferstein (631) 462-2226 x22
Envirotrac	5 Old Dock Rd, Yaphank, NY 11980 Contact: Dale Konas (631) 924-3001
East End Building Services, Inc.	31 Old Dock Road, Yaphank, NY 11980 (631) 849-6464

GEI requires its subcontractors to work in a responsible and safe manner. Subcontractors for this project will be required to develop their own HASP for protection of their employees, but, at a minimum, must adhere to applicable requirements set forth in this HASP.

7. Training Program

7.1 HAZWOPER Training

In accordance with OSHA Standard 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response" (HAZWOPER) responders will, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training will have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training will not be allowed to work in any Site activities in which they may be exposed to hazards (chemical or physical). Proof of training will be submitted to the PM or his/her representative prior to the start of field activities.

7.2 Annual 8-Hour Refresher Training

Annual 8-hour refresher training will be required of hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current 8-hour refresher training will be submitted to the PM or his/her representative prior to the start of field activities.

7.3 Supervisor Training

Personnel acting in a supervisory capacity will have received 8 hours of instruction in addition to the initial 40-hour training. In addition, supervisors will have 1 year of field experience and training specific to work activities (i.e., sampling, construction observation, etc.)

7.4 Site-Specific Training

Prior to commencement of field activities, the PM or the SSO will verify GEI field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the Site operations. It will include Site and facility layout, hazards, and emergency services at the Site, and will highlight the provisions contained within this HASP and applicable GEI H&S SOPs (Appendix E). This training will be documented on the Project Safety Briefing Form Appendix D). The signed form will be forwarded to the Health and Safety Team at: HealthandSafetyTeam@geiconsultants.com. In addition, GEI personnel will sign the plan to document that they understand the hazards and control measures presented and agree to comply with the procedures established in the HASP. Personnel that have not received project-specific training will not be allowed on-site.

7.5 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by the SSO or field representative to assist GEI personnel in safely conducting work activities. The briefing will include GEI subcontractors. The briefings can include information on new operations to be conducted, changes in work practices, or changes in the Site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. Documentation of these briefings will be recorded in the GEI field book, if the project duration is less than 5 days. If the project is longer than 5 days, the Tailgate Safety Briefing Form (Appendix P) will be used to document briefings. The meetings will also be an opportunity to periodically update the employees on monitoring results.

7.6 First Aid and CPR

The PM will verify that GEI field staff has current certifications in first aid and Cardiopulmonary Resuscitation (CPR), so that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association. GEI employees also attend annual Bloodborne Pathogens training in compliance with OSHA regulations.

7.7 Client Specific Training

For the sites that contain substations, substation awareness training provided by PSEG Long Island will be required.

Hazardous Waste manifest training will also be required for sites that require drum pickups.

8. Medical Surveillance Program

GEI maintains a continuous, corporate, medical surveillance program that includes a plan designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. GEI's CHSO and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at branch office locations. Comprehensive examinations are given to GEI field personnel on an annual or biennial basis (as determined to be appropriate by the CHSO) participating in hazardous waste operations. The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Under the CHSO's supervision, field personnel undergo a complete initial physical examination, including a detailed medical and occupational history, before they participate in hazardous waste site investigations. Extensive annual/biennial reexaminations are also performed. Upon completion of these tests, personnel are certified by an occupational health physician as to whether they are fit for field work in general, and fit to use respiratory protection.

If a GEI employee or other project worker shows symptoms of exposure to a hazardous substance and wishes to be rechecked, he/she will be directed to the nearest area hospital or medical facility.

GEI subcontractor personnel that will enter any active waste handling or other active non-"clean" area must certify that they are participating in a medical surveillance program that complies with OSHA regulations for hazardous waste operations (i.e., 29 CFR 1910.120 and 29 CFR 1926.65). Proof of medical clearance will be submitted to the GEI PM or SSO prior to the start of field activities.

9. Monitoring

Air monitoring will be performed to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of worker protection needed on-site in the event that intrusive work is conducted. Work requiring air monitoring includes the installation and/or abandonment of monitoring wells, DNAPL recovery wells, oxygen injection wells, and soil vapor points. Additionally, PID screening of the well head space will be conducted during groundwater sampling activities.

GEI may conduct perimeter air monitoring, and work zone monitoring for on-site GEI employees during intrusive activities only. Activities requiring air monitoring will be conducted in accordance with a pre-approved work plan. GEI will monitor and document daily Site conditions and operations and inform field representatives of results. If Action Levels are exceeded, the SSO will immediately implement Site action(s) according to Table 6 below and notify the PM and CHSO.

GEI will provide the following equipment for health and safety monitoring of on-site GEI personnel:

- PID with 10.6 eV lamp or equivalent;
- Drager Chip Measurement System (CMS) with appropriate gas detection chips; or
- Sensidyne Gas Detection Pump with appropriate gas detector tubes;
- Particulate Meter (PM-10 capable);
- Dust Meter; and
- Combustible Gas Indicator (CGI): LEL / Oxygen (O_2) / hydrogen sulfide (H_2S) / hydrogen cyanide (HCN) meter.

Air monitoring equipment will be calibrated and maintained in accordance with manufacturer's requirements. Calibrations will be recorded in the project notes daily or on a daily calibration form.

Organic vapor concentrations will be measured using a PID during intrusive activities. During intrusive operations, organic vapor concentrations will be measured continuously. Organic vapor concentrations will be measured upwind of the work site(s) to determine background concentrations at least twice a day, (once in the morning and once in the afternoon). The SSO will interpret monitoring results using professional judgment and according to the alert and Action Limits set forth in the associated Site Work Plan.

A dust meter will be used to measure airborne particulate matter during intrusive activities. Monitoring will be continuous and readings will be averaged over a 15-minute period for comparison with the Action Levels. Monitoring personnel will make a best effort to collect dust monitoring data from downwind of the intrusive activity. If off-site sources are considered to be the source of the measured dust, upwind readings will also be collected.

A multi-gas meter will be used to monitor for combustible gases (Lower Explosive Limit – LEL) and O_2 content in the work zone during intrusive activities. The meter will also be equipped with an H_2Ssensor and an HCN sensor. H_2S monitoring will be completed every 15 minutes or, if a sulfur odor is present, monitoring will be continuous. HCN monitoring will be completed every 15 minutes or, if an almond odor is detected, monitoring will be continuous.

Table 6 provides a summary of real time air monitoring Action Levels and contingency plans for work zone activities. The below Action Levels are determined by halving the Permissible Exposure Limits (PELs) or Threshold Limit Values (TLVs) as set forth by OSHA and the American Conference of Government Industrial Hygienists (ACGIH). O_2 values are based on the maximum use limits of a full-face respirator if oxygen were being displaced by a chemical.

Table 6. Real-Time Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level (above background)	Site Action
PID	Work Zone	1.0 ppm	Use detector tube for benzene or zNose® to verify if concentration is benzene. No respiratory protection is required if benzene is not present.
PID	Work Zone	10 ppm	Use Sensidyne detector tube for naphthalene or zNose® to verify if concentration is naphthalene. No respiratory protection is required if naphthalene is not present.
		10 – 50 ppm	No respiratory protection is required if benzene or naphthalene is not present.
		50 – 100 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels persist, upgrade to Level C.
		> 100 ppm	Stop work, withdraw from work area, notify PM and CHSO.
O_2 Meter	Work Zone	< 20.7%	Stop work, withdraw from work area, ventilate area, notify PM and CHSO.
		> 21.1%	Stop work, withdraw from work area, notify PM and CHSO.
H_2S Meter	Work Zone	< 5.0 ppm	No respiratory protection is required.
		> 5.0 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, notify PM and CHSO.
HCN Meter	Word Zone	< 1.0 ppm	Run CMS Drager tube. Continue monitoring with real-time meter, and continue work if CMS Drager tube reading is less than 2.0 ppm.
		> 1.0 ppm HCN Concentrations < 2.0 ppm	Run CMS Drager tube and confirm concentration is less than 2.0 ppm, notify PM and CHSO. Run CMS tube for sulfur dioxide, hydrogen sulfide, and phosphine chip potential interferences. Continue to monitor with real-time meter.
		> 2.0 ppm	Stop work, and move (with continuous HCN monitoring meter) at lease 25 ppm upwind of the excavation until continuous meter reads less than 1 ppm, notify PM and CHSO. Run CMS Drager hydrogen cyanide chip and re-evaluate activity, continue monitoring with a real-time meter, resume work if concentrations read less than 1.0 ppm.
Combustible Gas Indicator	Work Zone	< 10% LEL	Investigate possible causes, allow excavation to ventilate, use caution during procedures.
		> 10% LEL	Stop work, allow excavation/borehole to ventilate to < 10% LEL, if ventilation does not result in a decrease to < 10% LEL, withdraw from work area, notify PM and CHSO.
Particulate Meter	Work Zone	150 $\mu g/m^3$	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

10. Site Control Measures

10.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It will include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones will be established on the work site by the Contractor when operations begin for each task requiring such delineation. Maps depicting the zones will be available at the Site.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to Site contaminants exists, will only be allowed access after proper training and medical documentation.

The following will be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone – The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone.

Contamination Reduction Zone – The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for EZ entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone – Activities which may involve exposure to Site contaminants, hazardous materials, and/or conditions should be considered an EZ. This zone will be clearly delineated by cones, tapes, or other means. The Contractor may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ will be determined by the Contractor allowing adequate space for the activity to be completed, field members, and emergency equipment.

The Contractor is responsible for constructing, maintaining, and enforcing the zones.

10.2 Buddy System

GEI personnel should be in line-of-site or communication contact with another on-site person. The other on-site person should be aware of his or her role as a "buddy" and be able to provide assistance in the event of an emergency. A copy of this plan will be given to any person acting as a GEI "buddy" for informational purposes.

10.3 Sanitation for Temporary Work Sites

Temporary sanitary facilities including toilets will be available on-site.

10.4 Illumination

Illumination requirements identified by OSHA are directed to work efforts inside buildings and/or during non-daylight hours. Activities planned for the Site are anticipated to occur outside during daylight hours. However, if yard areas are used after dark, they will be equipped with illumination that meets or exceeds requirements specified in OSHA Standard 29 CFR 1926.56 "Illumination." Employees will not work on sites that are not properly lighted.

11. Accident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, including but not limited to, injuries, illnesses, near miss incidents, fires, fatalities, incidents involving the public, motor vehicle incidents and property damage. The report will be **immediately** made to the GEI PM **verbally** and all work will be suspended. The PM will **immediately** inform the GEI Safety Team and the Project-Specific National Grid Project manager**.**

A GEI Accident Report form will be submitted **immediately.** A DRAFT Incident Report Form will be completed and submitted to the Project-Specific National Grid Representative **within 4 hours**. A final incident report will be submitted to the Project-Specific National Grid PM, National Grid Regional Safety Lead, and/or the person to whom the verbal notification was initially provided **within 24 hours**.

An incident reporting flow chart, the Accident/Incident Report Forms and the Near Miss Reporting Form can be found in Appendix P. GEI report forms can also be found on the GEI Health and Safety smartphone app or on the Health and Safety page of the GEI Intranet.

Staff must be aware that addressing accidents and injuries takes precedence over completing field work. If a staff member requires medical attention, or an incident/accident has occurred that call this into question, work must stop and the situation must be addressed.

A copy of the National Grid Incident Reporting Requirements is included as Attachment 1.

11.1 Injury Triage Service

If a GEI employee experiences a work-related injury that is not life-threatening, the employee will initiate a call to Medcor Triage at 1-800-775-5866. The injured employee will detail any medical symptoms or complaints which will be evaluated by a Registered Nurse (RN) specially trained to perform telephonic triage. The RN will recommend first aid self-treatment or refer the injured employee for an off-site medical evaluation by a health professional at a clinic within GEI's workers' compensation provider network. GEI employees are still required to follow our Accident Reporting procedures as listed above.

11.2 Flow Chart for Accident Reporting

Employee	GEI reports incidents involving GEI personnel or subcontractor personnel including lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage.
Employee	The report is **immediately** made to the GEI PM and Site Safety Officer.
PM	The PM **immediately** notifies the Safety Team and the Project-Specific National Grid Project Manager. In addition, the PM will notify the GEI National Grid Client Manager.
CHSO	The CHSO informs the President, COO and Regional Manager of the incident.
Employee	The GEI Accident/Incident Report form is **immediately** completed and submitted to the Safety Team.
PM with assist from CHSO or RHSO	A ***DRAFT*** Incident Report Form found in the appendix of the HASP is completed and submitted to the Project-Specific National Grid Project Manager **within 4 hours** of the incident. A final report is to be submitted **within 24 hours**.
RHSO	The GEI Regional Health and Safety Officer initiates an accident investigation within the receipt of the accident report.
RHSO	The accident investigation report is submitted to the CHSO for approval.
CHSO	Incidents are reported to the Operations Committee each month in the H&S report.

12. Decontamination Procedures

A decontamination pad has been established for personnel decontamination and equipment decontamination.

12.1 Personnel Decontamination Station

A personnel decontamination station where employees can drop equipment and remove PPE will be set up at the decontamination pad by the Contractor. It will be equipped with basins for water and detergent, and trash bag(s), or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a sink where they will wash themselves wherever they have potentially been exposed to any contaminants (e.g., hands, face, etc.)

The following specific decontamination procedure will be used as necessary by GEI personnel or subcontractor personnel wearing PPE from Level D through Level C.

- ***Step 1*** – Equipment drop (respirator, tools, monitoring equipment, etc.) Decontaminate as appropriate (per GEI's field representative's instructions).
- ***Step 2*** – Boot wash/rinse (wash with non-foaming detergent, rinse with fresh water spray). Remove boots. If inner and outer gloves are worn, wash outer gloves, remove and save for later use, or remove and discard outer gloves and place in trash bag/can provided in the decontamination area.
- ***Step 3*** – Hard hat removal; wash if visibly contaminated (use same wash as in Step 2).
- ***Step 4*** – If Tyvek® (or equivalent) suit was worn and is visibly contaminated, remove and place in trash bag/can provided in the decontamination area or decontaminate (wash) and store for reuse. Contaminated washable coveralls should be removed and bagged for washing.
- ***Step 5*** – Respirator and/or eye protection removal (as applicable). Wash (per Step 2) to remove visible contamination.
- ***Step 6*** – Remove outer gloves.
- ***Step 7*** – Wash potentially exposed skin (use water and soap at indoor sink).
- ***Step 8*** – Disinfect respirator per manufacturer's recommendations.

Contaminated PPE (gloves, suits, etc.) will be decontaminated and stored for reuse or placed in plastic bags (or other appropriate containers) and disposed of in an approved facility.

Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with applicable state and federal regulations.

12.2 Heavy Equipment Decontamination

Modify for the specific project or delete if not applicable (then delete this note).

Heavy equipment decontamination will be performed by the Contractor within the limits of the on-site decontamination pad in accordance with the contract specifications. A steam generator and brushes will be used to clean demolition equipment and other tools. No heavy equipment will be permitted to leave the Site unless it has been thoroughly decontaminated.

Wastewater from the heavy equipment and personnel decontamination areas will be collected and disposed of in accordance with applicable state and federal regulations. The Contractor will be responsible for ultimate disposal of investigation-derived wastes.

12.3 Decontamination Equipment Requirements

The following equipment, if required, should be in sufficient supply to implement decontamination procedures for GEI's equipment.

- Buckets
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handled soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Methanol and/or Nitric Acid
- Liquid detergent and paper towels
- Plastic trash bags

The Contractor performing decontamination procedures is responsible for verifying that the above materials, as required for their operation, are in sufficient supply.

13. Supplemental Contingency Plan Procedures

13.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their annual health and safety training and new employee health and safety orientation training. Hazardous materials used on the Site will be properly labeled, stored, and handled. SDS will be available to potentially exposed employees.

13.2 Fire

In the event of a fire personnel will evacuate the area. GEI's field representative will contact the local fire department with jurisdiction and report the fire. Notification of evacuation will be made to the PM, the CHSO, and the Project Specific National Grid Representative. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM.

13.3 Medical Support

In case of minor injuries, on-site care will be administered with the Site first aid kit. For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger. Notify the PM, the CHSO, and the Project Specific National Grid Representative of the emergency.

Section 1 and Table 1 of this HASP contain detailed emergency information and a list of emergency services and their telephone numbers. Included in Appendices A through M are maps and directions to the hospital and/or occupational health clinic nearest the site. GEI field personnel will carry a cellular telephone.

13.4 Severe Weather

The contingency plan for severe weather includes reviewing the expected weather to determine if severe weather is in the forecast. Severe weather includes high winds over 30 miles per hour (mph), heavy rains or snow squalls, thunderstorms, tornados, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the Site will be the responsibility of GEI's field representative. Notification of evacuation will be made to the PM, the CHSO, and the Project Specific National Grid Representative. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM. If safe, work can resume 30 minutes after the last clap of thunder or flash of lightning.

13.5 Spills or Material Release

If a hazardous waste spill or material release occurs, if safe, the SSO or their representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following:

- SDS for the material spilled or released;
- Source of the release or spillage of hazardous material;
- An estimate of the quantity released and the rate at which it is being released;
- The direction in which the spill or air release is moving;
- Personnel who may be or may have been in contact with the material, or air release, and possible injury or sickness as a result;
- Potential for fire and/or explosion resulting from the situation; and
- Estimates of area under influence of release.

If the spill or release is determined to be within the on-site emergency response capabilities, the SSO will verify implementation of the necessary remedial action. If the release is beyond the capabilities of the Site personnel, personnel will be evacuated from the immediate area and the local fire department will be contacted. The SSO will notify the PM, the CHSO, and the Project Specific National Grid Representative.

13.6 Alcohol and Drug Abuse Prevention

Alcohol and drugs will not be allowed on the work Site. Project personnel under the influence of alcohol or drugs will not be allowed to enter the Site.

14. Health and Safety Plan Sign-Off

GEI personnel conducting site activities will be familiar with the information in this HASP. After reviewing this plan, please sign the copy in the project files, and bring a copy of the plan with you to the Site.

Site Name: Downstate OMM

Investigation: OM&M

GEI Project No: 1702897

Print Name	Signature
Project Manager: Chris Morris	

Appendix A

Arverne – Site Specific Information

Appendix B

East Garden City – Site Specific Information

Appendix C

Halesite – Site Specific Information

Appendix D

Oyster Bay – Site Specific Information

Appendix E

Rockaway Park – Site Specific Information

Appendix F

Bay Ridge – Site Specific Information

Appendix G

Clifton – Site Specific Information

Appendix H

Coney Island – Site Specific Information

Appendix I

Far Rockaway – Site Specific Information

Appendix J

Flatbush – Site Specific Information

Appendix K

Glenwood Landing – Site Specific Information

Appendix L

Hempstead-Clinton – Site Specific Information

Appendix M

Sag Harbor – Site Specific Information

1. Emergency Contact Information

Table 1m. Sag Harbor Emergency Information

Important Phone Numbers		Directions to Hospital
Local Police:	911	To Hospital and Occupational Health Clinic: See Attached Maps and Directions for each site in Appendix A Directions to Hospital: Drive Southeast on Bridge St toward Spring Street. Turn Left on Spring Street (335 feet). Turn Right at Main Street (1.0 mi). Continue onto Bridgehampton Sag HarborTurnpike/Sag Harbor Turnpike (3.4 mi). Slight right at Montauk Highway/NY-27 W (4.7 mi). Continue onto Hampton Road (0.9 mi). Turn Left at Lewis Street (0.2 mi). Take the 2nd Left onto Meeting House Lane. The Hospital will be on Left after 262 feet.
Fire Department:	911	
Ambulance:	911	
State Police or County Sheriff:	911	
Southampton Hospital: 3330 Noyac Rd Sag Harbor, NY 11963 Land, Sea, & Air Medical Review Specialists Occupational Health and Safety Provider: 910 Route 109 North Lindenhurst, NY	(631) 725-2112 (631) 225-3060	
Project Manager: Chris Morris Task Manager: Mike Quinlan	(631) 759-2967 office (631) 484-9152 cell (631) 708-8063 cell	
Corporate Health and Safety Officer : Steve Hawkins	(860) 368-5348 office (860) 916-4167 cell	
Regional Health and Safety Officer Jeena Sheppard	(856) 608-5663 office (856) 298-7138 cell	
Client Contact: Sarah Aldridge	(516) 545-2568 office (860) 334-0554 cell	
Nearest Telephone Location: On-site cellular		

Sag Harbor

Project Description:

Activities conducted at the former Sag Harbor MGP Site consist primarily of the following tasks:

- Groundwater Monitoring (quarterly and annually).
- Annual site-wide inspection, including the passive DNAPL collection system, the cover system and the groundwater cells.

Other activities may be conducted on an as needed basis. These activities may include:

- Site maintenance (such as the refurbishment or restoration of monitoring well caps and pads, replacement of signs, repainting, etc.)
- Installation and/or abandonment of monitoring wells and dense non-aqueous phase liquid (DNAPL) recovery wells
- Waste characterization sampling and drum removal
- Gauging and recovery of DNAPL

Site Description:

The former MGP site is located at 5 Bridge Street and West Water Street in Sag Harbor and is currently owned by NG. The adjacent properties are primarily commercial/residential. The NG property is currently being utilized as a gravel parking lot. The area subject to remedial work in the ROD included two adjacent commercial properties, the Village's Bridge Street ROW and an adjacent condominium property. The remedy included installation of an excavation support system, removal of a building to the north of the MGP property, excavation and off-site transport/treatment of certain soils; recovery of mobile tar from collection wells; and groundwater treatment at the site perimeter during excavation activities. A SMP was submitted to NYSDEC in February 2014 and the Final Engineering Report was approved in July 2015.

A passive DNAPL collection system was installed to mitigate the potential migration of any DNAPL left behind in the subsurface following the remedial action. The passive DNAPL collection system consists of a four inch (4”) groundwater well with a two foot (2’) sump installed on Long Island Avenue north of the 31 Long Island Avenue property and a four inch (4”) groundwater well with a two foot (2’) sump installed on the 5 Bridge Street Property.

Table 2: Activity Hazard Analysis

Activity	Potential Hazard	Control Measures
Carrying Equipment	Heavy lifting, strains/sprains, slips/trips/falls, pinch points	• Use proper lifting techniques as defined in the heavy lifting activity analysis below • Wear the proper type of glove to protect hands against sharp edges and skin/soft tissue injuries • Wear appropriate footwear • Be aware of hard to grip and hold items that may force your hand or wrist into awkward, stressful positions and cause disorders like tendinitis or carpal tunnel syndrome • Take breaks when carrying items frequently and/or for long distances • Do not over reach when picking up or placing items. • Use the buddy system when necessary • When climbing ladders, maintain three points of contact at all times. DO NOT carry equipment up or down ladders unless it is in a secure backpack or similar hands-free shoulder-strap bag or case. Lower or raise larger equipment by crane or rope
Dense Non-Aqueous Phase Liquid (DNAPL) Gauging and Recovery	Contaminant Exposure, Repetition, Slips/Trips/Falls	• Wear proper PPE during sampling including Tyvek or Tyvek apron with sleeves, Nitrile gloves, and face shield/safety glasses. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.
Drum Handling	Contaminant Contact • Wear proper PPE during sampling including nitrile gloves and safety glasses. Cuts or Abrasions Heavy Lifting , Slips/Trips/Falls	• Wear proper PPE during sampling including nitrile gloves and safety glasses and face shield as appropriate. • Use proper dollies or drum moving tools. • Use applicable tools to open/close drum lids. • Do not handle drums with bulging sides. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Use proper lifting techniques. • Ask fellow worker for help. • Keep trafficked areas free from slip/trip/fall hazards. • See SOP HS-003
Excavation and Trenching Oversight (as needed)	Crushing, entrapment, falls, fire/explosion	• Prior to excavating, determine utility locations and have locations marked by utility companies and the property owner. • Utilities shall be properly supported and barriers should be erected around excavations in remote areas. • Backfill temporary excavations when work is completed. • Personnel must remain 2 feet from the face of the excavation. • Sides, slopes, and faces shall meet OSHA requirements. • Excavation entry will be allowed only with proper sloping or shoring. • See SOP HS-006

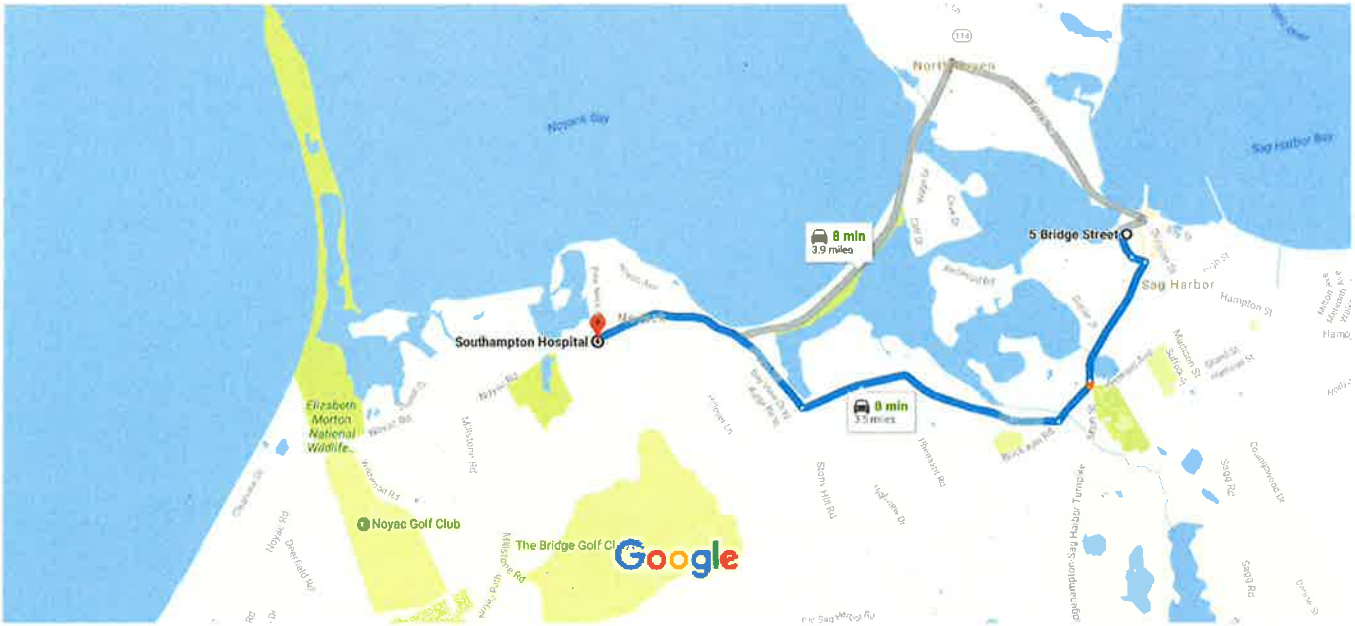
Activity	Potential Hazard	Control Measures
Groundwater Sampling	Contaminant Exposure, Heavy Lifting, Repetition, Slips/Trips/Falls	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses and Nitrile/neoprene gloves. • Dispose of gloves after use and wash hands. • User proper lifting techniques. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.
Heavy Equipment – Working Near	Struck-by, caught-in-between equipment, crushing, pinch points	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or (electrical hazard) EH-rated safety boots with composite toe and shank; safety glasses; nitrile/neoprene gloves; and earplugs. • Identify yourself and your work location to heavy equipment operators, so they may incorporate you into their operations. • Coordinate hand signals with operators. • Stay Alert! Pay attention to equipment backup alarms and swing radii. • Wear a high-visibility, reflective vest when working near equipment or motor vehicle traffic. • Position yourself in a safe location when filling out logs talking with the contractor. • Notify the contractor immediately if any problems arise. • Do not stand or sit under suspended loads or near any pressurized equipment lines. • Do not operate cellular telephones in the vicinity of heavy equipment operation. • See SOP HS-018
Waste Characterization	Contaminant Contact • Wear proper PPE during sampling including nitrile gloves and safety glasses. Cuts or Abrasions, Slips/Trips/Falls	• Wear proper PPE during sampling including nitrile gloves and safety glasses. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Keep trafficked areas free from slip/trip/fall hazards.
Working near Water	Drowning, hypothermia	• While working near water stay inside guard rails and or barriers. • While working out of out of safety zones a personal flotation device (PFD) must be worn at all times and an approved 30-inch ring buoys will be readily available for emergency rescue operations. • Use appropriate fall protection. • Buddy system shall be in use. • See SOP HS-017

Activity	Potential Hazard	Control Measures
Monitoring well, soil vapor point and/or oxygen injection well installation and abandonment.	Contaminant Exposure, Noise, Contact with Utilities, Cuts/Scrapes, Heavy Lifting, Repetition, Slips/Trips/Falls, Drill Rig Proximity	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses; Nitrile/neoprene gloves; and earplugs. • Confirm utility locate has been completed. • Confirm adequate clearance from overhead utilities. • Dispose of gloves after use and wash hands. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards. • Maintain awareness of location of equipment. Subcontractor use of a spotter for equipment operation
Waste Management	Contaminant Exposure, Cuts/Scrapes	• Wear proper PPE during sampling including Tyvek or Tyvek apron with sleeves, Nitrile gloves, and face shield/safety glasses. • Wear work gloves over nitrile gloves.
Replace well boxes and associated concrete on monitoring wells, soil vapor points and/or oxygen injection wells	Jackhammer Proximity, Silica Dust Inhalation (From Grout/Cement Mixing), Noise	• Wear proper PPE, including safety glasses, hard hat, high visibility reflective vest, and EH rated safety boots. Maintain awareness of location of equipment. • Stay upwind of mixing area. Wear a dust mask if necessary. • Wear hearing protection.
Site Cap Inspection (Annual)	Slips, Trips and Falls	• Keep trafficked areas free of slip/trip/fall hazards.

Google Maps

5 Bridge Street, Sag Harbor, NY to Southampton Hospital

Drive 3.5 miles, 8 min



Map data ©2017 Google 2000 ft

5 Bridge St

Sag Harbor, NY 11963

1. Head south on Bridge St toward Rose St

0.1 mi

2. Turn left onto Spring St

348 ft

3. Sharp right onto Main St

0.6 mi

4. Turn right onto Brick Kiln Rd

0.2 mi

5. Turn right onto Noyac Rd

1.3 mi

6. Turn right to stay on Noyac Rd
   ● Destination will be on the left

1.2 mi

Southampton Hospital

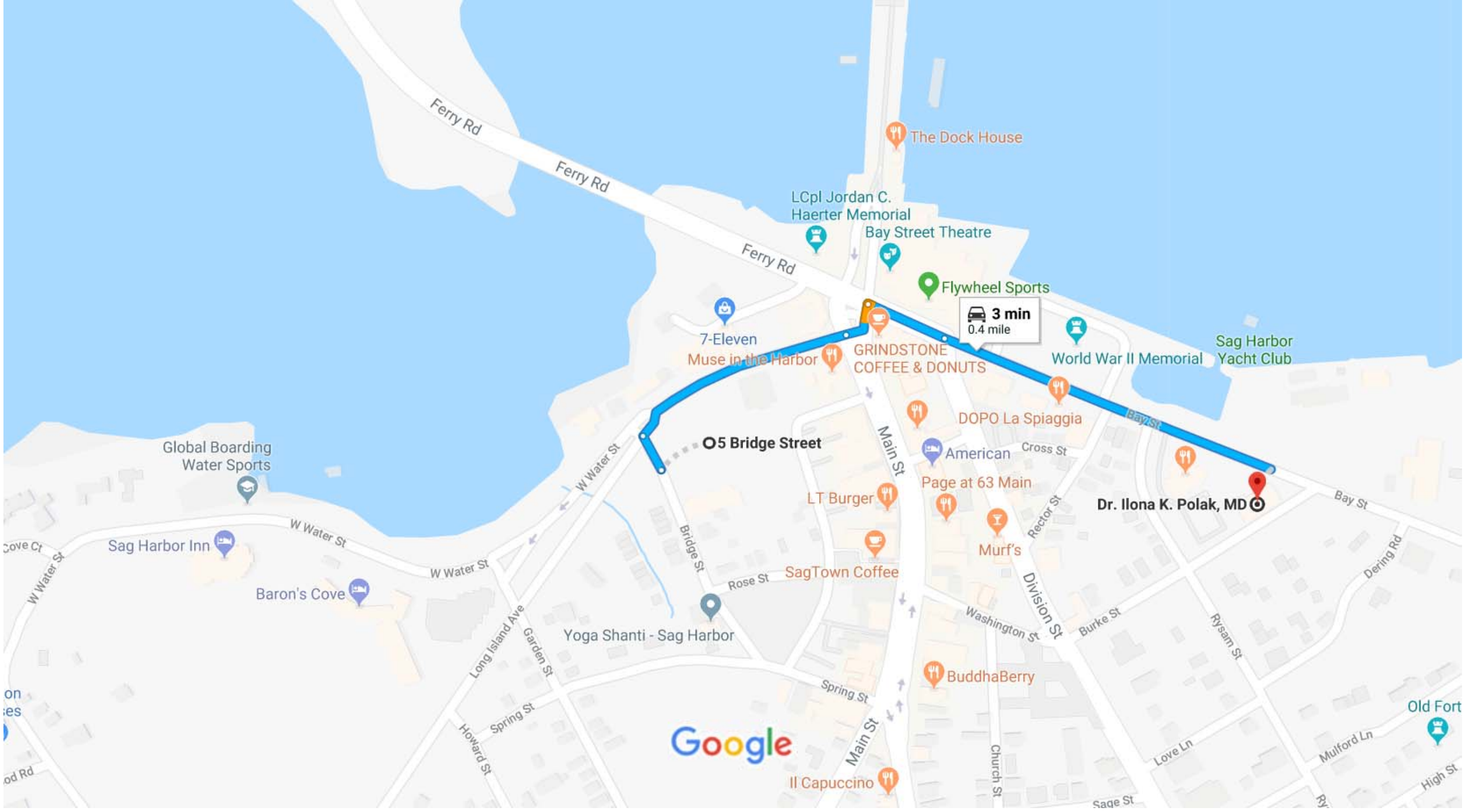
3330 Noyac Rd, Sag Harbor, NY 11963

Google Maps

Walk-In Clinic

5 Bridge St, Sag Harbor, NY to Dr. Ilona K. Polak, MD

Drive 0.4 mile, 3 min



Map data ©2018 Google 200 ft

5 Bridge St

Sag Harbor, NY 11963

↑ 1. Head northwest on Bridge St toward Long Island Ave

102 ft

↱ 2. Turn right onto Long Island Ave

0.1 mi

↰ 3. Turn left onto Main St

121 ft

↱ 4. Turn right onto Bay St/Lost at Sea Memorial Pike

226 ft

↑ 5. Continue straight onto Bay St

ⓘ Destination will be on the right

0.2 mi

Walk-In Clinic

Dr. Ilona K. Polak, MD

34 Bay St, Sag Harbor, NY 11963

Appendix N

Safety Data Sheets

ISO9001:2000 Certified

Material Safety Data Sheet

Nitric acid solutions, 0.4% - 50% v/v, 0.1N-6.0N

Section 1 - Chemical Product and Company Identification

MSDS Name:

Nitric acid solutions, 0.4% - 50% v/v, 0.1N-6.0N

Catalog Numbers:

LC17730, LC17750, LC17770, LC17800, LC17840, LC17850, LC17870

Synonyms:

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
7697-37-2	Nitric acid	0.04-50

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Colorless
Caution! Corrosive. May cause severe eye and skin irritation with possible burns.
Target Organs: None known.

Potential Health Effects

Eye:

Causes pain, photophobia, tearing, edema, corneal ulceration, severe burns, necrosis of deep tissue with permanent damage and blindness.

Skin:

Skin may turn brown-yellow. Deep burns are slow to heal and scarring may occur.

Ingestion:

Causes pain in mouth, throat, stomach followed by vomiting, bloody diarrhea, hypotension, oliguria, anuria, possible fatal circulatory collapse, asphyxia from glottal edema. Perforation burns of gastrointestinal tract possible with fever and peritonitis.

Inhalation:

May cause coughing, dizziness, weakness, dry throat/chest, chest pain, dyspnea, frothy sputum, hypotension, cyanosis, pneumonitis, fatal pulmonary edema.

Chronic:

Dermatitis, conjunctivitis, dental erosion, jaw necrosis, chronic cough, bronchitis, chemical pneumonitis, gastrointestinal disturbances.

Section 4 - First Aid Measures

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once. Cover burns with loose sterile non-medicated bandages.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes. Cover burns with a dry sterile bandage (secure, not tight).

Ingestion:

Get medical aid at once. Give 1 ounce of milk of magnesia. Give conscious victim large quantities of water to dilute acid. Give oxygen if respiration is depressed.

Inhalation:

Give artificial respiration if necessary. Get medical aid. Keep victim warm, at rest. Move victim to fresh air. Maintain airway and blood pressure.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

Move container if possible, cool with flooding amounts of water. Avoid breathing corrosive vapors. Negligible fire and explosion hazard for solutions <5%. At higher concentration, increased flammability of combustibles, readily oxidizable materials. Severe explosion hazard by reaction with incombatibles (metallic powders, carbides, hydrogen sulfide, turpentine). In or near fire material emits toxic and reactive nitrogen oxides of gases.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7732-18-5: Not published.
CAS# 7697-37-2: Not published.

Explosion Limits:

Lower: Upper:

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spill with an alkaline material such as soda ash or lime. Keep out of sewers/drains. Ventilate and wear protective clothing. Scoop material into suitable (plastic or glass) container, label for disposal as "corrosive".

Section 7 - Handling and Storage

Handling:

Avoid breathing dust, vapor, mist, or gas. Avoid contact with eyes, skin, and clothing. Handle as corrosive liquid, dispense with care; wear protective clothing, gloves, goggles.

Storage:

Store at room temperature. Store in glass or approved plastic containers only, keep capped. Protect from heat and incompatibles.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Local exhaust ventilation may be necessary to control any air contaminants to within their TLVs during the use of this product.

Exposure Limits

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Nitric acid	2 ppm TWA;4 ppm STEL	2 ppm TWA; 5 mg/m3 TWA	2 ppm TWA; 5 mg/m3 TWA;

OSHA Vacated PELs

Nitric acid: 2 ppm TWA; 5 mg/m3 TWA

Personal Protective Equipment

Eyes:

Do not wear contact lenses when working with chemicals. An eye wash fountain should be available in the immediate work area. Wear gloves, splash proof goggles and faceshield.

Skin:

Wear impervious gloves (viton, saranex).

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

PEL to 50ppm - SAF/SCBAF/SAF:PD,PP,CF.
>50ppm - SCBAF:PD,PP.
Firefighting - SCBAF:PD,PP. NOTE: DO NOT USE OXIDIZABLE SORBENTS IN RESPIRATORS.

Section 9 - Physical and Chemical Properties

Physical State:	Clear liquid
Color:	Colorless
Odor:	Acrid odor
pH:	Acidic
Vapor Pressure:	14 mm Hg @25c
Vapor Density:	0.7 - 2.2
Evaporation Rate:	>1 (ether=1)
Viscosity:	No information found.
Boiling Point:	181-212°F
Freezing/Melting Point:	-44 - 32°F
Decomposition Temperature:	No information found.
Solubility in water:	Soluble.
Specific Gravity/Density:	1.0-1.5
Molecular Formula:	No information found.
Molecular Weight	No information found.

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures up to boiling point. Nitric oxides quietly evolved - sunlight catalyses oxide formation (yellow color, aging).

Conditions to Avoid:

Incompatible materials, easily oxidized materials.

Incompatibilities with Other Materials

Metals, acetic acid, acetic anhydride, acrylonitrile, alcohols, anhydrides, fluorine, organic acids, perchlorates, aldehydes (e.g. acetaldehyde, acrolein, chloral hydrate, formaldehyde), ketones (e.g. acetone, acetophenone, MEK, MIBK), metals as powders (e.g. hafnium, raney nickel), organics, carbides, acetonitrile, acetone, arsine, phosphides, dioxides, thiocyanates, inorganic acids, chlorine, cyclic compounds, halides.

Hazardous Decomposition Products

Nitrogen oxides, nitric acid vapors, catalyzed by sunlight.

Hazardous Polymerization

Has not been reported

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.
CAS# 7697-37-2: QU5775000; QU5900000.

LD50/LC50:

CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg.
CAS# 7697-37-2:
Inhalation, rat: LC50 =67 ppm(NO2)/4H.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 7697-37-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

Severe eye, mucous membrane, and skin irritant.

Teratogenicity:

Reproductive:

Mutagenicity:

Neurotoxicity:

Section 12 - Ecological Information

No information found.

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

US DOT

	Nitric acid >2% W/W	**Nitric acid <2% W/W**
Shipping Name:	Nitric acid, Not more than 70%	Not regulated.
Hazard Class:	8	
UN Number:	UN2031	
Packing Group:	PG II	

Section 15 - Regulatory Information

US Federal

TSCA

CAS# 7732-18-5 is listed on the TSCA Inventory.
CAS# 7697-37-2 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ)

CAS# 7697-37-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313

This material contains Nitric acid (CAS# 7697-37-2, 0.04-50%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

OSHA - Highly Hazardous

CAS# 7697-37-2 is considered highly hazardous by OSHA.

US State

State Right to Know

Nitric acid can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations

European/International Regulations

Canadian DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 7697-37-2 is listed on Canada's DSL List.

Canada Ingredient Disclosure List

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 7697-37-2 is listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: November 17, 1997
Revision Date: August 13, 2007

ISO9001:2000 Certified

Material Safety Data Sheet
Methanol and Methanol, 50% v/v

Section 1 - Chemical Product and Company Identification

MSDS Name:
Methanol and Methanol, 50% v/v
Catalog Numbers:
LC16800, LC16810, LC16830
Synonyms:
Methyl alcohol, wood alcohol
Company Identification:
LabChem Inc
200 William Pitt Way
Pittsburgh, PA 15238
Company Phone Number:
(412) 826-5230
Emergency Phone Number:
(800) 424-9300
CHEMTREC Phone Number:
(800) 424-9300

Section 2 – Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
67-56-1	Methanol	50-100
7732-18-5	Water (for 50% v/v solution)	balance

Section 3 - Hazards Identification

Emergency Overview

Appearance: *Clear, colorless solution*

Danger! Flammable liquid. Poison. Harmful or fatal if inhaled. May cause blindness if swallowed or absorbed through the skin. Central nervous system depressant. Cannot be made nonpoisonous. May cause irritation to eyes, skin, and respiratory tract.

Target Organs: *Eyes, skin, respiratory and gastrointestinal tracts, central nervous system, optic nerve, liver, kidneys, blood*

Potential Health Effects

Eye:

Causes eye irritation. May cause permanent vision impairment or loss.

Skin:

May cause skin irritation. May be absorbed through the skin in harmful amounts.

Ingestion:

May cause liver and kidney damage. Inhalation or ingestion causes narcotic intoxication, headache, cramps, severe pain, and blindness. Kidney and liver damage may occur with possible heart or respiratory failure to coma and death. Some symptoms may be delayed for days.

Inhalation:
May cause respiratory tract irritation. Symptoms of inhalation may be similar to those of ingestion.

Chronic:
May cause blurred or painful vision, blindness, defatting of skin, and liver and kidney damage. Experiments with laboratory animals have shown reproductive toxicity effects.

Section 4 - First Aid Measures

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid at once. Do NOT allow victim to rub or keep eyes closed.

Skin:
Get medical aid at once. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:
Call a poison control center. If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid at once.

Inhalation:
Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation.

Notes to Physician:
Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors are heavier than air and may travel to a source of ignition and flashback. Cool containers with water spray. Vapor-air mixtures are explosive.

Extinguishing Media:
For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:
Not applicable.

Flash Point:
12°C (for methanol, 100%); 30°C (for methanol, 50%)

NFPA Rating:
CAS# 67-56-1: Health- 1, Flammability- 3, Instability- 0.
CAS# 7732-18-5: Health- 0, Flammability- 0, Instability- 0.

Explosion Limits:
Lower: 6.7 Upper: 36

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Shut off ignition sources; avoid vapors. Use non-sparking tools and equipment. Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in suitable container labeled for later disposal. Label reclaimed spill material as flammable. Isolate and ventilate the spill area. Keep out of sewers and drains.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Ground and bond containers when transferring material. Avoid breathing dust, vapor, mist, or gas. Keep away from flames and other sources of high temperatures that may cause material to form vapors or mists. Use explosion-proof equipment.

Storage:

Keep away from heat, sparks, and flame. Store tightly closed in a cool, dry, well-ventilated place.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits:

Chemical Name:	ACGIH	NIOSH	OSHA
Methanol	200 ppm TWA 250 ppm STEL	200 ppm TWA 250 ppm STEL 6000 ppm IDLH	200 ppm TWA 260 mg/m^3 TWA
Water	none listed	none listed	none listed

OSHA Vacated PELs:

Methanol: 200 ppm TWA, 260 mg/m^3 TWA, 250 ppm STEL, 325 mg/m^3 STEL

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State:	Liquid
Color:	Colorless
Odor:	Alcohol-like
pH:	Not available
Vapor Pressure:	97 mm Hg @ 20°C
Vapor Density:	1.11 (Air = 1.0)
Evaporation Rate:	5.2 (Ether = 1.0)
Viscosity:	0.55 cP @ 20°C
Boiling Point:	65°C (148°F)
Freezing/Melting Point:	-98°C (-144°F)
Decomposition Temperature:	Not available
Solubility in water:	Miscible
Specific Gravity/Density:	0.791
Molecular Formula:	CH_3OH
Molecular Weight:	32.04

Section 10 - Stability and Reactivity

Chemical Stability:
Stable under normal temperatures and pressures.

Conditions to Avoid:
Incompatible substances, heat, flames, sources of ignition.

Incompatibilities with Other Materials:
Strong oxidizers, strong acids, acid anhydrides, acid chlorides, strong bases, metals, peroxides.

Hazardous Decomposition Products:
Carbon monoxide, formaldehyde.

Hazardous Polymerization:
Has not been reported.

Section 11 - Toxicological Information

RTECS:
CAS# 7732-18-5: ZC0110000.
CAS# 67-56-1: PC1400000.

LD50/LC50:
CAS# 7732-18-5:
- Oral, rat: 99999 mg/kg

CAS# 67-56-1:
- Inhalation, rat: LC50 = 64000 ppm/4H
- Inhalation, rat: LC50 = 83.2 mg/L/4H
- Oral, rat: LD50 = 5628 mg/kg
- Skin, rabbit: LD50 = 15800 mg/kg.

Carcinogenicity:
CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 67-56-1: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:
Irritating to eyes, skin, and respiratory tract.

Teratogenicity:
Teratogenic effects have occurred in experimental animals.

Reproductive:
Reproductive toxicity has occurred in experimental animals.

Mutagenicity:
Mutagenic effects have occurred in experimental animals.

Neurotoxicity:
No information found

Section 12 - Ecological Information

Ecotoxicity: Freshwater fish: Oncorhynchus mykiss, LC50 = 13200 mg/L/96 h; Pimephales promelas, LC50 = 28100 mg/L/96 h

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

	US DOT*	
	100%	50%
Shipping Name:	Methanol	Flammable liquid, n.o.s. (Methanol)
Hazard Class:	3	3
UN Number:	UN1230	UN1993
Packing Group:	PG II	PGIII

* For international shipments, methanol has a subsidiary hazard class of 6.1.

Section 15 - Regulatory Information

US Federal

TSCA:
CAS# 7732-18-5 is listed on the TSCA Inventory.
CAS# 67-56-1 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ):
CAS# 67-56-1: final RQ = 5000 pounds (2270 kg)

CERCLA/SARA Section 313:
This material contains Methanol (CAS# 67-56-1, 50-100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

OSHA - Highly Hazardous:
None of the chemicals in this product are considered highly hazardous by OSHA.

US State

State Right to Know:

Methyl alcohol can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations:

None listed.

European/International Regulations

Canadian DSL/NDSL:

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 67-56-1 is listed on Canada's DSL List.

Canada Ingredient Disclosure List:

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 67-56-1 is listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: May 5, 1998
Revision Date: September 8, 2009

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.

Appendix O

Heat Stress and Cold Stress Guidelines

Heat Stress Guidelines

Form	Signs & Symptoms	Care	Prevention[3]
Heat Rash	Tiny red vesicles in affected skin area. If the area is extensive, sweating can be impaired.	Apply mild lotions and cleanse the affected area.	Cool resting and sleeping areas to permit skin to dry between heat exposures.
Heat Cramps	Spasm, muscular pain (cramps) in stomach area and extremities (arms and legs).	Provide replacement fluids with minerals (salt) such as Gatorade.	Adequate salt intake with meals[1]. ACCLIMATIZATION[2]
Heat Exhaustion	Profuse sweating, cool (clammy) moist skin, dizziness, confusion, pale skin color, faint, rapid shallow breathing, headache, weakness, and/or muscle cramps.	Remove from heat, sit or lie down, rest, replace lost water with electrolyte replacement fluids (water, Gatorade) take frequent sips of liquids in amounts greater than required to satisfy thirst.	ACCLIMATIZATION[2] Adequate salt intake with meals[1], only during early part of heat season. Ample water intake, frequently during the day.
Heat Stroke	HOT Dry Skin. Sweating has stopped. Mental confusion, dizziness, nausea, chills, severe headache, collapse, delirium, and/or coma.	HEAT STROKE IS A MEDICAL EMERGENCY • Remove from heat. • COOL THE BODY AS RAPIDLY AS POSSIBLE by immersing in cold (or cool) water, or splash with water and fan. • Call for Emergency Assistance. • Observe for signs of shock.	ACCLIMATIZATION[2] Initially moderate workload in heat (8 to 14 days). Monitor worker's activities.

Footnotes:

1.) American diets are normally high in salt, sufficient to aid acclimatization. However, during the early part of the heat season, (May, June), one extra shake of salt during one to two meals per day may help, so long as this is permitted by your physician. Check with your personal physician.

2.) ACCLIMATIZATION - The process of adapting to heat is indicated by worker's ability to perform hot jobs less fluid loss, lower concentrations of salt loss in sweat, and a reduced core (body) temperature and heart rate.

3.) Method to Achieve Acclimatization - Moderate work or exercise in hot temperatures during early part of heat season. Adequate salt (mineral) and water intake. Gradually increasing work time in hot temperatures. Avoid alcohol. Normally takes 8 to 14 days to achieve acclimatization. Lost rapidly, if removed from strenuous work (or exercise) in hot temperature for more than approximately 5 days.

Cold Stress Guidelines

Stress	Symptoms	What to do
Mild Hypothermia	• Body Temp 98 to 90°F • Shivering • Lack of coordination, stumbling, fumbling hands • Slurred speech • Memory loss • Pale, cold skin	• Move to warm area • Stay active • Remove wet clothes and replace with dry clothes or blankets • Cover the head • Drink warm (not hot) sugary drink
Moderate Hypothermia	• Body temp 90 to 86°F • Shivering stops • Unable to walk or stand • Confused and/or irrational	• All of the above, plus: ○ Call 911 ○ Cover all extremities completely ○ Place very warm objects, such as hot packs on the victim's head, neck, chest, and groin
Severe Hypothermia	• Body temp 86 to 78°F • Severe muscle stiffness • Very sleepy or unconscious • Ice cold skin • Death	• Call 911 • Treat victim very gently • Do not attempt to re-warm
Frostbite	• Cold, tingling, stinging, or aching feeling in the frostbitten area, followed by numbness • Skin color turns red, then purple, then white or very pale skin • Cold to the touch • Blisters in severe cases	• Call 911 • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm (not hot) water
Trench Foot	• Tingling, itching, or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm (not hot) sugary drink

Appendix P

Forms

GEI Consultants

Safety Briefing Log

Project Number:
Project Name:
Date:
Time:
Briefing Conducted by:
Signature:

This sign-in log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing.

TOPICS COVERED (check all those covered):

- ☐ General PPE Usage
- ☐ Hearing Conservation
- ☐ Respiratory Protection
- ☐ Personal Hygiene
- ☐ Exposure Guidelines
- ☐ Decon Procedures
- ☐ Emergency Procedures (include route to hospital)
- ☐ Confined Space
- ☐ Slips, Trips, Falls
- ☐ Heat Stress
- ☐ Cold Stresses
- ☐ Site Control
- ☐ Work Zones
- ☐ Lockout/Tagout
- ☐ Excavation Safety
- ☐ Confined Space
- ☐ Traffic Safety
- ☐ Changes to the HASP
- ☐ Initial Review of Hazard Evaluation
- ☐ Other (Specify):
- ☐ Other (Specify):

Personnel Sign-in List

Printed Name	Signature	Company Name

Project Safety Briefing Form

Project Number: **Project Name:**

Date: **Time:** **Project Manager:**

Briefing Conducted by: **Signature:**

This sign-in log documents the project specific-briefing conducted in accordance with the HASP and GEI H&S policy. GEI personnel who perform work on site are required to attend the Project briefing and to acknowledge it's receipt. Applicable health and safety SOPs are also required to be reviewed in this briefing and attached as an appendix to the HASP. Prior to the start of the project **or upon the start of a new on-site project team member**, this form must be completed. Please email this completed form to Health&SafetyCommittee@geiconsultants.com.

TOPICS COVERED (check all those covered):

☐	General PPE Usage	☐	Excavation Safety	☐	SOP:
☐	Hearing Conservation	☐	Confined Space	☐	SOP:
☐	Respiratory Protection	☐	Traffic Safety	☐	SOP:
☐	Personal Hygiene	☐	Changes to the HASP	☐	SOP:
☐	Exposure Guidelines	☐	Site Control	☐	SOP:
☐	Decon Procedures	☐	Work Zones	☐	SOP:
☐	Emergency Procedures (include route to hospital)	☐	Lockout/Tagout	☐	SOP:
		☐	Review of Hazard Evaluation	☐	SOP:
☐	Confined Space			☐	SOP:
☐	Slips, Trips, Falls	☐	Other (Specify):	☐	SOP:
☐	Heat Stress	☐	Other (Specify):	☐	SOP:
☐	Cold Stress	☐	Other (Specify):	☐	SOP:

Personnel Sign-in List

Printed Name	Signature

March 2013 template

GEI Consultants

Accident/Incident Report Form

Please complete this form and send it to your Branch Manager, HR and CHSO ***within 24 hours*** of the incident.

SECTION A ACCIDENT/INCIDENT DETAILS

EMPLOYEE INFORMATION:

Name: ____________________

Home Address: ____________________
Street Address City State Zip Code

Contact Information: ( ) ____________ ( ) ____________
Primary Secondary

Date of Birth: ____________________

Date of Hire: ____________________

Branch: ____________________

Supervisor: ____________________

OTHER INJURED (IF APPLICABLE):

Name: ____________________

Home Address: ____________________
Street Address City State Zip Code

Contact Information: ( ) ____________ ( ) ____________
Primary Secondary

Date of Birth: ____________________

Date of Hire: ____________________

Branch: ____________________

Supervisor: ____________________

Date and Time Accident/Incident	**Date and Time Reported**
______ /_____ /_____ Month Day Year	______ /_____ /_____ Month Day Year
_____ **A.M.** _____ **P.M.**	_____ **A.M.** _____ **P.M.**

LOCATION OF INCIDENT/ACCIDENT

Project Name: ____________________

Client and Location: ____________________

or ____________________

Office Location: ____________________

INCIDENT TYPE:
(Check All That Applies)

- ☐ **Personal Injury/Illness**
- ☐ **Vehicle Accident**
- ☐ **Property Damage**
- ☐ **Environmental Spill**
- ☐ **Other**

WITNESS INFORMATION

Name: ____________________

Contact Number: ____________________

Company: ____________________

WHAT HAPPENED TO THE INJURED PARTY: ☐First Aid Administered ☐Refused Treatment/Transport ☐Transported to Hospital ☐Returned to Work ☐ Went Home ☐ Went to Physician ☐ Unknown

Clinic/Hospital or Treating Physician: ____________________ Phone: ____________
Name Street Address City State Zip Code

SECTION B PERSONAL INJURY

Cause of Injury: ____________________

Part of Body Injured: ____________________ Multiple Injuries: ☐Y ☐N

Was PPE worn when injured? : ☐Y ☐N What PPE was worn? ____________________

WAS INJURY A RESULT OF THE USE A MOTOR VEHICLE: ☐ **YES** ☐ **NO** **(If yes, complete Section C)**

Please complete this form and send it to your Branch Manager, HR and CHSO ***within 24 hours*** of the incident.

GEI Consultants

Accident/Incident Report Form

SECTION C AUTO ACCIDENT ONLY

DRIVER/VEHICLE INFORMATION

Name of Insured: ______________________________

Department: ______________________________

Driver's License Number: ______________________________

DOB: ____/____/____ State: ______________________

Description of Vehicle: License Plate Number: __________

Make: ________ Model: ________ Year:_____ Color:________

Owner: ______________________________

Name of Other Driver: ______________________________

Driver's License Number: ______________________________

State: ____________________

Description of Vehicle: License Plate Number: __________

Make: ________ Model:______ Year:_____ Color:________

Insurance Carrier: ______________________________

Policy Number: ______________Ph. Number:______________

SECTION D PROPERTY DAMAGE OR CHEMICAL RELEASE ONLY

Type of Damage(s): ______________________________

Cause of Damage(s): ______________________________

Type of Chemical Released (if known): ______________________________

Quantity of Chemical Released: ______________________________

Spill Measures Employed: ______________________________

SECTION E NATURE OF ACCIDENT/INCIDENT AND EXTENT OF INJURIES/DAMAGES

(Please give a detailed description of what happened. Attach a sketch or picture if applicable)

____

____

____

____

____

____

____

____

____

I hereby certify that the above information is true and correct to my understanding of this accident/incident.

______________________________ ______________________________

Employee/Preparer's Name **Date and Time**

NEAR MISS REPORT

A near miss is a potential hazard or incident that has not resulted in any personal injury. Unsafe working conditions, unsafe employee work habits, improper use of equipment, or use of malfunctioning equipment have the potential to cause work related injuries. It is everyone's responsibility to report and/or correct these potential accidents/incidents immediately. Please complete this form as a means to report these near-miss situations. Send a copy of the completed form to the Project Manager, Regional Health and Safety Officer and the Corporate Health and Safety Officer.

Location: _____ Site Name: _____

Date: _____ Time: _____ ☐ a.m. ☐ p.m.

Weather conditions, site operations taking place during near miss. _____

Please check all appropriate conditions:

☐ Unsafe Act ☐ Unsafe equipment

☐ Unsafe Condition ☐ Unsafe use of equipment

Description of incident or potential hazard: _____

Employees or sub-contractors involved if applicable._____

Employee Signature ______________________________ Date _____

Print Name _____

NEAR MISS INVESTGATION

Description of the near-miss condition: _____
Causes (primary & contributing) _____
Corrective action taken (Remove the hazard, replace, repair, or retrain in the proper procedures for the task) _____
Actions not yet taken_____

Signed: ________________________________ Date Completed: _____

Print Name
Not completed for the following reason: ______Date:______

GEI Consultants

Appendix Q

GEI's Health and Safety SOPs

STANDARD OPERATING PROCEDURE

DM-006 Geoprobe® Direct Push Boring

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1. Objective

Describe standard operating procedures (SOP) for drilling of overburden soil borings using Geoprobe® and MacroCore® technologies.

2. Execution

- Confirm that appropriate measures have been taken for clearance of potential subsurface utilities. The responsibility for clearance may vary, depending on the client.
- Inspect the drilling rig to make sure it is clean and that the down-hole equipment has been decontaminated (QA-001). Record condition of all down-hole drilling equipment.
- Make sure the sampler is fitted with a piston rod assembly to block the sample tube until the desired subsurface sample interval is attained. Upon reaching the target sample depth, the piston tip will be released and the discrete sampler device is then advanced to collect the representative sample. This reduces the volume of slough that is collected.
- When the sampler is brought to the ground surface, it should be opened immediately, and the length of recovery should be measured and recorded.
- Log the soil sample using USCS procedures (SOP SM-003). Collect analytical samples if necessary (SOP SM-001).
- Decontaminate the cutting shoe if necessary (SOP QA-001 Equipment Decontamination) and have driller reassemble the parts with a new liner.
- Repeat the procedure described above until refusal or the boring is terminated.
- Periodically verify that depths cited by drillers are accurate.

3. Limitations

- If significant unanticipated contamination is encountered during drilling, stop drilling to confer with the project manager and re-evaluate health and safety conditions.
- Arrange for the storage of contaminated soil cuttings and water in drums or other appropriate containers in a secure place at the site (see SOP SC-003, *Investigation Derived Waste Management*).
- If possible, plan the drilling program to drill borings from the least to most contaminated areas. Be prepared in advance and know where alternative drilling locations are in the event that problems are encountered at soil boring locations. These locations must also have been cleared by the state or local utility service prior to drilling.

4. References

ASTM D6001-05 Guide for Direct Push Water Sampling for Geoenvironmental Investigations, April 2005

Geoprobe Systems, "Geoprobe MacroCore MC-5 1.25-inch Light Weight Center Rod Soil Sample System SOP", Technical Bulletin No. MK 3139, November 2006

5. Attachments

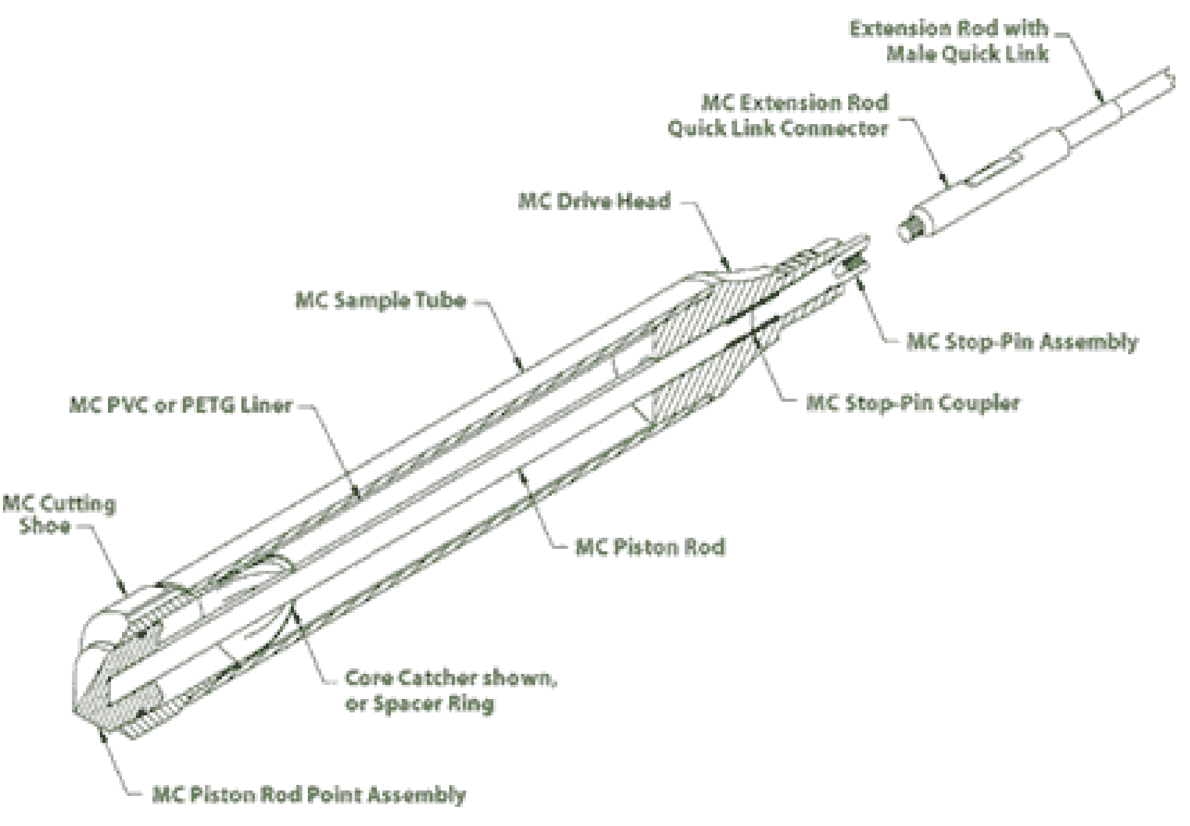
Attachment A – Geoprobe® with Macrocore® Sampler Assembly

6. Contact

Melissa Felter
Cathy Johnson

SOP DM-006

Attachment A – GeoProbe® with Macrocore® Sampler Assembly



Above: Diagram of a Macrocore® sampler

Right: A track-mounted GeoProbe ® Rig

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STANDARD OPERATING PROCEDURE

GW-003 Low Flow (Low Stress) Groundwater Sampling

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1. Objective

Describe methods to collect groundwater samples most likely to produce results that represent aquifer conditions.

Low-flow purging is limited to wells that, with sustained pumping, exhibit no continuous drawdown.

2. Execution

- Prior to groundwater sampling consult with the project manager to confirm that the type of pump is appropriate and consistent with the approved work plan.
- Record activities in the field notebook (see SOP FD-001 Field Notebook) and on a Monitoring Well Sampling Record such as the examples in Attachment A. Use a separate form for each sampling location and event. You may forego the forms and record all information in the field notebook if the Project Manager approves.
- Calibrate pH, temperature, Specific Conductance (SC), turbidity, Dissolved Oxygen (DO), and Oxidation-Reduction Potential (ORP) on the meter(s). Use calibration methods provided by the manufacturer of the equipment. Note that appropriate calibration for dissolved oxygen requires a water saturated air environment, along with measured temperature and barometric pressure.
- Begin with the monitoring well believed to have the least contaminated groundwater and proceed systematically to the well with the most contaminated groundwater. Check the well, the lock, and the locking cap for damage or evidence of tampering.
- Slowly and gently measure the depth to water with a water level probe and/or oil-water interface probe. Do not measure depth to well bottom at this time (wait until sampling has been completed). Measure water level in accordance with SOP GW-001 Water Level Measurement.
- Attach new polyethylene or Teflon lined tubing to the sampling pump and the flow-through cell that contains the meter probes.
- Slowly and gently insert new polyethylene or Teflon lined tubing to the pump intake (or use dedicated tubing that remains in the well) and to the middle of the saturated screened interval or to the pre-determined sampling depth.
- The tubing intake should be kept at least two (2) feet above the bottom of the well to prevent disturbance or suspension of any sediment or Non-Aqueous Phase Liquid (NAPL) present in the bottom of the well. Record the depth of the pump intake.

- If possible, position your sampling equipment and tubing so that it is in the shade. The goal is to minimize the effect of sunlight raising the temperature of water being collected.
- Start the pump on the lowest setting and increase slowly until flow begins. Adjust the pumping rate so that drawdown in the well is minimal (0.3 feet or less, is desirable but not mandatory). Use a pumping rate between 100 to 1,000 milliliters per minute (mL/min) (or approximately 0.1 to 1 quarts per minute). Measure flow rate on the pump or using a graduated container every 3 to 5 minutes and record. The minimum purge volume will be twice the combined volumes of the sampling string (i.e. pump, tubing, and flow-through cell).
- While purging, record water levels every 3 to 5 minutes and monitor and record the water quality indicator parameters: pH, temperature, specific conductance (SC), dissolved oxygen (DO), and turbidity. If specified in the field sampling plan also include ORP.
- Purging is complete when, after three consecutive measurements, the water quality parameters have stabilized as follows:

    - pH (+/- 0.1 standard units)
    - temperature (+/- 3%)
    - SC (+/- 3%)
    - turbidity (+/- 10% if >5 NTU; if 3 values are <5 NTU, consider the values as stabilized)
    - DO (+/-10% if >0.5 mg/L; if 3 values are <0.5 mg/L, consider the values as stabilized)
    - ORP (+/- 10 mV)

- Dispose of purge water according to the field plan.

Sample Collection:

- Following purge, remove the discharge tubing from the flow-through cell. Do not disturb pump and tubing between stabilization and sample collection.
- Fill sample containers directly from the sampling device in order of decreasing volatility (i.e., Volatile Organic Compounds (VOC) samples are collected first; see SOP SC-002 Sampling Handling). Fill all containers from the discharge end of the tubing. Collect samples at a flow rate equal to the steady state purge rate.
- If not using a dedicated pump, remove sampling device and decontaminate (see SOP QA-001 Equipment Decontamination). Discard used tubing.
- Store samples in a cooler on ice for transport to the laboratory.
- Measure depth to bottom of well.

- Secure the well cap.

3. Limitations

- Prior to departure for the field, obtain available information on well construction for use in field investigation (i.e., screen and riser material, well diameter and depth, screened interval, optimum sampling depth, etc.).
- If possible, when using dedicated equipment, install equipment into well at least 24 hours before sample collection to minimize disturbance of the water column and/or suspension of sediments or NAPL on bottom.
- If water quality indicator parameters do not stabilize after removing 3 to 5 well volumes or 2 hours, contact the Project Manager. Three options will be available: 1) continue purging until stabilization; 2) discontinue purging and do not sample; or 3) discontinue purging and sample.
- The key indicator parameter for VOCs is DO. The key indicator parameter for all other samples is turbidity.
- Fill all sample containers with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.
- Consult with the project manager before field filtering samples for metals if using low-flow sampling.
- Be aware of any preservatives in the sample bottles and handle with care, in accordance with the Health and Safety Plan.

4. References

Standard Reference for Monitoring Wells (April 19, 1991), Massachusetts DEP, DEP Publication No. WSC-310-91.

Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground Water Sampling (1994), M.J. Barcelona, H. A. Wehram, and M.D. Varljen, Ground Water, Vol. 32, No. 1, 12-22.

Low-Flow Purging and Sampling of Ground Water Monitoring Wells with Dedicated Systems (1995), R.W. Puls, and C.J. Paul, Groundwater Monitoring and Review, Summer 1995 116-123.

Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (2010), EQASOP-GW 001 Low Stress (Low Flow) SOP, Revision 3, U.S. Environmental Protection Agency, Region I, January 19, 2010.

Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling, (1998), Ground-Water Sampling SOP, Final, U.S. Environmental Protection Agency, Region II, March 16, 1998.

RCRA Ground-Water Monitoring: Draft Technical Guidance, (1993), U.S. Environmental Protection Agency, EPA/530-R-93-001.

To Filter, or Not to Filter, That is the Question, (1997), Special Topics Subcommittee Letter Report EPA-SAF-EEC-LTR-97-011, April 29, 1997, Meeting, U.S. Environmental Protection Agency, Science Advisory Board Environmental Engineering Committee, September 5, 1997.

Should Filtered or Unfiltered Groundwater and Surface Water Samples be Collected for the Risk Assessment?, (1995), MCP Q&A: Subparts I and J, Special #4, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection (DEP), February, 1995.

5. Attachments

Attachment A - Monitoring Well Sampling Record

6. Contacts

Brian Conte
Saskia Oosting

MONITORING WELL SAMPLING RECORD

PID Reading ____________________
Job Name ____
Job Number ____________________
By ____________________ Date _________________
Location ____________________
Measurement Datum ______________________________
Well Number ____________________

Pre-Development Information

Time (start) ______________________________
Water Level ____________________
Total Depth of Well ______________________________
One Purge Vol ____________________
Three Well Volume ______________________________

Water Characteristics

Color ____________________ ________ Clear _____ Cloudy
Odor _____ None _____ Weak ________ Moderate _____ Strong
Any films or immiscible material ____

Volume (gal)	Time	pH	Temp (°C)	Spec. Conductance (µS/cm)	Turbidity (NTU)	DO Conc. (mg/L)	ORP (mV)	TDS

Total Volume Removed (gal) _______________
pH _____________
Temperature (°C) _______________
Specific Conductance (µS/cm) _____________
DO Concentration (mg/L) _______________
ORP (mV) _____________
TDS _____________

Post Development Information

Time (Finished) ______________

Water Level ________________ Total Depth of Well ______________

Approximate Volume Removed (gal) ____________________________________

Water Characteristics

Color __________________________ _____ Clear ______ Cloudy

Odor ______ None _____ Weak _____ Moderate ______ Strong

Any films or immiscible material ____

Comments

Low-Flow Groundwater Sampling Form

Project number and name ____________ Sampling personnel ____________ Sample date ____________ Well ID ____________

Well location description: ____________

____

Well Construction

Well diameter ____________

Well measurement point ____________

Roadbox condition ____________

Well screen interval ____________

Well depth ____________

Sampling Information

Initial depth to water ____________ Time: ____________

Sample intake depth ____________

Pump type and ID ____________

Stabilized flow rate ____________

Stabilized flow rate = flow rate with no further drawdown

Samples Collected

VOCs 8260 ☐

SVOCs 8270 ☐

VPH ☐

EPH ☐

Metals ☐

PCBs ☐

Other ☐

Field values at time of sample collection:

Time: ____________ Depth to water: ____________

Sp.Cond. ____________ mS/cm

DO ____________ mg/L

ORP ____________ mV

pH ____________ s.u.

Temp. ____________ ^oC

Turb. ____________ NTU

Cumulative Time (min.)	**Volume (gal)**	**Water depth (ft)**	**Temp. (^oC)**	**Sp.Cond. (mS/cm)**	**D.O. (mg/L)**	**pH (s.u.)**	**ORP (mV)**	**Turb. (NTU)**
Typical Groundwater Values			5 to 15	0.05 to 5	0 to 4	5 to 7	-100 to +500	aim for <10

Notes: ____________

Sample Information:

Sample ID ____________

Sample Time: ____________

Color: ____________

Turbidity: ____________

Field Filtered YES / NO Analyses: ____________

Filter type: ____________

Odor/Sheen/NAPL ____________

Duplicate Collected YES / NO

If yes, duplicate ID: ____________

Purge water disposal? to ground drummed other:

Well Volume Conversion:

Diam. (in)	Factor (gal/ft)
1	0.04
1.5	0.09
2	0.16
4	0.65
6	1.50

well volume =
3.14 x (r)^2 x 7.48 gal/ft
where r = 1/2 diameter in ft

Stabilization Criteria:

Sp.Cond. +/- 3%
DO +/- 10%
ORP +/- 10 mV
pH +/- 0.1 Std Units
Temp. +/- 3%
Turb. +/- 10% if values >1 NTU

Guidance:

1 Position tubing at midpoint of saturated screened interval

2 Minimize drop in water level and purge until parameters are stable

3 Disconnect flow thru cell during sampling

4 Call Project Manager if issues arise (e.g. stabilization takes more than 2 hrs, well goes dry, odd data).

5 For VPH and VOC samples, if stabilization flow rate is less than 200 ml/min, contact PM

STANDARD OPERATING PROCEDURES

SOP No. HS-001 Biological Hazards

1.1 Objective

The objective of this Standard Operating Procedure (SOP) is to prevent or limit the potential for GEI personnel to encounter biological hazards during field activities.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for contact with biological hazards such as animals, insects, plants, and sewage. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for encounters with biological hazards and the control methods to be implemented by GEI employees. These hazards must be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Mammals

During some site operations, animals such as stray or domesticated dogs or cats, raccoons, snakes, bears, rats, bats, etc. may be encountered. Employees should use discretion and attempt to avoid contact with animals. If these animals present a problem, efforts will be made to remove these animals from the site by contacting a licensed animal control technician.

1.3.1 Rabies

The rabies virus is transmitted through the bite of an infected animal or contact with saliva or brain/nervous system tissue of an infected animal. The rabies virus infects the central nervous system, causing disease in the brain. The early symptoms of rabies in people are fever, headache, and general weakness or discomfort. As the disease progresses, more specific symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation (increase in saliva), difficulty swallowing, and hydrophobia (fear of water). Death usually occurs within days of the onset of these symptoms.

If you are bitten or think you may be exposed, wash any wounds immediately and thoroughly with soap and water. Then go to the hospital emergency room and notify the Project Manager and the People Safety Team. The doctor, possibly in consultation with the state or local health department, will decide if you need a rabies vaccination. Decisions to start series of vaccinations will be based on your type of exposure and the animal you were exposed to, as well as laboratory and surveillance information for the geographic area where the exposure occurred. If possible have someone document what type of animal it was, how it was behaving prior to the bite, what caused it to bite the employee, and if it's not a domestic animal that would be easy to find again in the future, try to get animal control on site to capture it. An Incident Report Form must be completed and submitted, per GEI's Incident reporting procedures. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

1.4 Insects and Arachnids

Insects, including bees, wasps, hornets, mosquitoes, ticks, spiders, etc., may be present at a job site making the chance of a bite/sting possible. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life-threatening condition. Some insect bites can transmit diseases such as Lyme disease or a virus such as West Nile. The following is a list of preventive measures:

- Apply insect repellent prior to performing field work and as often as needed throughout the work shift.
- Wear proper personal protective equipment (PPE), including protective clothing (work boots, socks, and light colored clothing).
- Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many insects are most active (between dawn and dusk).
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible.
- Field personnel who have or may have insect allergies must have insect allergy medication onsite and must inform the Site Safety Officer (SSO) and the People and Safety Team of their particular allergy prior to commencing work.
- Field personnel should perform a self-check at the end of the day for ticks.

1.4.1 Tick-borne Diseases

Lyme Disease

Lyme disease is caused by infection from a deer tick that carries a spirochete (a bacterium). During the painless tick bite, the spirochete may be transmitted into the bloodstream, often after feeding on the host for 12 to 24 hours. The ticks that cause the disease are often no bigger than a poppy seed or a comma in newsprint. The peak months for human infection are from May to September.

Symptoms appear in three stages. First symptoms usually appear from 2 days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick was attached. The rash is often bulls-eye like with red around the edges and clear in the center. The rash may be warm, itchy, tender, and/or "doughy." This rash appears in only 60 to 80 percent of infected persons. An infected person also has flu-like symptoms of a stiff neck, chills, fever, sore throat, headache, fatigue, and joint pain. These symptoms often disappear after a few weeks.

The second stage symptoms, which occur weeks to months later include meningitis, severe headache, drooping of the muscles on the face, called Bell's Palsy, encephalitis, numbness, withdrawal, and lethargy. These symptoms may last for several weeks to several months. Third stage symptoms, which occur months or years later include arthritis, heart problems, and loss of memory. The third stage symptoms may mimic multiple sclerosis and Alzheimer's disease.

When in areas that could harbor deer ticks, employees should wear light color clothing, and visually check themselves and check and be checked by another employee when coming from wooded or vegetated areas. If a GEI employee has a tick bite, the People and Safety Team and Project Manager must be contacted immediately. The employee will be offered the option for medical treatment by a physician, which typically involves antibiotics. An Incident Report form must be completed in compliance with the Incident Reporting procedures. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

If personnel feel sick or have signs similar to those mentioned above, the SSO and the People and Safety Team must be notified immediately.

Figure 1: From left to right, the deer tick adult female, adult male, nymph, and larva on a centimeter scale.

How to Remove a Tick

A tick can be removed from the skin by pulling gently at the head with tweezers. If tweezers are not available, use tissue paper or cloth to grasp the tick. It is important to grasp the tick as close to the site of attachment and use a firm steady pull to remove it. Wash hands immediately after with soap and water. The affected area should also be washed with soap and water, then disinfected with an antiseptic wipe, if available. All mouth parts must be removed from the skin. If the tick was removed by breaking off the mouth parts, an irritation or infection may occur because the organism that is causing the disease can still enter the body through the skin.

Treatment for Lyme Disease

Treatment with antibiotics is effective and recovery is usually complete. For first stage symptoms, antibiotics are usually given orally. However, treatment for second and third stage symptoms is prolonged and recovery may take longer. Antibiotic treatment is usually provided intravenously for second and third stage Lyme disease.

Babesiosis

The deer tick can also cause Babesiosis, an infection of the parasite Babesia Microti. Symptoms of Baesiosis may not be evident, but may also include fever, fatigue and hemolytic anemia lasting from several days to several months. Babesiosis is most commonly diagnosed in the elderly or in individuals whose immune systems are compromised. If there are no signs or symptoms of Babesiosis, usually no treatment it needed. If an employee believes they might have Babesiosis they'll see a physician to be tested. Treatment usually consists of taking prescription medications for 7 to 10 days.

Ehrlichiosis

Ehrlichiosis is a tick-borne disease which can be caused by either of two different organisms. Human monocytic ehrlichiosis (HME) is caused by *Ehrlichia chaffeensis*, which is transmitted by the lone star tick (*Amblyomma americanum*). Human granulocytic anaplasmosis (HGA), previously known as human granulocytic ehrlichiosis (HGE), is caused by *Anaplasma phagocytophilia*, which is transmitted by the deer tick (*Ixodes scapularis*).

Ehrlichiosis is transmitted by the bite of infected ticks, including the deer tick and the lone star tick. The symptoms of HME and HGE are the same and usually include fever, muscle aches, weakness and headache. Patients may also experience confusion, nausea, vomiting and joint pain. Unlike Lyme disease or Rocky Mountain spotted fever, a rash is not common. Infection usually produces mild to moderately severe illness, with high fever and headache, but may occasionally be life-threatening or even fatal. Symptoms appear 1 to 3 weeks after the bite of an infected tick. However, not every exposure results in infection. For those that become infected a drug called Doxcycline will be prescribed.

Rocky Mountain Spotted Fever

Rocky Mountain spotted fever is a tick-borne disease caused by a rickettsia (a microbe that differs somewhat from bacteria and virus). In the eastern United States, children are infected most frequently, while in the western United States, disease incidence is highest among adult males. Disease incidence is directly related to exposure to tick-infested habitats or to infested pets. Rocky Mountain spotted fever is characterized by a sudden onset of moderate to high fever (which can last for 2-3 weeks), severe headache, fatigue, deep muscle pain, chills and rash. The rash begins on the legs or arms, may include the soles of the feet or palms of the hands and may spread rapidly to the trunk or rest of the body. Symptoms usually appear within 2 weeks of the bite of an infected tick. Like Ehrlichiosis the prescription drug Doxcycline is the first line treatment option.

1.4.2 Mosquito-Borne Disease

West Nile Virus
West Nile Virus is a mosquito-borne infection transmitted through the bite of an infected mosquito. The symptoms of West Nile Virus can be asymptomatic (no symptoms) or in more serious cases can lead to West Nile Fever. West Nile Fever can include fever, headache, tiredness, body ache, an occasional rash on the trunk of the body, and swollen lymph glands, In severe cases, people have developed West Nile Encephalitis or Meningitis which symptoms include fever, headache, neck stiffness, tremors, coma, and in some cases death. The incubation period for the disease is usually 2 to 15 days. The symptoms can range from a few days to several weeks. Most mosquitoes are not infected and the chance of infection from a mosquito bite of an on-site employee is very small.

1.5 Repellants

The following precautions will be used to help reduce the risk of mosquito bites:

Reduce mosquito-breeding areas by making sure wheelbarrows, buckets, and other containers are turned upside down when not used so that they do not collect standing water. According to the Environmental Protection Agency (EPA), many mosquitoes can breed in pooled water that’s minimal enough to fill a bottle cap.

Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many mosquitoes are most active (between dawn and dusk).

Use mosquito repellant according to the manufacturer’s directions when outdoors for long periods of time and when mosquitoes are most active.

Centers for Disease Control and Prevention (CDC) evaluation of information contained in peer-reviewed scientific literature and data available from the EPA has identified several EPA-registered products that provide repellent activity sufficient to help people avoid the bites of disease carrying mosquitoes. Products containing these active ingredients typically provide reasonably long-lasting protection:

- **DEET** (Chemical Name: N,N-diethyl-m-toluamide or N,N-diethly-3-methyl-benzamide)
- **Picaridin** (KBR 3023, Chemical Name: 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1-methylpropyl ester)

- **Oil of Lemon Eucalyptus** or **PMD** (Chemical Name: para-Menthane-3,8-diol) the synthesized version of oil of lemon eucalyptus
- **IR3535** (Chemical Name: 3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester)
- **Permethrin** (3-Phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate) **–** Permethrin kills ticks and can be used on clothing (but not skin)

The EPA characterizes the active ingredients DEET and Picaridin as “conventional repellents” and Oil of Lemon Eucalyptus, PMD, and IR3535 as “biopesticide repellents”, which are derived from natural materials.

In general, higher concentrations of active ingredient provide longer duration of protection, regardless of the active ingredient, although concentrations above approximately 50 percent do not offer a marked increase in protection time. Products with less than 10 percent active ingredient may offer only limited protection, often from 1 to 2 hours. Products that offer sustained release or controlled release (micro-encapsulated) formulations, even with lower active ingredient concentrations, may provide longer protection times. Regardless of what product you use, if you start to get mosquito bites reapply the repellent according to the label instructions or remove yourself from the area with biting insects if possible.

Clothing and other products can be purchased pre-treated, or products can be treated using EPA-registered products. Permethrin is the only pesticide approved by the EPA for these uses. Permethrin binds tightly to the fabrics, resulting in little loss during washing and minimal transfer to the skin. Permethrin is poorly absorbed through the skin, although sunscreens and other products may increase the rate of skin absorption.

If you decide to use permethrin-treated clothing, consider these tips:

- Read the application instructions carefully and apply the product according to the label directions. Do not over-treat products.
- Permethrin treatments are only intended for use on fabrics; do not apply them directly to the skin or other items.
- Do not apply permethrin to clothing while it is being worn.
- Apply the product to clothing outdoors in well ventilated areas that are protected from wind.
- Hang treated fabrics outdoors and allow them to dry completely before wearing them.
- Wash permethrin treated clothing separately from other clothing items.

1.6 Poisonous Plants

The potential for contact with poisonous plants, such as poison ivy, oak, and sumac exists when performing fieldwork in wooded or boggy areas. Urushiol, an oily organic allergen found in plants, can cause an allergic reaction when in contact with the leaves or vines.

Poison ivy can be found as vines on tree trunks or as upright bushes. Poison ivy consists of three leaflets with notched edges. Two leaflets form a pair on opposite sides of the stalk, and the third leaflet stands by itself at the tip. Poison ivy is red in the early spring and turns shiny green later in the spring. Poison ivy grows throughout much of North America, including all states east of the Rocky Mountains. It is normally found in wooded areas, especially along edge areas where the tree line breaks and allows sunshine to filter through. It also grows in exposed rocky areas, open fields, and disturbed areas.

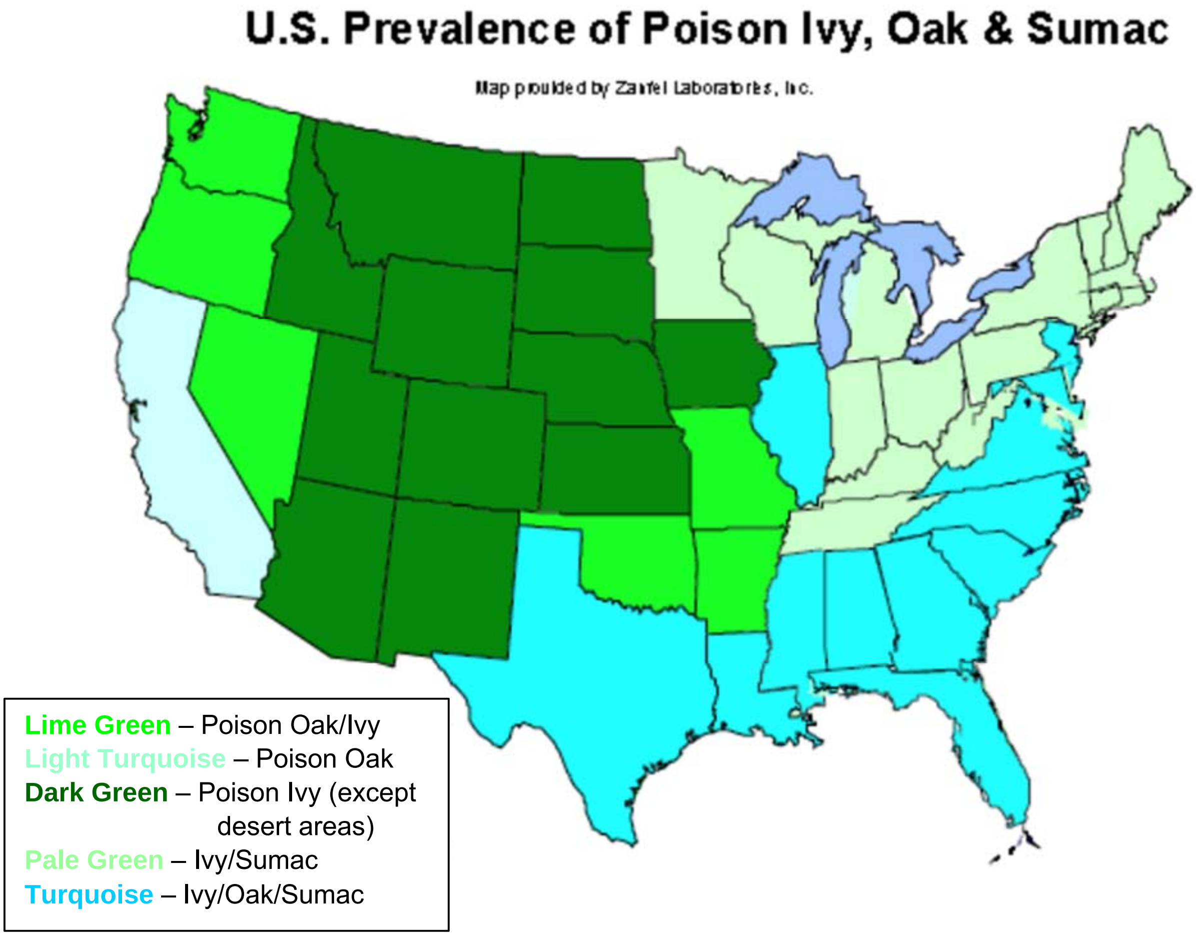
Poison oak can be present as a sparsely-branched shrub. Poison oak can grow anywhere in the United States with the exception of Hawaii, Alaska, and some southwest areas that have desert climates. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches.

Poison sumac can be present in the form of a flat-topped shrub or tree. It has fern-like leaves, which are velvety dark green on top and pale underneath. The branches of immature trees have a velvety “down.” Poison sumac has white, “hairy” berry clusters. Poison sumac grows exclusively in very wet or flooded soils, usually in swamps and peat bogs, in the eastern United States.

Poison Ivy

Poison Oak

Poison Sumac



Source: United States Department of Agriculture Plants Database, http://plants.usda.gov/

To prevent exposure to these poisonous plants:

- Wear proper PPE, including long sleeves, long pants, boots, and gloves.
- Barrier skin creams, such as lotion containing bentoquatum (Tecnu®), may offer some protection prevent the occurrence of exposure symptoms.
- Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. Employees with known allergies should identify themselves to the SSO or Project Manager prior to starting field work as a precautionary measure. If you believe you have contacted one of these plants:
  - Immediately wash skin thoroughly with soap and water, taking care not to touch your face or other body parts.
  - Contact the People and Safety Team and Project Manager immediately after caring for affected skin.

  - Wash exposed clothing separately in hot water with detergent.

- After use, clean tools, and soles of boots with rubbing alcohol or soap and lots of water. Urushiol can remain active on the surface of objects for up to 5 years.
- If a rash occurs, contact the People and Safety Team and complete and submit an Incident Report Form. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

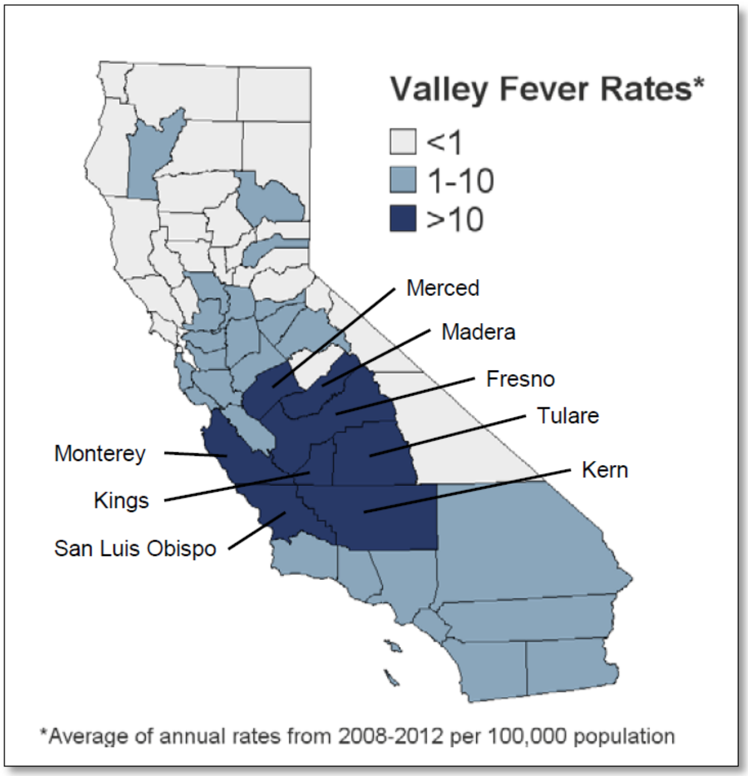
1.7 Sewage and Bacterial Impacted Sediments

Some project work may be conducted at sites that serve or have served as a combined sewer overflow and consequently may have received untreated sanitary sewage from numerous sources. Decomposed sewage can potentially be encountered within sites and their sediments. Sediments could contain soil and marine microorganisms, and bacterium associated with sewage. Many of these bacterium can cause illness through ingestion, direct contact, or the inhalation of a bio-aerosol possibly in the form of dust. Potential respiratory exposure to biological agents can also occur through the inhalation of aerosols produced during sediment handling activities. PPE as identified in the site-specific HASP will be worn to minimize potential exposures. Employees will follow the decontamination or disposal procedures identified in the HASP.

1.7.1 Fungal Spores in Soil – Valley Fever

Valley Fever is an illness that usually affects the lungs. It is caused by the fungus *Coccidioides immitis* that lives in the top 2 to 12 inches of soil in many parts of California. When fungal spores are present, any work activity that disturbs the soil, such as digging, grading, or other earth moving operations, or vehicle operation on dirt roads, can cause the spores to become airborne, therefore increasing the risk of Valley Fever. All employees on sites where the fungus is present, and who are exposed to dusty conditions and wind-blown dusts are at increased risk of becoming infected.

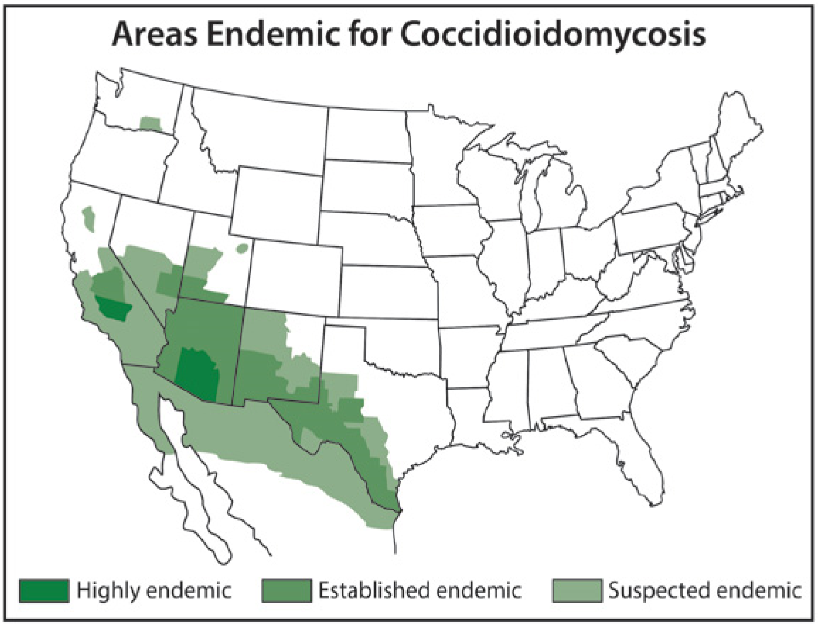
Valley Fever fungal spores are too small to be seen, and there is no reliable way to test the soil for spores before working in a particular place. Valley Fever can be found throughout the southwestern United States, parts of Mexico, and South America. Some California counties consistently have Valley Fever fungus present in the soil. In these regions Valley Fever is considered endemic. Health departments track the number of cases of Valley Fever illness that occur. This information is used to map illness rates as seen on the figures below from the Center of Disease Control Valley Fever Awareness website.



Valley Fever Rates*

*Average of annual rates from 2008-2012 per 100,000 population

Rates of reported Valley Fever cases in California counties from 2008–2012. Darkest colored counties had the highest rates of Valley Fever.



Areas Endemic for Coccidioidomycosis

When present, symptoms usually occur between 7 to 21 days after breathing in spores, and can include:

- Cough
- Fever
- Chest pain
- Headache
- Muscle aches
- Rash on upper trunk or extremities
- Joint pain in the knees or ankles
- Fatigue

Symptoms of Valley Fever can be mistaken for other diseases such as the flu (influenza) and TB (tuberculosis), so it is important for employees to obtain medical care for an accurate diagnosis and possible treatment.

While there is no vaccine to prevent Valley Fever, the following important steps must be taken in order to limit risk:

- Determine if the worksite is in an endemic area. Contact the local health department for more information about the risk in the county GEI is performing work that may disturb soils.
- Prepare work plans and work practices that reduce employee’s exposure, which may include:
  - Provide air conditioned cabs with properly maintained dust filters for vehicles that generate heavy dust and make sure employees keep windows and vents closed.
  - Suspend work during heavy winds.
- When exposure to dust is unavoidable, National Institute for Occupational Safety and Health (NIOSH)-approved respiratory protection with particulate filters rated as N95, N99, N100, P100, or High Efficiency Particulate Air (HEPA) must be provided. The Project Manager must work with the Safety Team to develop and implement a respiratory protection program in accordance with California’s Occupational Safety and Health Administration (Cal/OSHA’s) Respiratory Protection standard (8 CCR 5144) for the project.
- Take measures to reduce transporting spores offsite, such as:
  - Clean tools, equipment, PPE, and vehicles before transporting offsite.
  - If employee’s clothing is likely to be heavily contaminated with dust, provide coveralls and change rooms, and showers where possible.

1.8 Injury Reporting

If a GEI employee suffers an injury, bite, or sting on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.9 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.10 References

http://www.cdc.gov/ncidod/dvbid/westnile/index.htm
http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm
http://www.epa.gov/pesticides/health/mosquitoes/insectrp.htm
http://www.cdc.gov/niosh/topics/lyme/
Protecting Yourself from Ticks and Mosquitoes, NIOSH Fast Facts, Publication No. 2010-119
http://npic.orst.edu/pest/mosquito/ptc.html
http://www.cdc.gov/features/valley-fever-10-things/
https://www.cdph.ca.gov/HealthInfo/discond/Documents/VFGeneral.pdf
https://blog.epa.gov/blog/tag/mosquitoes/

1.11 Attachments

None

1.12 Contact

Health&SafetyTeam@geiconsultants.com

1.13 Review History

- June 2016
- June 2014
- November 2013
- October 2010

STANDARD OPERATING PROCEDURE
HS-004 Driver Safety

1.1 Objective

GEI has implemented a Safe Driving Program to encourage safe driving habits and promote the ongoing safety of our staff and the communities where we work. For more information, refer to the Operation of Vehicles section of GEI's Employee Handbook.

This Standard Operating Procedure (SOP) provides requirements and recommendations to minimize the potential risks while operating or riding in a motor vehicle.

1.2 General

GEI employees will adhere to the following requirements when operating a vehicle while conducting business on behalf of GEI. These requirements apply to GEI-owned, rental, and personal vehicles used to conduct GEI business:

- Employees must maintain a valid and current driver's license.
- Employees using a personal vehicle for work-related travel must have proper insurance coverage that meets the requirements in the state in which they reside.
- Employees must wear their safety belt while in a moving vehicle.
- Vehicle incidents will be reported in accordance with GEI's Incident Reporting procedures (*refer to* GEI's Safety App for smart phones or the Safety page on the GEI intranet.).
- Vehicles will be properly maintained and safely operated (*refer to* GEI's Fleet Maintenance Program).
- Employees will follow safe driving behaviors, which include limiting distractions such as manipulating radios or other equipment that may cause a distraction. Employees should not exceed the posted speed limit and should maintain a safe distance between other vehicles.
- When parking a vehicle at a job site, the employee should position the vehicle in a manner which reduces or eliminates the need to operate the vehicle in reverse. It is recommended, a safety cone should be placed at the rear of the vehicle after parking the vehicle and be removed prior to moving the vehicle. This precautionary measure makes the employee aware of other vehicles, equipment, and structures within the backup radius of the vehicle.

When driving an unfamiliar vehicle (rental or GEI-owned), it is the driver's responsibility to orient themselves to the vehicle by:

- Walking around the vehicle to observe the condition of the vehicle and hazards that could be within the travel path.
- Becoming familiar with the size of the vehicle.
- Note if the vehicle has anti-lock braking system (ABS[1]).
- Adjusting mirrors (rear and side).
- Adjust seats to be situated as far back as safely practical, away from the air bag, located in the steering wheel.
- Becoming familiar with dashboard, center console, and steering controls.
- Locating the turn signals, windshield wipers, lights, emergency flashers, and the heating, air conditioning, and defrost controls.

1.3 Driving Defensively

Driving defensively means not only taking responsibility for oneself and actions but also keeping an eye on “the other guy.” Good defensive drivers may be able to anticipate what the other driver will do next. GEI recommends the following guidelines to help reduce risks while driving:

- Do not start the vehicle until each passenger and any belongings are secured in the vehicle.
- Remember that driving above or below the speed limit can increase the likelihood of a collision.
- Be aware of impaired drivers; if a car is straddling the center line, weaving, making wide turns, stopping abruptly, or responding slowly to traffic signals, the driver may be impaired or using a cellular telephone. Avoid an impaired driver by turning right at the nearest corner or exiting at the nearest exit.
    - If it appears that an oncoming car is crossing into your lane, pull over to the roadside, sound the horn, and flash the headlights.
    - If an unsafe or suspicious driver is observed, notify the police.
- Follow the rules of the road. Do not contest the “right of way” or try to race another car during a merge. Always be respectful of other motorists.

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[1] ABS is a mechanism that allows the wheels on a vehicle to maintain contact with the surface of the road, based on inputs from the driver (braking), to prevent the wheels from locking up (ceasing rotation) and to avoid an uncontrolled skid.

- Allow large vehicles, including tractor trailers, extra breaking distance, turning radius, and avoid traveling in the other driver's blind spots.
- Do not follow too closely. GEI employees should use a minimum of "3-second following distance."
- While driving, be cautious, aware, and responsible.
- Use extra caution, observe road signs, and reduce speed in construction areas and school zones.
- Always be aware of pedestrians, bicyclists, and motorcyclists.

1.4 Cellular Phone Use and Other Distractions

Refer to the *Portable Communication Device Use While Driving* section of the GEI Employee Handbook for GEI's policy on the use of cellular telephones while operating a vehicle.

1.5 Drugs and Alcohol

The use of illegal drugs or alcohol is prohibited when driving a vehicle on GEI business. Be aware of the side effects of prescription and over-the-counter medications which can impair an employee's ability to drive.

1.6 Adverse Driving Conditions

When operating a vehicle, its possible adverse driving conditions may be encountered. Below is a list of possible conditions and how they can be mitigated.

1.6.1 Driving at Night

Vision maybe limited at night due to impairment of the driver's depth perception, color recognition, and peripheral vision. Another factor adding danger to night or early morning driving is fatigue. Drowsiness makes driving more difficult by dulling concentration and slowing reaction time. Effective measures to minimize these hazards by preparing the car and following guidelines:

- Check the headlights to ensure they are properly aimed. If you notice the headlights are not properly aimed, report it to the Branch Manager, or if applicable the rental car agent. Misaimed headlights blind other drivers and reduce the driver's ability to see the road.
- In addition to the known hazards of consuming alcohol prior to driving, night driving can potentially be affected because the recovery rate of glare from headlights is prolonged. Thus reducing your ability to see.

- Smoking in GEI vehicles and rentals is not permitted. When driving a personal vehicle for business, avoid smoking while driving. Nicotine and carbon monoxide may hamper night vision.
- Observe driving safety as soon as the sun goes down. Twilight is one of the most difficult times to drive, because the eyes' pupils are constantly changing to adapt to the growing darkness Always use headlights at dusk and at dawn; lights will not help the driver see better in early twilight, but they will make it easier for other drivers to see your car. Drive at a speed that allows you to see the road that is within the headlights span. Driving in a manner that prevents you from seeing hazards as they are illuminated is known as overdriving the headlights; it may be necessary for the driver to reduce speed to be prepared to brake within the illuminated area of the headlights.
- If an oncoming vehicle does not lower beams from high to low, avoid glare by watching the right edge of the road and using it as a steering guide.
- The driver should make frequent stops for light snacks and exercise. If the driver is too tired to drive, stop in a safe area and get some rest.

1.6.2 Snow/Freezing Conditions

When snow and ice are present, be prepared by following these winter driving safety tips.

1.6.2.1 Prepare the Vehicle Before a Snowstorm

- Check under the hood and take a look at the vehicles cooling system. Make sure the vehicle contains adequate antifreeze and the hoses are in good condition.
- Test heaters and defrosters ahead of time to make sure they are in good working condition.
- Test the windshield wipers and check the condition of the wiper blades. If wipers leave streaks on the windshields, replace the blades at the next possible opportunity. Keep the receipt to expense the cost with GEI or with the car rental company.
- It is recommended that a windshield washer/antifreeze solution is used during winter conditions.
- Check the lights on the vehicle and periodically clear them of snow and dirt.
- Vehicle batteries need extra power in cold conditions. Make sure the battery's terminals are clean and cables are secure.
- Determine if the vehicle has a anti-lock brake (ABS) system.
- Keep the gas tank at least half-full in the winter to help avoid gas line freeze up.

1.6.2.2 Driving During and After a Snowstorm

- Wear sunglasses to aid in limiting reflection from snow.
- Be aware of blind spots created by snow banks.
- Be extra cautious of pedestrians and other vehicles in intersections.
- Allow extra time for braking and increase the distance between your car and the car immediately in front of the car.
- Reduce speed and do not exceed the posted limit.
- If the tires starts to lose traction, remove the foot off the gas and gradually reduce speed. Accelerate slowly once traction is regained.
- If the vehicle starts to skid, and does not have anti-lock brakes, steer into the skid. This will bring the back end of the car in line with the front. Avoid using the brakes. If the vehicle does have anti-lock brakes, firmly brake as you steer into the skid.

1.6.3 Driving In the Rain

To prevent losing control of the car on wet pavement, take these preventive measures.

- Prevent skids by driving slowly and carefully, especially on curves.
- Steer and brake with a light touch.
- When necessary to stop or slow, do not brake hard or lock the wheels.
- Maintain mild pressure on the brake pedal.

Skidding
If the car begins to skid, ease the foot off the gas, and carefully steer the car in the direction you want the front of the car to go. For cars without anti-lock brakes, avoid using the brakes. This procedure, known as “steering into the skid,” will bring the back end of the car in line with the front. If the car has anti-lock brake systems (ABS), brake firmly as you steer into the skid.

Hydroplanning
Hydroplaning happens when the water in front of the tires builds up faster than the car’s weight can push it out of the way. The water pressure causes the car to lose contact with the road surface and slide on a thin layer of water between the tires and the road. At this point, the car can be completely out of contact with the road, making it possible for the driver to skid or drift out of the lane, or even off the road.

To avoid hydroplaning, keep the tires properly inflated and maintain good tread on the tires. If tires need to be replaced on a company vehicle, notify the branch manager or their designee. Slow down when roads are wet, and stay away from puddles. Try to drive in the tire tracks left by the cars in front of the vehicle. If the car begins to hydroplane, do not brake or turn suddenly. This could throw the car into a skid. Ease the foot off the gas until the car slows; accelerate slowly once traction is regained. If braking is needed, do so gently with light pumping actions. If the car has ABS, brake normally; the car's computer will mimic a pumping action, as necessary.

If weather conditions worsen to the point where the driver is not comfortable driving, pull the vehicle over to a safe location until conditions improve. Do not drive during severe weather conditions. Do not attempt to drive on roads with standing water or that have been flooded. Find an alternate route if these conditions exist.

1.6.4 Off Road

If operation of a vehicle is required off public or private roads or in situations where four-wheel-drive vehicles are required, the appropriate vehicle for the situation will be used.

Be sure any gear or equipment is secured inside the vehicle so it doesn't bounce around while the vehicle is off-road.

- Know the underside of the vehicle. Look under the vehicle and learn where the lowest-hanging parts are located so they are not damaged.
- Scout tricky terrain on foot. Don't hesitate to get out of the vehicle to examine, up close, the terrain and soil conditions. And be sure to scout out what's on the other side of a hill ahead of time so there are no surprises.
- Drive cautiously. Drive, "as slow as possible, as fast as necessary." Remember to use the gears to efficiently manage engine power, braking, and torque.
- Create a mental picture. Look ahead and visualize the paths to the vehicle will travel. Follow those paths.
- Drive straight up and down hills. Avoid diagonal lines that put the vehicle in a situation where it might roll.

1.7 Driver Training

GEI employees are required to complete driver safety training every 3 years. This training is managed by the People Team and will be assigned through GEI's e-learning provider.

1.8 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on GEI's Safety App (for smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health & Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.9 Limitations

Follow safety procedures as defined in the site-specific HASP.

1.10 References

National Safety Council
Oklahoma Safety Council
GEI Consultants, Inc. Employee Handbook

1.11 Attachments

None

1.12 Contact

Health&Safetyteam@geiconsultants.com

1.13 Review History

- November 2016
- May 2014
- November 2013
- January 2011

STANDARD OPERATING PROCEDURES

SOP No. HS-006 Excavations and Trenches

1.1 Objective

The objective of this Standard Operating Procedure (SOP) is to highlight the hazards and safety procedures when work activities include excavations and/or trenches. The following guidelines will be followed when excavations or trenches are present on GEI projects.

1.2 General

This SOP is intended for use by employees engaged in work on project sites that include trenching and/or excavation operations. The site-specific health and safety plan (HASP) must include a hazard assessment for the project that identifies the potential for trenching and excavation hazards and the control methods to be implemented by GEI employees. These hazards must be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

An “excavation” is any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

A “trench” (trench excavation) is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

Do not enter a trench or excavation without consulting with the Project Manager, Corporate Health and Safety Officer (CHSO), or Regional Health and Safety Officer (RHSO).

1.2.1 Personal Protective Equipment

Employees will be provided with the personal protective equipment (PPE) necessary to help protect them from the hazards of work activities related to excavations and/or trenches. <u>All employees will wear a hard hat, steel toe or composite toe boots, and safety glasses at a minimum</u>. In addition, face shields, gloves, fall protection and hearing protection may be required. PPE must be maintained in good condition, kept clean and properly stored when not in use. More information regarding PPE is located in Section 6 of GEI’s Corporate Health and Safety Program.

1.3 Hazards

Hazards associated with excavations and trenches can include collapse, falls, falling objects, hazardous atmospheres, and incidents involving mobile equipment. One cubic yard of soil can weigh as much as a car.

1.4 Entry

GEI employees will not enter trenches or excavations that do not comply with OSHA 29 CFR 1926.650. If a project requires GEI employees to enter a trench or excavation, the trench or excavation must meet the following requirements described in the following sections.

Do not enter a trench or excavation without consulting with the Project Manager, Corporate Health and Safety Officer (CHSO), or Regional Health and Safety Officer (RHSO).

1.4.1 Competent Person

The excavation must be inspected prior to the start of each shift by a competent person who most likely will work for the contactor performing the work. The competent person is an individual who is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to workers, soil types and protective systems required, and who is authorized to take prompt corrective measures to eliminate these hazards and conditions. GEI generally does not act as the competent person.

1.4.2 Soil Type

The competent person for the project will determine what the soil type is and what type of protective system will be implemented. The type of soil where the excavation or trench is being dug has significant influence on what type of protective system will need to be in place. There are four types of soil: stable rock, type A, type B, and type C. As you progress from stable rock to type C, the cohesive properties of the soil change the soil becomes less stable.

1.4.3 Protective System

A protective system is required for trenches or excavations greater than 5 feet in depth unless the excavation is made entirely in stable rock. In special situations the competent person may require a protection system for an excavation that is less than 5 feet deep. The competent person is responsible for assessing the soil type and the protective systems required for a specific trench when an excavation is less than 20 feet deep. If the excavation is greater than 20 feet in depth, the protection system requires a design by a registered professional engineer or based on tabulated data prepared and/or approved by a registered professional engineer.

The protective system will be designed based on soil type, depth of excavation, water level, loads adjacent to the excavation, changes in weather conditions, or other operations in the area. Protective systems can include sloping or benching of the sidewalls, shoring the sidewalls using an approved support system, or shielding workers with a trench box or other similar type of support.

The different types of protective systems include:

Benching is a method of protecting workers from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near vertical surfaces between levels. Benching cannot be done with Type C soil.

Sloping involves cutting back the trench wall at an angle inclined away from the excavation.

Shoring requires installing aluminum hydraulic or other types of support structures to prevent soil movement and cave-ins.

Shielding protects workers by using trench boxes or other types of supports to prevent soil cave-ins.

Designing a protective system can be complex because many factors must be considered: soil classification, depth of cut, water content of soil, changes caused by weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench) and other operations in the vicinity.

1.4.4 Access and Egress

Excavations and trenches greater than 4 feet in depth require a safe access and egress including ladders, steps, or ramps. These points of access and egress are to be no greater than 25 feet of lateral travel in any direction.

1.4.5 Atmospheric Hazards

Where oxygen deficiency (atmospheres containing less than 20.7% oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation will be tested before employees enter excavation.

1.5 Subcontractor Oversight

When GEI is overseeing excavation activities performed by a subcontractor, the following safety hazards should be monitored:

- Care must be taken not to create new hazards like narrow walkways along edges of an excavation.
- Heavy equipment must not be parked or working at the edge of the excavation.
- Spoils should not be stockpiled within 2 feet of the trench edges.
- Confirm with subcontractor that underground utilities have been located before any excavation or trenching activities begin (*refer to* SOP HS-014 Utility Mark-out).
- Confirm with the subcontractor that the excavation or trench has been tested for hazardous atmospheres before entering.
- Confirm with the subcontractor that the excavation or trench has been inspected by a competent person before each work shift and after any type of precipitation. If hazards are identified during this inspection, verify that the hazards are controlled prior to entering the trench or excavation.
- GEI employees will not work under raised or suspended loads.
- Excavations/trenches must be protected at the end of a work shift if they are to be left open. These trenches/excavations must be covered and a sign that reads “Hole” must be placed in a location that will notify anyone of the hazard. Or a secure barricade will need to be installed.

In circumstances where GEI employees are working on sites where a contractual agreement with the excavation contractor does not exist and we cannot confirm the above stated conditions, entry into trenches or excavations will not be conducted. Any safety concerns that arise should be communicated to the Project Manager and, if necessary, the client.

1.6 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened.

The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.7 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

Some states, including Massachusetts, require a trench permit prior to trenching or excavation activities. Verification of local requirements will be evaluated in the planning stage.

1.8 References

OSHA 29 CFR 1926.650 – Subpart P; *Excavations*
OSHA Construction eTool – http://www.osha.gov/SLTC/etools/construction/index.html
OSHA FactSheet Trenching and Excavation Safety – viewed on 9/13/2016
https://www.osha.gov/OshDoc/data_Hurricane_Facts/trench_excavation_fs.pdf

1.9 Attachments

None

1.10 Contact

Health&SafetyTeam@geiconsultants.com

1.11 Review History

- September 2016
- May 2014
- November 2013
- January 2011
- Initial Version Date Unknown

STANDARD OPERATING PROCEDURES

SOP No. HS-010 Inclement Weather

1.1 Objective

This Standard Operating Procedure (SOP) is intended for use by employees engaged in work with the potential to be affected by inclement weather. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for working in inclement weather and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.2 General

Employees should be aware of local weather conditions and monitor advisories issued by the National Weather Service and other local reporting services. Depending on location and season, storms are capable of producing heavy rain, floods, extreme temperatures, high wind conditions, lighting, tornados, and/or snowfall.

1.2.1 Heavy Rain

If working or driving in a rain storm, use extreme caution. When driving, turn your low beam lights on when the rainfall becomes heavy. Employees should be aware of the following:

- Heavy rain decreases visibility, especially when driving.
- Surfaces and tools become slippery.
- If you are working in the rain and your clothes become wet there is a risk of hypothermia when exposed to winds, even in warm temperatures.
- If the storms are going to produce thunder and/or lightning, leave the work area immediately and move to a safe area.
- Use your best judgment to determine if the rainfall becomes too heavy to continue working safely.

1.2.2 Lightning

Lightning can strike as far as 10 miles from the area where it is raining. That's approximately the distance you can hear thunder. **If you can hear thunder, you are within striking distance. Seek safe shelter immediately.** This can be within a building or vehicle. Wait 30 minutes after the last clap of thunder or flash of lightning before going outside again.

1.2.3 Flooding

Flooding may occur as a result of heavy rain in a short period of time. Flooding can be particularly acute in canyon areas where dry creek beds can turn into raging rivers from rainfall in distant or higher elevation areas. Be aware of this and your surroundings and move to a safe place if you begin to see signs that flooding may occur. Signs of potential flooding include sudden appearance of water in dry creek beds, increased water flow in rivers or streams, or quick rise in water levels.

Do not attempt to drive through areas or streets that are flooded. Seek alternate routes. Be particularly cautious at night when flooded areas are difficult to see. Urban flooding can stop traffic; increase the potential for traffic accidents; and can trap people in vehicles.

1.2.4 Extreme Temperatures

Work activities may take place in extreme heat or cold. Be prepared if these conditions are anticipated. Have the appropriate personal protective equipment (PPE) available; exercise proper fluid intake; and take breaks to prevent heat and cold stress. For more information about these conditions see the heat stress and cold stress programs found in GEI’s Health and Safety Program.

1.2.5 High Winds, Tropical Storms, and Tornados

High Winds can be extremely dangerous. Appropriate measures will be taken to secure equipment and loose items when working in windy conditions. The project manager should be contacted about the weather conditions and, if necessary, work should be postponed.

Tropical storms are described as storms with sustained winds ranging from 39 to 73 miles per hour (mph) and hurricanes produce sustained winds that exceed 74 mph. When winds approach 40 mph (gale force winds) twigs begin to break off of trees and vehicles will veer off of the road. <u>When winds approach 40 mph or the GEI employee feels unsafe</u> based on the activities being performed, stop work and seek shelter as soon as possible. Blowing or falling debris and overhanging limbs/signs can be a significant hazard. If possible, avoid driving in these conditions; 70 percent of injuries during hurricanes are a result of vehicle accidents. Note that tall or elevated equipment will have manufacturer’s safe operating wind speeds defined that could be less than 40 mph. The operator’s manual should be consulted prior to operation of the equipment.

A tornado is a violent, dangerous, rotating column of air that is in contact with both the surface of the earth and a cumulonimbus cloud or, in rare cases, the base of a cumulus cloud. The Fujita Scale is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure. Based on the Fujita Scale, or F-Scale, numbers begin at F0: 40-72 mph and go to F6: 319-379 mph (F6 is generally theoretical). Nearly three-fourths of tornados are on the weak F0-F1 scale with just over two-thirds of deaths resulting from the violent F4-F5 tornados.

If a tornado is seen, stop work and seek shelter immediately. If a tornado siren is sounded move immediately to safety indoors and then move to a windowless interior space, basement, stairwell, or designated fall-out shelter. Windows should not be opened before an oncoming tornado. If there is no shelter available, seat belt yourself into your stationary vehicle or seek a depression or low spot on the land surface.

1.2.6 Snowfall and Ice Conditions

Working in the winter months may result in activities taking place during periods of snowfall or icy conditions. If you are working during or after snow has fallen, dress appropriately for the conditions. Snow and ice can cause working surfaces to become slippery. Clear snow and ice from work areas to prevent slip hazards. Use caution when performing snow or ice removal activities to prevent injuries. Driving in snowy and icy conditions is also hazardous. Reduce speed and use caution if you must drive in these conditions.

If the weather conditions deteriorate and you do not feel safe working in these conditions, stop work, move to a safe indoor location, and contact your project manager to let them know the weather, work conditions, and your location.

1.3 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.4 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection. Protection in extreme weather conditions can best be accomplished if the conditions are anticipated and actions are taken. Monitor local weather conditions prior to starting work.

1.5 References

Center for Disease Control and Prevention – Natural Disasters and Severe Weather
http://www.bt.cdc.gov/disasters/

National Lightning Safety Institute

NOAA, National Weather Service

Office of Climate, Water, and Weather Services

1.6 Attachment

None

1.7 Contact

Safety Team
Health&SafetyTeam@geiconsultants.com

1.8 Review History

- Previous revision dates were not documented
- May 2014
- July 2016

STANDARD OPERATING PROCEDURES

SOP No. HS-011 Ladders – Fixed and Portable

1.1 Objective

GEI employees may be required to use ladders to access equipment or work areas as part of work activities. Ladders can be used on construction or manufacturing sites and in office settings. All GEI employees will receive training on the use and hazards associated with ladders. The following guidelines must be followed when GEI employees use a fixed ladder or a portable ladder, such as an extension or stepladder.

1.2 General

This standard operating procedure (SOP) is intended for use by all employees. The site-specific health and safety plan (HASP) must include a hazard assessment for the project that identifies ladder usage by GEI employees. These hazards must be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Ladder Selection

The selection of the ladder will be dependent on the intended use of the ladder. Factors to consider when selecting the proper ladder are:

- Expected working height
- Expected load to be placed on the ladder
- Conductivity of the ladder material.

1.4 Ladder Inspection

Ladders must be inspected before use by a competent person. Items to look for include:

- The ladder must be Occupational Safety and Health Administration (OSHA) and American National Standard Institute (ANSI) compliant.
- The weight placed on the ladder (person and equipment) must not exceed the ladder’s specified load capacity noted on the ladder.
- Rungs, cleats, and steps must be parallel, level, and uniformly spaced when the ladder is in position for use; round rungs are prohibited.

  If a structural defect in the ladder is observed (e.g., cracks, loose rungs, slivers, sharp edges, oil, grease, mud, and other slipping hazards), the ladder must be immediately removed from service for repair or disposal. Tag defective ladders “Out of Service” and do not use them; notify your Branch Manager so that the ladder can be replaced or repaired. If the ladder cannot be repaired it must be labeled as broken or disassembled and then disposed of properly. GEI does not issue or permit the use of unsafe ladders.

1.5 Use of Ladders

- Ladders are to be used only for the purpose for which they were designed.
- Ladders will not be tied or fastened together to provide longer sections unless they are specifically designed for such use.
- Placement of a ladder will only be on a stable, level surface unless secured to prevent accidental displacement.
- Areas around the top and bottom of ladders will be kept clear of equipment and debris.
- Ladders used near exposed energized electrical equipment will have nonconductive side-rails.
- When climbing or descending a ladder the employee must face the ladder, maintain three points of contact, and not carry objects or use backpacks that may throw off balance and cause a fall.
- The top or top step of a ladder will not be used as a step or work surface.
- The second to top step will also not be used.
- Do not lean away from a ladder; stay centered on the ladder.

1.6 Use of Portable Ladders

A portable ladder is one that can be readily moved or carried. The two common types of portable ladders are extension ladders and stepladders.

- When using an extension ladder, the base of the ladder must be placed at a working angle of one quarter (¼) of the working length of the ladder from the top support. For example: when using a 12-foot ladder, the base of the ladder must be 3-feet away from the structure.
- If an extension ladder is being used to access an upper landing surface, the ladder side rails must extend a minimum of 3 feet above the landing surface.
- If a stepladder is to be used, a metal spreader or locking device must be present and locked in place prior to use.
- The cross-bracing on the rear section of the stepladder will not be used for climbing unless the ladder is designed and steps are provided for climbing on both the front and rear sections.
- The top or top step of a stepladder will not be used as a step or work surface.
- The second to top step will also not be used.
- If a structural defect in the ladder is observed (e.g., cracks, loose rungs, slivers, sharp edges, oil, grease, mud, and other slipping hazards), the ladder must be immediately

removed from service for repair or disposal. Tag defective ladders “Out of Service” and do not use them; notify your Branch Manager so that the ladder can be replaced or repaired. If the ladder cannot be repaired it must be labeled or disassembled and then disposed of properly. GEI does not issue or permit the use of unsafe ladders.

1.7 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.8 Limitations

Follow safety procedures as defined in the site-specific HASP.

1.9 References

OSHA 29 CFR 1926.1053 – Subpart X; *Stairways and Ladders*
OSHA Construction eTool - http://www.osha.gov/SLTC/etools/construction/falls/4ladders.html

1.10 Attachments

None

1.11 Contact

Health&SafetyTeam@geiconsultants.com

1.12 Review History

- June 2016
- May 2014
- November 2013
- August 2011
- October 2010

GEI CONSULTANTS, INC.

SOP No. HS-014
Revision No. 5
Revised Date: June 2016

STANDARD OPERATING PROCEDURE

SOP HS-014 Utility Mark-out

1.1 Objective

This Standard Operating Procedure (SOP) provides guidance for utility mark-out procedures related to drilling, excavation, or other sub-surface or intrusive activities to avoid injury to GEI employees or property damage. This SOP is applicable when GEI is responsible for its operation or our subcontractor's operation for utility mark-out. A utility mark out is when paint, flags or other markers are put in place to identify the location of an underground utility.

Clients or local agencies may have additional requirements or procedures to mark out of utilities. If local utility mark-out procedures differ from those described within this SOP, applicable state or municipal regulations should be followed.

1.2 General

This SOP is intended for use by employees engaged in work with sub-surface or intrusive activities. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for subsurface hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.2.1 Contractor/GEI Responsibilities

- The contractor or GEI employee will pinpoint each exploration area with white paint, flags, or stakes. personal protection equipment (PPE), including eye protection when using spray paint will be worn.
- Exploration locations should be marked-out with sample identification number(s) and type of sample (e.g., boring, test-pit, or monitoring well).
- The contractor compiles information about the work areas on a request form specified by the state utility mark-out program and submits it. Work area location maps can be sent to the utility mark-out program to clarify locations.
- The mark-out program customer service representative will provide a mark-out ticket number and a list of utilities notified upon receipt of the request information. This information will be recorded on the GEI documentation form in Appendix B and/or in other project documents.
- If known, the contractor or GEI employee will also notify non-member utility operators (e.g., apartment complexes, commercial complexes, railroads with communication cables, etc.).

1.2.2 Utility Mark Outs

- Utility companies or their sub-contractors will only mark-out, or clear, utilities under their responsibility. Generally, this means that they will only mark-out utilities within the public right-of-way up to private property boundaries. Information needed to determine the location of utilities on private properties will be requested from the property owner. This may include available property drawings or as-built figures. If this information is not available, additional non-intrusive surveys of the property may be required by a private utility locator to find underground utilities by using techniques such as ground penetrating radar (GPR).
- American Public Works Association (APWA) Uniform Color Code For Marking Underground Utility Lines are:
    1. **White** – Proposed Excavation
    2. **Pink** – Temporary Survey Markings
    3. **Red** – Electric Power Lines, Cables, Conduit and Lighting Cables
    4. **Yellow** – Gas, Oil, Steam, Petroleum, and Gaseous Material
    5. **Orange** – Communications, Alarm, Signal Lines, Cables or Conduit
    6. **Blue** – Water
    7. **Purple** – Radioactive Materials
    8. **Green** – Sanitary and Storm Sewers and Drain Lines

1.2.3 Utility Mark Out Review

- Before the intrusive work activities begin, the contractor or GEI employee will verify that each utility company has completed a utility location for the work area or the location has been cleared by a private locator and record this on the mark-out request information sheet.
- A visual survey of the project area will be done prior to the start of intrusive activities. This visual inspection will be done to identify signs, manholes, utility boxes, or other evidence of an underground utility is present and has been considered.
- The contractor or GEI employee can begin work on the scheduled work date and time if the utility operators have responded, taking care to find and preserve markings that have been made.
- Completed clearance documentation will be located on the excavation site during excavation activities and kept in project files.

1.2.4 Excavations

- When excavating near a buried utility, observe the approximate location around that utility.
- If exposing a utility, proper support and protection must be provided so that the utility will not be damaged.
- If the excavation work requires significant spans of the utility to be exposed, it is the contractor's responsibility to support the infrastructure (to prevent sagging or collapse) as needed. Contact the utility operator for support, guidance, or assistance.
- When the excavation is complete, provide proper backfill for utilities that have been exposed.
- Take care not to damage the conduit or protective coating of a utility. If the damage occurs, leave the damaged utility exposed and immediately call the utility owner.
- If a gas line is encountered, everyone will be evacuated according to the site evacuation procedures and the contractor must notify police, fire, and emergency personnel. No attempt should be made to tamper with or correct the damaged utility. All site personnel are to evacuate to the site's predetermined meeting point or a location a minimum of 300 feet away from the incident location.
- If the contractor needs to dig within the approximate location of a combustible, hazardous fluid, or gas line (natural gas, propane or gasoline), soft digging is required (hand digging, vacuum extraction) to a maximum depth of 5 feet. The approximate location is defined as 24 inches on either side of the designated center line of the utility if the diameter is not provided or 24 inches from each outside edge if the diameter is provided.

1.3 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification and/or the receipt of the Incident Report Form, RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.4 Limitations

- Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.
- Mark-out notification time usually does not include holidays. Make sure holidays are considered and mark-out time is scheduled accordingly. Under no circumstances are intrusive activities allowed to be performed prior to the required mark-out.
- Do not use white paint if precipitation is eminent. Consider using stakes if snow is predicted.

1.5 References

Reference the website for the “Call Before You Dig – 811” for the utility mark-out agency for the state you working in prior to site work. If you have issues locating the appropriate agency, contact the Safety Team for assistance.

1.6 Attachments

Attachment A – Standard Utility Color Codes

Attachment B – GEI Utility Clearance Documentation Form

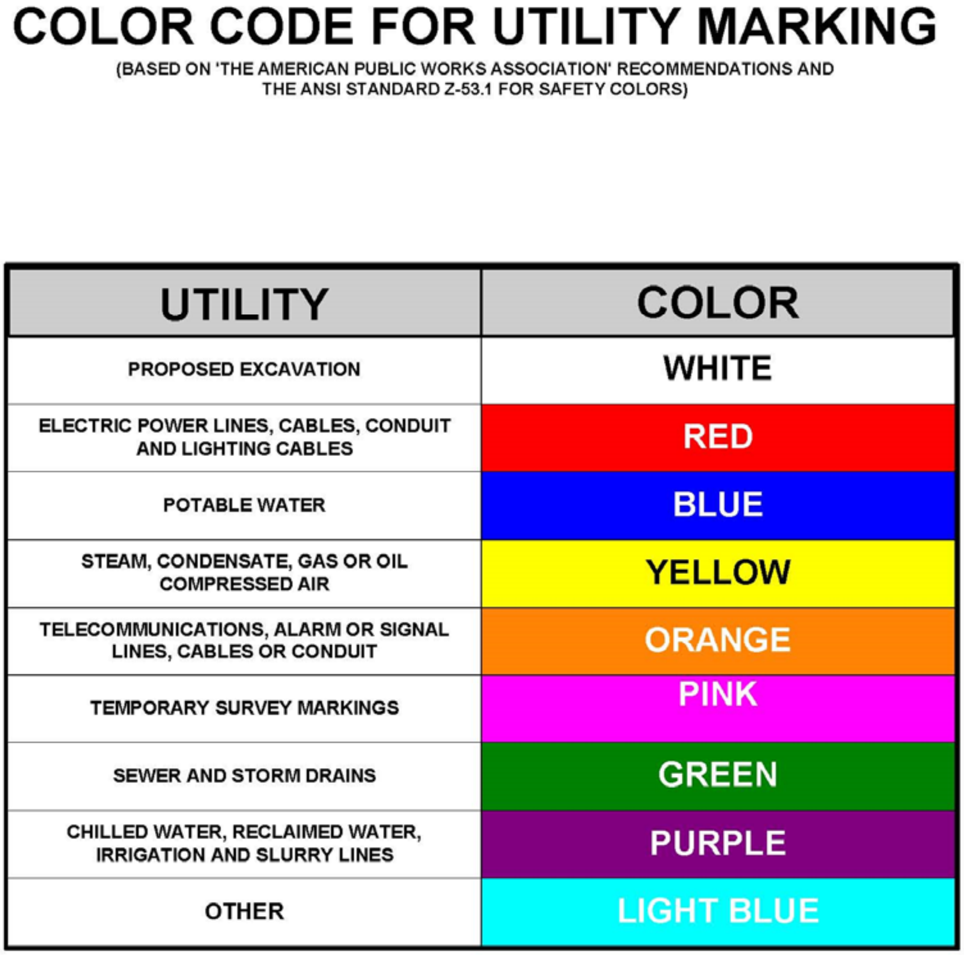
1.7 Contact

Health&SafetyTeam@geiconsultants.com

1.8 Review History

- June 2016
- May 2014
- November 2013
- February 2011
- November 2010

ATTACHMENT A



COLOR CODE FOR UTILITY MARKING

(BASED ON 'THE AMERICAN PUBLIC WORKS ASSOCIATION' RECOMMENDATIONS AND THE ANSI STANDARD Z-53.1 FOR SAFETY COLORS)

UTILITY	COLOR
PROPOSED EXCAVATION	WHITE
ELECTRIC POWER LINES, CABLES, CONDUIT AND LIGHTING CABLES	RED
POTABLE WATER	BLUE
STEAM, CONDENSATE, GAS OR OIL COMPRESSED AIR	YELLOW
TELECOMMUNICATIONS, ALARM OR SIGNAL LINES, CABLES OR CONDUIT	ORANGE
TEMPORARY SURVEY MARKINGS	PINK
SEWER AND STORM DRAINS	GREEN
CHILLED WATER, RECLAIMED WATER, IRRIGATION AND SLURRY LINES	PURPLE
OTHER	LIGHT BLUE

ATTACHMENT B

Utility Clearance Documentation

Please print clearly. *For more room, use back of page.*

Client: ______________________________

GEI Project Name & Number: ______________________________

Site: ______________________________

Excavation/Drilling Location ID: ______________________________

Excavator/Driller: ______________________________

GEI PM: ______________________________ GEI Field Team Leader: ______________________________

Utility Drawings Reviewed: ______________________________

Provided By: ______________________________ Reviewed By: ______________________________

Utility Clearance Call Date: ______________ Name of Utility: ______________________________

Utility Clearance Call Date: ______________ Name of Utility: ______________________________

Utility Clearance Received from (utility & rep name): ______________________________ Date: __________

Utility Clearance Received from (utility & rep name): ______________________________ Date: __________

Company that completed clearance: ______________________________ Date: __________

GEI Staff Responsible for Oversight: ______________________________

Metal Detector Survey (yes/no): ______________ Drilling Location Cleared by: ______________________________

Contractor Name: ______________________________ Company Name: ______________________________

Contractor Signature: ______________________________ Date: __________

GEI Staff Responsible for Oversight: ______________________________

Private Location Clearance Required (yes/no): ______________ Date: ______________________________

Contractor Name: ______________________________ Company Name: ______________________________

Contractor Signature: ______________________________ Date: __________

Methods used for utility location (i.e. GPR, electronic pipe location) ______________________________

GEI Staff Responsible for Oversight: ______________________________

Hand clearing Performed (yes/no): __________ Methods: ______________________________ Date: __________

Contractor Name: ______________________________ Company Name: ______________________________

Contractor Signature: ______________________________ Date: __________

GEI Staff Responsible for Oversight: ______________________________

GEI Consultants, Inc. Representative (name & title): ______________________________

GEI Consultants, Inc. Representative Signature: ______________________________ Date: __________

Based upon the best available information, appropriate utility clearance procedures were performed for the invasive work specified. If client ordered site specific deviations from existing GEI utility clearance procedures, they are approved by the client signature below:

Client Representative (name & title): ______________________________

Client Representative Signature: ______________________________ Date: __________

Notes:

STANDARD OPERATING PROCEDURES

SOP No. HS-016 Traffic Hazard Management

1.1 Objective

The objective of this Standard Operating Procedure (SOP) is to prevent or limit the potential for GEI personnel to encounter traffic hazards during field activities.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for traffic hazards. The site-specific health and safety plan (HASP) will include a hazard assessment for the project that identifies the potential for exposure to traffic hazards and the control methods to be implemented by GEI employees, including review or attainment of necessary permits, traffic control plans, and flagger/police detail requirements for the local jurisdiction. Routine checks of the work zone will be made to ensure there are adequate levels of protection. These hazards will be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Safety page of the GEI intranet.

1.3 Traffic Hazard Management

Traffic Hazard Management is the process of identifying and managing the potential risks associated with the movement of traffic through, around, or past a work area. This Traffic Hazard Management SOP is designed to assist employees in identifying and managing these hazards. Work areas should be as safe as possible. It is the responsibility of GEI employees to follow the Traffic Hazard Management SOP and adhere to these safety standards. Safety is not negotiable.

Under no circumstances are GEI employees permitted to commence work in a situation that the employee believes or knows their health and safety, or the health and safety of others, is at risk.

Major risk factors for work site Traffic Hazard Management include:

- The speed of traffic moving through a work site.
- The distance and clearance between moving traffic, workers, vehicles and equipment, and over-head power lines.
- Traffic volume and vehicle composition.
- Nature and conditions at the work site and approaches to the work site.

- Other factors such as the time of day, sight distance, weather, presence of pedestrians, or cyclists, and the type of work being carried out.
- Other hazards in proximity to the work site (e.g., power lines, open excavations) that may have conflicting safety management measures that need to be considered when developing the HASP.

1.4 Site Preparation

The following management measures will be considered whenever working in traffic areas. In addition, remain aware of the amount of traffic around the working area. The work space should be large enough for the job to be completed safely. Check permit, traffic control plans, and flagger/police detail requirements for the local jurisdiction. Perform routine checks of the work zone to make sure there are adequate levels of protection.

1.4.1 Traffic Barriers and Warning Signs

GEI employees will comply with the U.S. Department of Transportation’s (DOT) Manual on Uniformed Traffic Control Devices (MUTCD) and/or state regulations for temporary traffic barriers (cones, barriers) and sign placement when required for working in traffic areas. Clearly define the work site by placing traffic barriers around the work space to indicate the space that is needed to safely perform the work. The traffic barrier will help make the work site more visible to other workers, pedestrians, cyclists, and moving vehicles. Place traffic barriers in such a way as to give yourself and equipment adequate space to work within the barriers. OSHA suggests placing the first warning sign at a distance calculated to be 4 to 8 times (in feet) the speed limit (in MPH).

1.4.2 Adequate Light

Requirements for night conditions and work areas with poor visibility are similar to day requirements. However there are a number of additional things to consider, such as visibility of the work site to advancing traffic and sufficient lighting. OSHA requires lighting for workers on foot and equipment operators to be at least 5-foot-candles or greater.

Visibility of the work area can be increased by employing the following measures:

- Using parked vehicles hazard and flashing lights.
- Wearing reflective personal protective equipment (PPE), such as a safety vest, in good condition.
- Providing adequate lighting to illuminate the work area with lights positioned so that there is no glare to approaching drivers.
- Placing reflective advance warning signs and traffic barriers so that they are visible to road users.

1.4.3 Distance from the Nearest Traffic Lane

Work areas located along roadsides will have a minimum clearance as defined by DOT's MUTCD and/or state or local DOT regulations for traffic barrier and sign placement.

1.4.4 PPE

The proper PPE, as outlined in the project HASP, will be worn when appropriate. The color/type of safety vest will comply with site regulations.

1.5 Equipment Operation

Vehicles and heavy equipment operators should use a spotter when possible if it is necessary to drive in reverse to reduce risk of collision with oncoming traffic. If it is necessary to drive against the flow of traffic make sure this area is within the work zone and properly blocked off from oncoming traffic.

1.6 Pedestrian Safety

When working near pedestrian traffic, a safe alternate pedestrian route will be established. Refer to local regulations when establishing pedestrian walkways.

1.7 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health & Safety Officer (RHSO).

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.8 Limitations

Follow safety procedures as defined in the site-specific HASP, federal DOT, and local jurisdictions. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.9 References

DOT’s Manual on Uniformed Traffic Control Devices (2009 Edition)

Hazard Exposure and Risk Assessment Matrix for Hurricane Response and Recovery Work: https://www.osha.gov/SLTC/etools/hurricane/work-zone.html

1.10 Attachments

None

1.11 Contact

Health&SafetyTeam@geiconsultants.com

1.12 Review History

- November 2016
- May 2014
- November 2013
- August 2011
- October 2010 Initially HS-027 Traffic Hazards

STANDARD OPERATING PROCEDURES
HS-017 Water Safety

1.1 Objective

The objective of this Standard Operating Procedure (SOP) provides requirements and best practices for GEI personnel during field activities taking place on board a boat/barge or when working in or near water. If conducting aquatic surveys or electrofishing activities, please *refer to* **HS-022 Aquatic Ecological Surveys and Electrofishing Safety** for additional safety information for working in or near water.

1.2 General

This SOP is intended for use by employees where there is the potential to perform work while on board a boat/barge or when working in or near water. The site-specific health and safety plan (HASP) will include a hazard assessment for the project that identifies the potential hazards and the control methods to be implemented by GEI employees. The site-specific HASP, project hazards, and control methods will be reviewed during the project safety briefing and documented on the Project Safety Briefing form found on the Safety page of the GEI intranet.

1.3 Working near Water

OSHA Construction Industry Standards (29 CFR 1926.106) state, "…employees working over or near water, **where the danger of drowning exists**, will be provided a U.S. Coast Guard-approved life jacket or buoyant work vests." (*Emphasis added, not in original text*) OSHA General Industry Standards (1910) do not address working over or near water; therefore, GEI uses the OSHA Construction Standard for any work near water.

The following safety devices, when appropriate, will be used by employees working near water:

- **Life Jacket or Personal Flotation Devices (PFD).** Employees will be required to wear U.S. Coast Guard-approved personal flotation devices that are marked or labeled Type III PFD or a Type V PFD that is marked or labeled for use as a work vest for commercial use or for use on vessels. GEI employees will inspect personal floatation devices for defects that could alter their strength or buoyancy prior to, and after, each use. Tag worn, damaged, or defective PFDs "Out of Service" and do not use them; notify the Branch Manager so that the PFD can be disposed of and replaced. GEI does not issue or permit the use of unsafe PFDs.
- **Ring Buoys.** U.S. Coast Guard-approved ring buoys with at least 90 feet of line will be readily available for emergency rescue operations. Distance between ring buoys will not exceed 200 feet.

- **Life-saving Skiff.** When GEI employees are working over or adjacent to water, at least one lifesaving skiff will be immediately available for potential rescue purposes.

These requirements can be superseded by the use of 100 percent fall protection. If an employee cannot fall into the water as a result of the use of active or passive fall protection, there is no danger of drowning and the bullet points above are not required. The type of fall protection or the need for the above mentioned safety measures will be described in the site specific HASP. If 100 percent fall protection is in place, the boat will, at a minimum, have U.S. Coast Guard-approved PFDs on board for each person and at least one throw-able flotation device, such as a ring buoy.

GEI employees will not work alone when working near water.

1.4 Boat/Barge Safety Practices

Boat safety practices will be conducted in general accordance with guidance provided in the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM) 385-1-1 and the U.S. Coast Guard. The following safety practices will be adhered to:

- If there is an accident the U.S. Coast Guard must be notified. The attached U.S. Coast Guard accident report form can be used to document the accident. Federal law requires the operator, or owner, if the operator is deceased or unable to make the report, to file a boating accident report with the state reporting authority when, as a result of an occurrence that involves a boat or its equipment:
  - Incident involving a fatality.
  - A person disappears from the vessel under circumstances that indicate death or injury.
  - A person is injured and requires medical treatment beyond first aid.
  - Damage to vessels and other property totals $2,000 (lower amounts in some states and territories) or more.
  - The boat is destroyed.
- Boats operated by GEI will comply with U.S. Coast Guard regulations.
- Any GEI employee that is operating a boat is required to take a Boating Safety Course. The course will be in accordance with the requirements of the state in which the boat will be operated. Documentation of course completion will be sent to the People & Safety Team.
- The boat operator will be familiar with United States Geological Survey navigation rules.

- Any boat operator, whether GEI or a subcontractor, is not to exceed 12 hours of duty time in a 24-hour period.
- GEI employees will wear a PFD as described in Section 1.3 when on board a boat /barge.
- For a boating activity where the vessel launches and is no longer in view of on-shore personnel, a Float Plan will be completed and left with a reliable person who can be depended upon to notify the U.S. Coast Guard, or other rescue organizations, should you not return or check-in as planned. If there is a change of plans after leaving, be sure to notify the person holding the Float Plan. Please *see* the attached U.S. Coast Guard Float Plan form.
- For a task requiring more than 1 day, daily communications with the reliable person will be maintained.
- The consumption of alcoholic beverages and the use of illegal drugs will not be permitted aboard boats/barges on which GEI employees are conducting company business, this includes boats/barges that may belong to someone else (subcontractor, client, etc.).
- Employees working on a boat will monitor the weather, incorporating, as appropriate, National Oceanic and Atmospheric Administration (NOAA) marine weather broadcasts and other local commercial weather forecasting services as may be available.
- For retrieving a person overboard, the boat operator, or other competent person will throw a life ring, that is attached to the boat with at least 90 feet of rope, and use a ladder attached to the boat or the boat step transom to allow the person to climb out of the water.
- Emergency procedures for fire, person overboard, and capsizing will be reviewed on the first day of operations and when there is a change of personnel occurs.
- Check with your local and state agency to verify their boat law/regulations.
- Beware of carbon monoxide poisoning when the boat engine is running in closed or poorly ventilated areas.

1.4.1 Boating Safety Equipment

The U.S. Coast Guard requires particular safety equipment to be aboard a boat. This list includes those items as well as other equipment that GEI requires as a minimum. Other safety equipment may be required based on the type and size of the boat being operated. The boat will be equipped with:

- At least one mounted ABC-1 type U.S. Coast Guard-approved portable fire extinguisher.
- A Type IV life ring attached to at least 90 feet line. Distance between ring buoys will not exceed 200 feet.
- A Coast Guard approved PFD for each person on board as well as one.
- A visual distress signal, such as flare.
- VHF-FM Marine Radio with Digital Selective Calling System.
- An efficient sound-producing device, such as a whistle or horn.
- One U.S. Coast Guard approved backfire flame arrestor device on each carburetor of all gasoline engines installed after April 25, 1940, except outboard motors.
    - Devices will be marked to show compliance with SAE J-1928 or UL 1111 Standards.
- Ladder attached to the boat or the boat step transom.
- An adequately-sized first aid kit.
- Charts and navigation aids.

1.5 Training

1.5.1 General

Training will be conducted for employees unfamiliar with the use of safety equipment and personal protective equipment (PPE) required by this SOP. Employees working over or near water will be trained in their responsibilities and the safe work practices associated with working on or near water.

1.5.2 Operating a Boat

A Boating Safety Course is required for employees that will be operating a boat. The course will in accordance with the requirements of state in which the boat will be operated. There is no regulated refresher date; therefore, GEI will require the course be retaken every 5 years to demonstrate continued proficiency. Documentation of course completion will be sent to the Safety Team.

1.6 Wading In Water

GEI employees may be required to wade in water during the performance of project work including but not limited to aquatic surveys and other ecological activities. Employees will be familiar with safe wading procedures and emergency preparedness as described below. Working in and around water can be an inherently hazardous activity (hypothermia, drowning risk) for which safety will be the primary concern.

1.6.1 General Safety

Field sampling operations in and around water will not be carried out alone. A minimum team size is two people. Employees will wear appropriate clothing and PPE in accordance with Section 1.6.2, Personal Protective Equipment Requirements for Wading, as defined below and as discussed in HS-022 Aquatic Ecological Survey and Electrofishing Safety.

Instream crews will have a First Aid kit onsite during wading operations and will work in a manner that is safe for themselves and their co-workers. The crew leader is the recognized authority and operational decision-maker. Crew members have the duty to comply with all of the crew leader’s instructions concerning their health and safety and to report to the crew leader anything that is likely to be hazardous to their health or safety or to that of other employees or persons granted access to the work area.

Employees undertaking instream sampling or wading operations will be familiar with the hazards associated with those activities and agree to use common sense and safe wading practices during sampling. Field staff will have up-to-date Cardio-Pulmonary Resuscitation (CPR) and First Aid training.

1.6.2 Personal Protective Equipment Requirements for Wading

The following PPE is required when wading in water and will be provided by GEI:

- Leak-free chest waders or hip waders (neoprene, heavy weight polyurethane, PVC, or high-quality breathables), dependent upon depth. Hip waders can be worn when water depth is known not to be over “knee-deep” on any employee wearing hip waders.
- Non-slip footwear (felt wading shoe or boot, as well as stream wading cleat).
- Wading belt (nylon or rubber acceptable, worn on outside of chest waders).
- Polarized sunglasses (side shields or ‘wrap around’ style is/are recommended) and a hat with a visor is recommended (e.g., baseball cap style).
- PFDs will be worn where the crew leader considers the water is of sufficient depth or velocity for a PFD to be effective as protection from risk of drowning. PFDs will be U. S. Coast Guard approved personal flotation devices that are marked or labeled Type III or V PFD. Wading should not be carried out where water depth is greater than waist deep.
- In some situations, a wading staff might be useful as a “third leg” to help stabilize personnel during stream crossing or other wading operations.

1.6.3 Safety Procedures for Wading Operations

Office Preparation

- The crew leader will verify all employees have received instruction in the fundamentals of wading safety and working around water.
- It is the crew leader's responsibility to verify that employees are properly outfitted for the intended work.
- Where available, employees should attempt to identify any information on known instream hazards at the intended field site, including current discharge stage.
- Each instream sampling team will establish a means of emergency communication such as using walking talkies or specific hand signals.

Field Preparation

- A crew leader will be designated for activities in water.
- Crew members will be equipped with the personal equipment detailed in Section 1.6.2, Personal Protective Equipment Requirements for Wading.
- Each instream work site will be visually inspected for hazards such as deep holes, submerged logs, animals, etc. before commencing wading operations.
- In order to aid in identifying underwater hazards, all crew members will be equipped with polarized sunglasses. Glasses also protect against eye injury caused by sticks and branches. Wide brimmed hats or 'baseball' style caps are also beneficial in increasing the effectiveness of polarized glasses.
- Using visible landmarks, personnel will assess flow stage for the waterbody and continue to monitor for changes in water level during sampling operations. Changes in water level could indicate the onset of a flash flood.
- Clear command signals will be established between crew members prior to beginning operation. Crew members will inform the crew leader of any dangerous situations. Do not go into water that is above the level you have experienced before and are physically capable of handling.

1.6.4 Wading Procedures

- Operate slowly and carefully. Footing in most streams is poor and most falls occur when crew members are hurrying. Operations should cease when fatigue sets in.
- Plan a route that minimizes your exposure to the strongest currents/deepest water. Sand and gravel bottoms are usually secure and safe bottoms to wade on. Avoid standing on large, smooth rocks as much as possible.

- Plan on generally working in a downstream to upstream direction, ensuring solid footing before shifting positions
- Be aware of floating debris and changing water levels.
- In shallow water, less than knee deep, it may be possible to walk “normally” with a modified, wide stance. As water gets deeper and footing becomes obscured by water depth or turbidity, sidestepping will help maintain a wide, stable base.
- In moderate currents, position your feet so that you are facing upstream with your body side-on to the current to brace yourself and reduce your profile in the current.
- When crossing streams, it is easier and safer to move at a slight downstream angle with the current than to move directly across or upstream against the current.
- In difficult situations, take small shuffling steps, angling your body slightly upstream. If using a wading staff, position it upstream, maintaining two points of contact with the bottom at all times.
- In particularly difficult situations, use a buddy system in which you and a partner cross the stream together arm in arm, one upstream of the other so that you are supporting each other
- If you do happen to lose your footing and begin to float downstream, don’t try to swim. Bring your knees up and roll over on your back with your feet downstream, working your way to the sides or to a suitable place to get out.

1.7 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health and Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.8 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE will be worn correctly to provide the intended level of protection.

1.9 References

Occupational Safety and Health Administration (OSHA) 29 CFR 1926.106 – Subpart E: Personal Protective and Life Saving Equipment: Working Over or Near Water.

U.S. Code of Federal Regulations (CFR) Title 33 – Navigation and Navigable Waters; Chapter I – United States Coast Guard.

United States Army Corps of Engineers, Safety and Health Requirements Manual (EM), 385-1-1. November 3, 2003 – Section 19 Floating Plant and Marine Activities

United States Army Corps of Engineers, Safety and Health Requirements Manual (EM), 385-1-1 September 15, 2008 – Section 01.C Physical Qualifications of Employees

1.10 Attachments

U.S. Coast Guard Float Plan Form

U.S. Coast Guard Navigation Rules

U.S. Coast Guard Accident Report Form

1.11 Contact

Health&SafetyTeam@geiconsultants.com

1.12 Review History

- November 2016
- November 2015
- December 2014
- November 2013
- August 2011
- June 2008 –previously HS-024

STANDARD OPERATING PROCEDURES
SOP No. HS-023 Scaffolding

1.1 Objective

GEI employees may be required to use various types of scaffolding as part of project activities. These procedures and best practices described in this document apply to working on and around supported and suspended scaffolds in order to provide GEI employees with a basic awareness of scaffolding systems and the hazards associated with them. GEI employees are not considered the "scaffold competent person" and will not erect, dismantle, move, or alter scaffolding.

This Standard Operating Procedure (SOP) does not cover aerial lifts or elevating platforms. Refer to SOP HS-020 Aerial Lifts for information on these types of mobile equipment.

1.2 Terminology

Competent Person: Person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate the hazard.

Coupler: A device for locking together the ends of a tube and coupler scaffold.

Elevating Platform: A platform that rises to any desired working height.

Guardrail System: A vertical barrier erected to prevent employees from falling off a scaffold platform or walkway to lower levels. Guardrail systems consist of top-rails, mid-rails, toe boards, and posts.

Live Load: The load to which a structure is subjected in addition to its own weight.

Mid-Rail: Horizontal rail installed halfway between the top guardrail and the working platform.

Mobile Scaffold: A powered or unpowered, portable, caster- or wheel-mounted supported scaffold.

Mudsill: Platforms designed to distribute scaffold weight. The size of mud sills used is based on ground support conditions and maximum anticipated loads on the scaffold legs.

Outrigger: Structural member of a supported scaffold used to increase the base width of a scaffold in order to provide support for and increase stability of the scaffold.

Qualified Person: One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

Scaffold: Any temporary elevated platform and its supporting structure, used for supporting employees and/or materials.

Supported Scaffold: Supported scaffolds consist of one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support.

Suspended Scaffold: Suspended scaffolds are platforms suspended by ropes, or other non-rigid means, from an overhead structure.

Toe board: A vertical barrier installed at deck level along the sides and ends of a platform or scaffold.

Top-Rail: Horizontal rail installed at the top of a guardrail system.

1.3 General Requirements for all Scaffolds

Common hazards associated with all types of scaffolding include falls from elevation due to the lack of fall protection, collapse of the scaffold system by instability or overloading, being struck by falling objects, and electrocution due to the proximity of the scaffold to electrical power lines. To minimize the exposure to scaffolding hazards, the following considerations must be made prior to working on or around scaffolding systems:

- Scaffolds will be furnished and erected in accordance with the Occupational Safety and Health Administration (OSHA) Subpart L Scaffolding standards for persons engaged in work that cannot be done safely from the ground or from solid construction.
- All scaffolds will be designed by a qualified person.
- All scaffolds will be constructed and loaded in accordance with the design.
- All scaffolding, either leased or purchased, will have the manufacturer’s safety instructions available for erection and use. Scaffolding must be erected and used following the manufacturer’s instructions.
- Scaffolds are to be erected, moved, dismantled, or altered only by experienced and trained employees who have been selected for that work by the competent person. GEI employees are not considered the scaffold competent person and will not erect, dismantle, move or alter scaffolding.
- GEI employees should visually check the scaffold prior to use for their own safety or confirm with the competent person that the scaffold is ready for use.
- Scaffold components manufactured by different vendors will not be mixed.
- Scaffolding more than 10 feet above a lower level will require fall protection (i.e. fall harness).
- The front edge of the platform cannot be more than 14 inches from the face of the work unless the front edge is protected by a guardrail and/or personal fall arrest system.

- Scaffolds and their components will be capable of supporting, without failure, at least four times the maximum intended load.
- Each platform, on all working levels of scaffolds, will be fully planked or decked according to 29 CFR (Code of Federal Regulations) Part 1926.451(b).
- Scaffolds will be maintained in safe condition.
- Scaffolds will not be altered or moved horizontally while they are in use or occupied.
- Hard hats are required for workers on or around scaffolding when there is a danger of falling objects and head injury.
- Working on scaffolds or platforms during storms, high winds, or when covered with snow or ice is prohibited.
- Scaffolds must not be erected, used, dismantled, altered ,or moved when the scaffold or any conductive material on them might come closer to power lines than 10 feet for insulated lines and uninsulated lines of more than 300 volts and less than 50 kilovolts.
    - If greater than 50 kilovolts the minimum distance will be 10 feet plus 0.4 inches for each kilovolt over 50 kilovolts.
    - Insulated lines of less than 300 volts have a 3-foot minimum distance.
- A visual inspection will be conducted by the scaffold competent person immediately when a scaffold or platform has been damaged or weakened by any cause. GEI employees will not occupy the structure until the inspection has been completed and all identified discrepancies corrected.
- Frames and accessories for scaffolds will be maintained in good repair. Every defect, unsafe condition, or noncompliance with the manufacturer's specifications or recommendations will be corrected immediately. Any broken, bent, rusted, altered, or otherwise structurally damaged item/section or accessory will not be used.
- Ladders or make-shift devices are strictly prohibited and will not be used to increase the height of a scaffold or platform.
- Scaffolds will not be loaded in excess of the working load for which they are designed.
- Slippery conditions on scaffolds and platforms will be eliminated as soon as they occur.
- Cross braces, runners, and bearers will not be used for climbing. Access to scaffolds will be by stairs and ladders only.
- Tools and parts will not be carried in hands or pockets when ascending or descending access ladders. Tool belts, tool buckets and ropes, or other acceptable means will be used to raise and lower such items.
- Each employee on a scaffold greater than 10 feet from a lower level must be protected from falling (i.e. fall harness).

1.3.1 Erectors and Dismantlers

Erectors and dismantlers are workers whose principal activity involves assembling and disassembling scaffolding before other work can commence, and after that work, or a portion of it, has been completed. GEI employees will not act as an erector or dismantler of scaffolds.

1.4 Supported Scaffolding

Supported scaffolds are the most common type of scaffold and consist of one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support. Frame or fabricated frame scaffolds, manually-propelled or mobile scaffolds, pump jack scaffolds, ladder jack scaffolds, pole scaffolds, and other specialty type scaffolds are all examples of supported scaffolds.

When working on supported scaffolding the following must be followed:

- The assembly, erection, operations, use and maintenance of tubular welded frame scaffolds will meet manufacturer's requirements and recommendations.
- In order to assure stability, supported scaffolds must be set on:
    - Base plate,
    - Mud sills
    - Or other adequate firm foundation
- Footings must be capable of supporting the loaded scaffold without settling or displacement.
- Unstable objects may not be used to support scaffolds or platform units
- Scaffold poles, posts, legs and uprights must be plumb. Additionally, poles, posts, legs, and uprights will be securely and rigidly braced to prevent swaying and displacement.
- Frames and panels must be connected by cross, horizontal, or diagonal braces, alone or in combination, which secure vertical members together laterally.
- As frames are stacked, cross braces must be of such length as will automatically keep the scaffold plumb, level, and square.
- All brace connections must be secured to prevent dislodging.
- Spacing of the panels or frames will be consistent throughout the scaffold being assembled.
- Frames and panels must be joined together vertically by coupling or stacking pins or equivalent means.
- Frames and panels must be locked together to prevent uplift, where uplift can occur. Uplift is the separation of a frame from the frame below it.
- Employees must be able to safely access any level of a scaffold that is 2 feet above or below an access point.

- OSHA standards specifically forbid climbing cross-braces as a means of access.
- The scaffold competent person is responsible for determining the safety and feasibility of installing and using safe means of access, based on site conditions and the type of scaffold involved.
- Each platform must be fully planked or decked between the front uprights and the guardrail supports.
- Platforms used solely as walkways, or during erection or dismantling, require only the planking that the competent person establishes is necessary to provide safe working conditions.
- No gaps greater than 1 inch are permitted between adjacent planks or deck units, or between the platform and the uprights, unless the competent person can demonstrate that a wider space is necessary. In such cases, the gap will be as small as possible and not exceed 9.5 inches.
- Wooden planking must not be covered with opaque finishes, except that platform edges may be marked for identification. Platforms may be coated periodically with wood preservatives, fire retardants, and slip-resistant finishes, provided they do not obscure the top or bottom wood surfaces.
- Scaffold platforms and walkways must be at least 18 inches wide, unless they are used in areas that are so narrow that they must be less than 18 inches wide. In such cases, the platforms must be as wide as feasible, and fall protection must be provided.
- Nothing that could cause a slip, trip or fall (i.e. tools, scrap material, chemicals, snow, ice, etc.) is allowed to accumulate on the platform.
- All planking will be Scaffold Grade as recognized by grading rules for the species of wood used.
- Scaffolds and scaffold components must be inspected for visible defects before each shift by a competent person, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane).
- Any part of a scaffold that has been damaged or weakened so that it no longer meets OSHA strength requirements must either be repaired, replaced, braced, or removed from service by the competent person.

1.5 Suspended Scaffolding

- The safe use of a suspended scaffold begins with secure anchorage. The weight of the scaffold and its occupants must be supported by both the structure to which it is attached and by each of the scaffold components that make up the anchorage system. These components include:
    - Tiebacks

  - Counter weights
  - Direct Connections

- A scaffold competent person must evaluate all direct connections, tiebacks, and counter weights, *prior to use* to confirm that the supporting surfaces are able to support the imposed load. Because the platform is the work area of a suspended scaffold, an inspection requires safety checks of both the platform structure and how the platform is used by the scaffold competent person. GEI employees should confirm with the scaffold competent person that the checks have been performed prior to scaffold use.
- Adjustable suspension scaffolds are designed to be raised and lowered while occupied by workers and materials, and must be capable of bearing their load whether stationary or in motion.
- Scaffolds and scaffold components must be capable of supporting, without failure, their own weight and at least four times their maximum intended load.
- Each suspension rope, including connecting hardware, must be capable of supporting, without failure, at least six times the maximum intended load applied to that rope while the scaffold is operating at the greater of either:
  - the rated load of the hoist, or
  - two times the stall load of the hoist
- Scaffolds will be altered only under the supervision and direction of a competent person.
- Employees must be able to safely access any level of a scaffold that is 2 feet above or below an access point.
- Direct access to or from another surface is permitted only when the scaffold is not more than 14 inches horizontally and not more than 24 inches vertically from the other surface.
- For two-point adjustable suspension scaffolds, access to one platform from another may only take place when the platforms:
  - are the same height
  - are abutting
  - have walk-through stirrups specifically designed for that purpose
- Fall protection consists of either personal fall arrest systems or guardrail systems, and must be provided on any scaffold 10 feet or more above a lower level (two-point scaffolds require both personal fall arrest systems and guardrail systems). This is especially critical with suspended scaffolds, because they often are operated at extreme elevations.
- Even if a suspended scaffold has been assembled in compliance with every applicable standard, GEI employees must exercise caution and use sound work practices to assure their safety. Extreme weather, excessive loads, or damage to structural components can all affect a scaffold's stability.

- A competent person must evaluate all direct connections prior to use to confirm that the supporting surfaces are able to support the imposed load.
- All suspension scaffolds must be tied or otherwise secured to prevent them from swaying, as determined by a scaffold competent person.
- A scaffold competent person must inspect ropes for defects *prior to each work-shift* and *after every occurrence that could affect a rope's integrity*.
- When lanyards are connected to horizontal lifelines or structural members on single-point or two-point adjustable scaffolds, the scaffold must have additional independent support lines equal in number and strength to the suspension lines and have automatic locking devices.
- Emergency escape and rescue devices must not be used as working platforms, unless designed to function as suspension scaffolds and emergency systems.

1.6 Inspections

All scaffolds and their components will be thoroughly inspected, prior to use, by a scaffold competent person before each erection to ensure the soundness of the scaffold. GEI employees may not act as the scaffold competent person. At a minimum:

- The scaffold competent person will supervise the erection, modification, and disassembly of scaffolds.
- A visual inspection will be made of all tubular components by the competent person. All foreign objects on the inside of the tubular part will be removed. If the object cannot be moved, the part will not be used.
- The exterior and interior of all legs, runners, braces, and bearers will be inspected by the competent person for corrosion. All corrosion found will be corrected. A professional engineer will verify that the part which contained the corrosion meets the design criteria after the corrosion has been removed. Components with corrosion should not be used since their strength is unknown.
- Before scaffold is erected, the surface of the proposed location will be inspected by the competent person for stability, level, potential obstructions, and electrical hazards.
- Erected scaffolds will be visually inspected by the competent person before each day's use and/or each work shift to insure a safe condition is maintained. All inspections will be documented.
- Unsafe equipment or conditions must be tagged out by a competent person, and must be complied with. When tags are used to document inspections by the competent person GEI employees will comply with the requirements of the tagging system. Scaffolds that have been tagged as unsafe by the competent person will not be used by GEI employees.

1.7 Training

GEI employees will have safety training prior to scaffolding use. If the training is taken outside of RedVector than a copy of the training certificate must be submitted to the Safety Team.

1.7.1 Scaffold Users

Scaffold users are those whose work requires them, at least some of the time, to be supported by scaffolding to access the area of a structure where that work is performed.

Each employee who performs work while on a scaffold is required to complete scaffold user training assigned by the Regional Health and Safety Officer (RHSO). The training will allow employees to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards. Training will include:

- The nature of any electrical hazards, fall hazards, and falling object hazards in the work area.
- The correct procedures for dealing with those hazards.
- The proper use of the scaffold and the proper handling of materials on the scaffold.
- The maximum intended load and the load-carrying capacity of the scaffold.
- Any other pertinent requirements.

GEI will retrain an employee when they have reason to believe that the employee lacks the skill or understanding to use a scaffold. Such retraining is required in at least the following situations:

- Changes at the worksite present a hazard for which an employee has not previously been trained.
- Changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard for which an employee has not previously been trained.
- Inadequacies in an affected employee’s work indicate that the employee has not retained the necessary proficiency.

1.8 Injury Reporting

If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and RHSO.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or supervisor/project manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the RHSO will conduct an investigation and evaluation on what happened and how and why it happened. The CHSO will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.9 Limitations

In addition to these procedures, follow all safety procedures as defined in the site-specific health and safety plan (HASP) and other GEI Health and Safety SOPs.

1.10 References

OSHA 29 CFR 1926.450 to 454 – Subpart L; Scaffolds

OSHA Scaffolding eTool - http://www.osha.gov/SLTC/etools/scaffolding/index.html

1.11 Attachments

None

1.12 Contact

Health&SafetyTeam@geiconsultants.com

1.13 Review History

- November 2016 rev 4
- November 2015 Rev 3
- May 2014 rev 2
- Created date unknown

STANDARD OPERATING PROCEDURES

SOP No. HS-025 Manual Lifting

1.1 Objective

The purpose of this Standard Operating Procedure (SOP) is to identify and reduce potential work-related musculoskeletal disorder (WMSD) hazards. The SOP is intended to comply with state regulations and safe work practices developed by the Occupational Safety and Health Administration (OSHA). Modifications to meet these requirements will be made to this program as changing laws or regulations dictate.

1.2 General

Lifting heavy items is one of the leading causes of injury in the workplace. Overexertion and cumulative trauma when lifting are significant factors for injuries. When employees use smart lifting practices and work in their "power zone", they are less likely to suffer from back sprains, muscle pulls, wrist/elbow/spinal and other injuries caused by lifting heavy objects. Common things to consider prior to lifting an object are: weight of the object, awkward postures, high-frequency and long duration lifting, inadequate handholds, and physical/environmental factors.

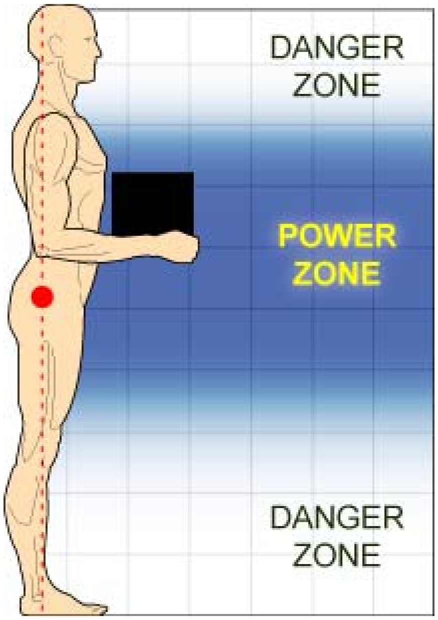


Figure 1: Lifting Power Zone

1.3 Safe Lifting Guidelines

The following safe lifting guidelines will be followed by employees involved in manual lifting activities:

- Before manual lifting is performed, a hazard assessment must be completed. The assessment must consider size, bulk, and weight of the object(s), if mechanical lifting equipment is required, if two-man lift is required, whether vision is obscured while carrying and the walking surface and path where the object is to be carried.
- Get a co-worker to help if equipment or other item is too heavy to lift.
- If possible, use powered equipment instead of manually lifting heavy materials. Lifting equipment such as dollies, hand trucks, lift-assist devices, jacks, or carts can be provided for employees.
- Reduce lifts from shoulder height and from floor height by repositioning the shelf or bin to closer to the power zone.
- Make sure walkways are clear of tripping hazards before moving materials.
- Use your legs and keep your back in a natural position while lifting. Keep the load close to your torso.

- Test the load to be lifted to estimate its weight, size, and bulk and to determine the proper lifting method.
- Do not twist while carrying a load. Instead, shift your feet and take small steps in the direction you want to turn.
- Make sure there are appropriately marked and sufficiently safe clearances for aisles and at loading docks or passageways where mechanical-handling equipment is used.
- Properly stack loose or unboxed materials which might fall from a pile by blocking, interlocking, or limiting the height of the pile to prevent falling hazards.
- Bags, containers, bundles, etc. should be stored in tiers that are stacked, blocked, interlocked, and limited in height so that they are stable and secure to prevent sliding or collapse.

- Storage areas should be kept free from accumulation of materials that could lead to tripping, fire, or explosion.
- Work methods and stations should be designed to minimize the distance between the person and the object being handled.

Supervisors should periodically evaluate work areas and employees' work techniques to assess the potential for and prevention of injuries. New operations should be evaluated to engineer out hazards before work processes are implemented.

1.4 Regulations

OSHA does not have a standard which sets limits on how much a person may lift or carry. They do however state that lifting loads heavier than about 50 pounds will increase the risk of injury.

The National Institute for Occupational Safety and Health (NIOSH) has developed a mathematical model that helps predict the risk of injury based on the weight being lifted and other criteria. The NIOSH model is based on previous medical research into the compressive forces needed to cause damage to bones and ligaments of the back. The mathematical model is incorporated in the *Applications Manual for the Revised NIOSH Lifting Equation*, which can be found on the NIOSH website (http://www.cdc.gov/niosh/docs/94-110/). It should be noted, however, that this NIOSH document provides only voluntary guidelines.

If there is a situation that arises where an employee is required to perform manual lifting on a reoccurring basis, the NIOSH Lifting Equation will be used to determine the appropriate weight that employee can safely lift. The lifting equation establishes a maximum load of 50 pounds for employees that are less likely to have to lift something, and don’t have to do any long distance travel or maneuvering of the item. This 50 pounds is then adjusted to account for:

- how often the employee is lifting
- twisting the back during lifting
- the vertical distance the load is lifted
- the distance of the load from the body
- the distance the employee must move while lifting the load
- how easy it is to hold onto the load

GEI uses 50 pounds as a standard. However each individual should not attempt to carry loads heavier than they can safely manage.

1.5 Training

Training will include general principles of ergonomics, correct manual lifting techniques to avoid musculoskeletal injuries, recognition of hazards and injuries, procedures for reporting hazardous conditions, and methods and procedures for early reporting of injuries.

1.6 Lifting Assistance

If employees are assigned a task that involves repetitive lifting and carrying of equipment the Safety Team and Project Manager should be contacted to conduct an ergonomic evaluation. The task should be discussed to determine if there is an alternative method that can be used. The alternative method should institute an engineering or administrative control to reduce/limit the amount of lifting that is required of the employee. Some examples include providing smaller containers to reduce the weight of what needs to be lifted; providing a device that helps carry awkwardly-shaped objects easier; or using a winch, fork lift, or other device to lift the item(s) for the employee.

1.7 Injury Reporting

Injuries experienced during manual lifting activities should receive prompt medical attention. If a GEI employee suffers an injury on the job that is not life threating, call Medcor Triage at 1-800-775-5866 to speak with a medical professional. Then, immediately report the injury to the Supervisor/Project Manager and Regional Health and Safety Officer.

After verbal notification has been made, an Incident Report Form is to be completed by the employee and/or Supervisor/Project Manager and submitted to the People & Safety Team immediately following care of the incident. This form is available on the Safety App (smart phones) and on the Safety page on the GEI intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident Report Form, the Regional Health & Safety Officer (RHSO) will conduct an investigation and evaluation on what happened and how and why it happened. The Corporate Health & Safety Officer (CHSO) will then recommend (as necessary) engineering controls, personal protection equipment, training or other appropriate measures to minimize the potential for future musculoskeletal injuries. The CHSO/RHSO may develop educational information based on lessons learned for distribution to GEI employees.

1.8 Limitations

Follow safety procedures for manual lifting.

1.9 References

OSHA Technical Manual (OTM), Section VII: Chapter 1 - Back Disorders and Injuries

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=29936 (Viewed 7/12/2016)

https://www.osha.gov/SLTC/etools/electricalcontractors/materials/heavy.html (Viewed 7/12/2016)

1.10 Attachments

None

1.11 Contact

Health&SafetyTeam@geiconsultants.com

1.12 Review History

- July 2016
- August 2014

STANDARD OPERATING PROCEDURE

SG-001 General Guidance on Soil Vapor Intrusion Evaluations

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1. Objective

The goal of a soil vapor intrusion evaluation is to assess whether complete exposure pathways of soil vapor to indoor air exist. A complete exposure pathway exists if vapors from constituents are migrating through various pathways into residential or commercial buildings at concentrations that may result in an unacceptable human health risk. If a complete exposure pathway does not exist, then further assessment of soil vapor intrusion is not required.

Depending on the status of investigation performed at the site it may be appropriate to approach an evaluation of soil vapor intrusion at different tiers. If little work has been performed relative to the potential for contaminants to affect soil vapor near a structure, then a screening level assessment is an appropriate first step. However, if a plume is well delineated and the potential for groundwater impacts, or nearby source material, to affect soil vapor near a potential receptor structure is well understood, then it may be more appropriate to directly develop and implement a soil vapor and/or indoor air sampling plan. To accommodate the potential varied states of knowledge when a vapor intrusion evaluation is required, a flexible approach is needed that incorporates the following elements.

- SOP SG-002 Soil Vapor Sample Collection
- SOP SG-003 Sub-Slab Soil Vapor Collection
- Indoor Air Sampling
- SOP SG-004 Ambient Air Sample Collection

Soil vapor intrusion evaluations should be approached on a site-specific basis and depending on the site-specific setting and proximity to impacted groundwater or source material, it may be appropriate to proceed in a hierarchical fashion through each tier of evaluation or a variety of tiers may be combined and implemented simultaneously. The SOPs presented in this SOP address each of these sampling procedures.

2. Execution

2.1. Implementation Triggers

Soil vapor intrusion evaluations may be implemented at various times based on event triggers throughout the Site Characterization (SC), Remedial Investigation (RI), and site remedial action plan. The following event triggers would require the implementation of this soil vapor intrusion investigation.

- Identification of a potential complete exposure pathway
- Private property owner request for sampling

- State or Federal administrative order

2.2. Factors Affecting Soil Vapor Intrusion

Prior to conducting a soil vapor intrusion assessment at a private property, an analysis of the factors contributing to the migration of soil vapor to indoor air should be conducted. The completion of this analysis should take into account the two types of factors: environmental and building factors.

2.2.1. Environmental Factors

Environmental factors include site specific conditions in the subsurface and above the ground surface that may affect the rate and direction at which soil vapor may migrate.

The soil and groundwater conditions between the contamination and the residential/commercial building should be evaluated and recorded in any soil vapor intrusion investigation. If the SC/RI has been completed, then the data are available for this review. If the SC/RI has not been completed, then at a minimum the nature and extent of impacted soil and/or groundwater between the site and the residential/commercial building should be defined.

After compiling the necessary site-specific data, that information should be reviewed to determine groundwater conditions at the site. The potential for man-made or natural preferential pathways for vapor migration in the vadose zone and/or for groundwater migration in the saturated zone should also be determined at this time.

- The depth to groundwater below the residential or commercial building will be determined. For example, in cases where groundwater intersects the foundation there is no vadose zone to collect a sub-slab sample. In cases where the groundwater is close to the foundation, there is a risk of causing/exacerbating groundwater intrusion through the foundation during periods of high groundwater.

Additional Site Observations

- Direction of groundwater flow from the contaminant source to the residential or commercial building;
- The location, depth, extent, and concentration of potential constituents in unsaturated soil and groundwater on the property; and,
- Presence of an overlying water bearing zone that does not have impacts beneath the residential or commercial building. An un-impacted shallow water zone will significantly retard or completely prohibit the potential for deeper impacted groundwater to affect soil vapor.
- Potential “smear zones” (residual non-aqueous phase liquid (NAPL) present at depths over which the water table fluctuates) should also be identified as they may also affect the rate of soil vapor migration.
- Location, depth, extent of NAPL, if present.

Soils which are highly organic, wet, and/or of low permeability should be identified. If these soils are present beneath a structure and above impacted groundwater or soil, they may effectively shield the building from potential vapor intrusion. Conversely, dry and porous soils underlying a building may provide a less inhibited soil vapor intrusion pathway. The limits of backfill surrounding residential or commercial building should be also noted.

2.2.2. Building Factors

Building Factors include the physical characteristics, such as structure, floor layout, air flow, and physical conditions. These conditions will be documented during the evaluation. The New York State Department of Health (NYSDOH) Center for Environmental Health's Indoor Air Quality Questionnaire and Building Inventory form is presented in Attachment A. At a minimum, the following information should be recorded.

- Building foundation construction characteristics (basement, footers, crawl spaces, etc), including potential preferential vapor intrusion pathways such as foundations cracks and utility penetrations.
- Basement wall materials (hollow block, stone, or poured concrete, etc.)
- Presence of an attached garage.
- Recent renovations to the building such as new paint or new carpet.
- Mechanical heating/cooling equipment that may affect air flow.
- Use and storage of petroleum products such as home heating oil storage tanks, underground storage tanks (USTs), or kerosene heaters.
- Recent use of petroleum-based finish or other products containing volatile organic compounds (VOCs).
- Areas of pavement on the property should also be identified in the event sub slab vapor sampling is not feasible or appropriate due to a high groundwater table. Paved areas could serve as surrogate locations in lieu of sub slab soil vapor sampling if high water table conditions exist.

The construction materials and integrity of the floor of the structure closest to the potential point of entry for soil vapor (basement level or first floor for slab-on-grade constructions) should be identified. In addition to the foundation type and integrity, this survey should note any preferential pathways (utility lines/pipes, sumps, etc.) that may exist within the bottom-most level of the structure.

The operation and presence of heating systems, including fireplaces and clothes dryers, may create a pressure differential between the structure and the outside environment, causing an increase of migration of soil vapor into the building. The NYSDOH guidance document suggests limiting indoor air sampling to the heating season (with the exception of immediate inhalation hazard situations), which is roughly defined as November 15th to March 31st. However, sampling may be completed at any time during the year for any sampling completed in response to a request by a community member. In situations where non-heating season sampling has taken place, consideration should be given to re-sampling the property within the heating season. The operation of HVAC systems should be noted on the building inventory form (Attachment A).

During the initial building assessment and visit, and again when sub-slab soil vapor and/or indoor air sampling are performed, differential pressure measurements between indoor air, ambient air, and soil vapor should be collected and recorded to document the potential effect building conditions have on soil vapor migration.

2.2.3. Property Visit

A property visit will be conducted prior to sampling. During the site visit, technical representatives will complete site visit observations, inventories and occupant questionnaire forms (Appendix A). During the course of the interview, observations will be made to identify any potential areas or issues of concern or the presence of any odors, and if sampling appears necessary, identify potential sampling points and general building characteristics. The questionnaire is also used to identify potential sources and activities that may interfere with sampling results. The questionnaire will specifically address the activities of the occupant's (e.g., smoking, work place activities) that may contribute to indoor air concentrations of volatile chemicals.

The responses to the questionnaire will be evaluated and a determination will be made as to whether additional investigation is required.

2.2.4. Chemical Inventory

The chemical inventory complements the identification of the building factors affecting soil vapor intrusion. The chemical inventory will identify the occurrence and use of chemicals and products throughout the building. These products can be used to develop an indoor environmental profile. A separate inventory should be prepared for each room on the floor being tested as well as any other indoor areas physically connected to the areas being tested. Inventories will include product names, chemical ingredients, or both. If possible, photographs of the products should be taken of the location and condition of the inventoried products and the photographic records should be indexed with the inventory records. The products inventory can also be used to document odors and if possible portable vapor monitoring equipment measurements should be taken and recorded. A product inventory will be repeated prior to each round of testing at the building. If available, the volatile ingredients should be recorded for each product. If the ingredients are not listed on the label, record the manufacturer's name and address or phone number if available. The product inventory form is presented in Attachment A.

2.2.5. Water Table Conditions and Vapor Intrusion Assessment Approach

Sub-slab soil vapor sampling is intended to evaluate the potential for vapor intrusion. However, there are circumstances where collection of sub-slab soil vapor samples may not be feasible if the water table is near, at, or above the elevation of a buildings foundation slab. An evaluation of the water table elevation relative to the building slab should be made before attempting to install a sub-slab vapor sampling point.

If the water table is found to be sufficiently below the building slab and sub-slab vapor sampling can be performed, then the following Low Water Table Scenario should be followed.

2.2.5.1. Low Water Table Scenario

If the water table elevation is lower than the basement slab, then the following samples should be collected.

- Sub-slab soil vapor samples
- Indoor air samples from basement level
- Indoor air samples from main living space (First floor)
- Outdoor ambient air sample

If the water table is deemed to be at too high of an elevation to allow sub-slab vapor sampling, then alternate means of evaluating the potential for vapor intrusion must be employed. If a building has a groundwater sump, the sump should be evaluated to determine if there is water present in the sump and if that water is representative of groundwater or if the water is stagnant. If water in the sump represents groundwater, then a sample from the sump should be collected. The High Water Scenario below summarizes the methods to evaluate potential vapor intrusion if sub-slab vapor sampling cannot be conducted due to high groundwater conditions.

2.2.5.2. High Water Table Scenario

If the water table elevation is higher than the basement slab, then the following tasks should be performed.

- Determine if a sump pump is present and actively pumping water.
- If sump is actively pumping, collect a sample of groundwater from the sump.
- Collect an indoor air sample from basement level.
- Collect an indoor air sample from main living space (first floor).
- Identify exterior soil vapor sample location near foundation (outside of foundation backfill) and preferably beneath a surrogate vapor cap (e.g. paved driveway, patio).
- Collect soil vapor samples from exterior soil vapor location
- Collect an outdoor ambient air sample.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

4. Attachments

Attachment A - NYSDOH Center for Environmental Health's Indoor Air Quality Questionnaire and Building Inventory Form

5. Contact

Chris Berotti

ATTACHMENT A

Off-Site Property Sampling Documentation Form

Property Location/Address: ______________________________

Property: _____________________________

Sampling Date: _____________________________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Preparer's Name: _______________________________ Date/Time Prepared: _____________
Preparer's Affiliation: _______________________________ Phone No.: _________________
Purpose of Investigation:____

1. OCCUPANT Interviewed: Yes ☐ No ☐

Last Name: ____________________________ First Name: ___________________________
Address: ____
County: _______________________
Home Phone: __________________________ Office Phone: _________________________
Number of Occupants/persons at this location _______ Age of Occupants_________________

2. OWNER OR LANDLORD (Check if same as occupant __) Interviewed: Yes ☐ No ☐

Last Name: ____________________________ First Name: ___________________________
Address: ____
County: _______________________
Home Phone: __________________________ Office Phone: _________________________

3. CONTACT NAME (Check if same as Occupant ____, Owner ____)

Last Name: ____________________________ First Name: ___________________________
Address: ____
County: _______________________
Home Phone: __________________________ Office Phone: _________________________

4. PROPERTY LOCATION: ____

Relative to Site:
Direction _________ Direction to Nearest Cross Street: _________
Distance _________ Distance to Nearest Cross Street: _________

Surrounding Land Use:
North: ________________ East: ________________
South: ________________ West: ________________

Property Location/Address: ____________________________
Property: ___________________________
Sampling Date: ___________________________

5. PROPERTY BOUNDARIES

Delineate the boundaries of the property (on a separate project map, outline property location, private well location, septic/leachfield location, groundwater flow, compass direction, windrose.)

6. BUILDING CONSTRUCTION

Type of Building (Circle appropriate response)

Residential
Industrial
School
Church
Commercial/Multi-use
Other: _________________

If the property is residential, type? (Circle appropriate response)

Ranch
Raised Ranch
Cape Cod
Duplex
Modular
2-Family
Split Level
Contemporary
Apartment House
Log Home
3-Family
Colonial
Mobile Home
Townhouses/Condos
Other:_______________

If multiple units, how many? ________

If the property is commercial, type?

Business Type(s) _____________________________________

Does it include residences (i.e., multi-use)? Yes ☐ No ☐

If yes, how many? ______

Other characteristics:

Number of floors______ Building age______

Is the building insulated? Yes ☐ No ☐ How air tight? Tight / Average / Not Tight

Construction Material ___________________________________

7. BASEMENT AND CONSTRUCTION CHARACTERISTICS

Does the building have a basement and/or crawl space, or is it slab-on-grade construction?

____

Describe the construction of the basement/crawl space (Circle all that apply)

a. Above grade construction: wood frame concrete stone brick
b. Basement type: full crawlspace slab other ________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

c. Basement floor:	concrete	dirt	stone	other ________
d. Basement floor surface:	uncovered	covered	covered with ____________	
e. Concrete floor:	unsealed	sealed	sealed with _____________	
	unpainted	painted	painted with ____________	
f. Foundation walls:	poured	block	stone	other ________
g. Foundation walls:	unsealed	sealed	sealed with _____________	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	

Does your basement have a sump? Yes ☐ No ☐

Is, is there water in the sump? Yes ☐ No ☐

Describe sump conditions:____

____

Have you observed standing water in your basement? Yes ☐ No ☐

If so, what is the frequency of this observation? _____________During rain events? ☐

Have you observed sheen atop the standing water? Yes ☐ No ☐

Basement/Lowest level depth below grade: ________(feet)

Are there any cracks in the floor of your basement? Yes ☐ No ☐

Description: ____

____

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

Description: ____

____

What activities occur in the finished basement?

Description: ____

____

Approximately how many hours per day (or week) do you spend in your basement? __________

8. HEATING, VENTING AND AIR CONDITIONING

Type of heating system(s) used in building: (Circle all that apply – note primary)

Property Location/Address: ______________________________
Property: ______________________________
Sampling Date: ______________________________

Hot Air Circulation
Electric Baseboard
Space Heaters
Hot Water Baseboard
Heat Pump
Radiant Floor
Steam Radiation
Wood Stove
Outdoor wood boiler
Unvented Kerosene Heater
Other ______________________________

The primary type of fuel used is:

Fuel Oil
Kerosene
Wood
Natural Gas
Propane
Coal
Electric
Solar
Other? ____________________

Time of use of each type of heating? ____

Domestic hot water tank fueled by: ____

Boiler/furnace located in: Basement Outdoors Main Floor Other________________

Air conditioning: Central Air Window units Open Windows None

Are there air distribution ducts present? Yes ☐ No ☐

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

____

____

____

____

Type of insulation (e.g. blown, fiber, etc.)? ____

Does building have energy efficient windows (e.g. double paned) Yes ☐ No ☐

Was weather-stripping recently added/upgraded? Yes ☐ No ☐

Particleboard used in construction? Yes ☐ No ☐

9. OCCUPANCY

Property Location/Address: ______________________________
Property: ____________________________
Sampling Date: ____________________________

Level	General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage)
Basement	____
1st Floor	____
2nd Floor	____
3rd Floor	____
4th Floor	____

10. BULK PETROLEUM STORAGE

Aboveground storage tank on the property Yes ☐ No ☐

If yes, how old is tank? ________________ Condition? ___________________

Last inspected? ________________ Location: _____________________

Describe conduits to building (type, location, and entry portal condition): __________________

____

Underground storage tank on the property. Yes ☐ No ☐

If yes, how old is tank? ________________ Condition? ___________________

Last inspected? ________________ Location: _____________________

Describe conduits to building (type, location, and entry portal condition): __________________

____

11. WATER AND SEWAGE

Water Supply:

Public Water Drilled Well Driven Well Dug Well Other _______________

Is there use of groundwater water for irrigation purposes? Yes ☐ No ☐

Sewage Disposal:

Public Sewer Septic Tank Leach Field Dry Well Other _______________

12. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Yes ☐ No ☐

If not, is there a separate garage or carport? Yes ☐ No ☐

b. Does the garage have a separate heating unit? Yes ☐ No ☐ NA ☐

Property Location/Address: ______________________________
Property: ______________________________
Sampling Date: ______________________________

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, ATV, car)

Yes ☐ No ☐ NA ☐ Please specify__________________

Is gasoline stored in the garage? Yes ☐ No ☐

Quantity? ________________

d. Has the building ever had a fire? Yes ☐ No ☐

When?_________________

e. Is a kerosene or unvented gas space heater present? Yes ☐ No ☐

Where? ________________

f. Is there a workshop or hobby/craft area? Yes ☐ No ☐

Where & Type? ________________

g. Is there smoking in the building? Yes ☐ No ☐

How frequently? _______________

h. Have cleaning products been used recently? Yes ☐ No ☐

When & Type? ________________

i. Have cosmetic products been used recently? Yes ☐ No ☐

When & Type? ________________

j. Has painting/staining been done in the last 6 months? Yes ☐ No ☐

Where & When? _______________

Is house paint stored inside? Yes ☐ No ☐

Where? _______________

k. Is there new carpet, drapes or other textiles? Yes ☐ No ☐

Where & When? _______________

l. Have air fresheners been used recently? Yes ☐ No ☐

When & Type? ________________

m. Is there a kitchen exhaust fan? Yes ☐ No ☐

If yes, where vented?____________

n. Is there a bathroom exhaust fan? Yes ☐ No ☐

If yes, where vented?____________

o. Is there a clothes dryer? Yes ☐ No ☐

If yes, is it vented outside? Yes ☐ No ☐

p. Has there been a pesticide/chemical fertilizer application? Yes ☐ No ☐

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

When & Type?____

Conducted by Owner or Private Yard Service ___________________________

Is yard waste/trash burned on-site? Yes ☐ No ☐

Do any of the building occupants use solvents at work? Yes ☐ No ☐

(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? ____

If yes, are their clothes washed at work? Yes ☐ No ☐

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, Use dry-cleaning regularly (weekly)
Use dry-cleaning infrequently (monthly or less)
Yes, work at a dry-cleaning service
No
Unknown

Is there a radon mitigation system for the building/structure? Yes ☐ No ☐

Date of Installation: ____________

Is the system active or passive? Active ☐ Passive ☐

Are there any recent/past improvements to building? Yes ☐ No ☐

Interior painting? ____

Any landscaping improvements that involved bringing fill on site? Yes ☐ No ☐

Other ____

Approximately when (how long ago) did these improvements occur? ______________

Does anyone living here engage in any of the following activities or hobbies?

a. Art projects (e.g. oil painting, ceramics, pottery, stained glass, metal sculpture)

Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________
Name: ____________________________ Age: _________ Sex: _____________

Property Location/Address: ____________________________
Property: ___________________________
Sampling Date: ___________________________

b. Furniture refinishing Yes ☐ No ☐

Name: ______________________________ Age: _________ Sex: ______________

Name: ______________________________ Age: _________ Sex: ______________

c. Model building(e.g. planes,boats,cars) Yes ☐ No ☐

Name: ______________________________ Age: _________ Sex: ______________

Name: ______________________________ Age: _________ Sex: ______________

d. Gardening Yes ☐ No ☐

Name: ______________________________ Age: _________ Sex: ______________

Name: ______________________________ Age: _________ Sex: ______________

e. Automotive work Yes ☐ No ☐

Name: ______________________________ Age: _________ Sex: ______________

Name: ______________________________ Age: _________ Sex: ______________

f. Ammunition reloading Yes ☐ No ☐

Name: ______________________________ Age: _________ Sex: ______________

Name: ______________________________ Age: _________ Sex: ______________

Is there a wood burning stove? Yes ☐ No ☐

If so, how frequently is it used?

____

____

Is there a barbeque grill? Yes ☐ No ☐

If so, how frequently is it used? What is the type of fuel?

____

____

Has the building ever had fumigation? Yes ☐ No ☐

Property Location/Address: ____________________________
Property: ___________________________
Sampling Date: ___________________________

If so, when and how frequently? Type?

____

____

13. ODOR SUMMARY

Have the occupants observed any unusual odors? ________________________________

____

____

____

____

History of odor observation – date of onset, duration, severity, etc.

____

____

____

____

____

____

____

14. PRODUCT INVENTORY

Record the specific products found in building that have the potential to affect indoor air quality on the attached product inventory form.

15. INDOOR SKETCH

Draw a plan view sketch (on grid paper) of the basement, first floor, and any other floor where sampling was conducted in the building as well as any outdoor sample locations. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Property Location/Address: ______________________________
Property: ______________________________
Sampling Date: ______________________________

Product Inventory
Off-Site Property Sampling Documentation
Soil Vapor Intrusion Investigation

Property Address:	**Performed by:**
Date of Inventory:	**Field Instrument Make & Model:**

Location	**Product Description**	**Size (units)**	**Condition ***	**Chemical Ingredients**	**Field Instrument Reading (units)**	**Photo ** Y/N**

Notes

* Describe the condition of the product containers as Unopened (UO), Used (U), or Deteriorated (D)

** Photographs of the front and back of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

STANDARD OPERATING PROCEDURE

SG-002 Soil Vapor Sample Collection

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1. Objective

This procedure outlines the general steps to collect soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary soil vapor probes should be installed using the procedures outlined below. All soil vapor probes should be installed using a direct-push drill rig (e.g., Geoprobe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

Document pertinent field conditions prior to installation of any probe points.

- Record weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North);
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Soil Vapor Point Installation Specifications

Each soil vapor point should be constructed as follows:

- Six-inch stainless steel Geoprobe® AT86 series Permanent Implants (soil vapor screens) or equivalent and threaded to an (expendable) stainless steel anchor point.
- The implants should be fitted with inert Teflon or stainless steel tubing of laboratory or food grade quality.
- The annular space surrounding the vapor screen interval and a minimum of 6-inches above the top of the screen should be filled with a porous backfill

material (e.g., glass beads or coarse silica sand) to create a sampling zone 1 foot in length.

For temporary points, a hydrated bentonite surface seal should be created at the surface to minimize infiltration. For permanent points, the additional measures described below should be included.

- The soil vapor points should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet (or to grade, whichever is smaller) to prevent ambient air infiltration.
- If needed, the remainder of the borehole should be backfilled with clean material.
- A protective casing should be set around the top of the point tubing and grouted in place to the top of the bentonite to minimize infiltration of water or ambient air, as well as to prevent accidental damage to the soil vapor point.
- The tubing top should be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

2.3. Soil Vapor Sample Collection

Soil vapor samples should be collected as indicated in the work plan and in accordance with applicable state or federal guidance documents. Specifically, samples from the points should be collected as follows:

- Permanent soil vapor points should not be sampled or purged for a minimum of 24 hours after installation. Temporary points may be purged and sampled immediately following installation.
- Document pertinent field conditions prior to sampling as described above.
- A suction pump should be used to remove a minimum of three implant volumes from the soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute.
- Samples should be collected for volatile organic compounds (VOCs) in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate should not exceed 0.2 liters per minute.
- A helium tracer gas should be used to identify any potential migration or short circuiting of ambient air during sampling as described below.
- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing

laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.

- Connect the tubing from the soil vapor probe to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample should be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- All laboratory analytical data should be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

2.4. Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the soil vapor probe seal and assess the potential for introduction of ambient air into the soil vapor sample.

A tracer gas evaluation should be conducted on the each temporary soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent soil vapor probe during the initial sampling event and a minimum of 10% of the soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

Retain the tracer gas around the sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.

- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber should have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >10%.
- The chamber should have a gas-tight fitting or sealable penetration to allow the soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that should be pre-calibrated to extract soil vapor at a rate of no more than 0.2 liters per minute. Purge the tubing using the pump. Calculate the volume of air in the tubing and probe and purge one to three tubing/probe volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary.

If the evaluation on a probe indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement subsequent sample collection.

A non-detectable level of tracer gas is preferred, however, if the evaluation on a probe indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

4. Contact

Chris Berotti

STANDARD OPERATING PROCEDURE

SG-003 Sub-slab Soil Vapor Collection

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1. Objective

This procedure outlines the general steps to collect sub-slab soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary sub-slab soil vapor probes will be installed using the procedures outlined below. All sub-slab soil vapor probes will be installed using a direct-push drill rig (e.g., Geoprobe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

Document pertinent field conditions prior to installation of any probe locations.

- Record weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours. Record the indoor conditions (temperature, heating/cooling system active, windows open/closed, etc.).
- Measure the differential pressure at the building. Measure the indoor and outdoor barometric pressure using a high resolution device. Where possible, measure the sub-slab barometric pressure at the sampling point.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Indoor floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, heating, ventilating and air conditioning (HVAC) system air supply and return registers, compass orientation (North), footings that create separate foundation sections, and any other pertinent information should be completed;
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sub-Slab Soil Vapor Point Installation Specifications

Each sub-slab soil vapor point will be constructed as follows:

- Drill an approximately 3/8-inch hole through the slab. If necessary, advance the drill bit 2-3 inches into the sub-slab material to create an open cavity.
- Using dedicated inert Teflon or stainless steel tubing of laboratory or food grade quality, insert the inlet of the tubing to the specified depth below the slab. For permanent installation, only stainless steel tubing and fittings will be used.
- For permanent point installations, the annular space surrounding the vapor probe tip will be filled with a porous backfill material (e.g., glass beads or coarse silica sand) to cover 1-inch of the above the tip of the probe.
- Seal the annular space between the hole and the tubing using an inert non-shrinking sealant such as melted 100% beeswax, permagum grout, putty, etc. For permanent installations, cement may be used.
- For permanent points, a protective casing will be set around the top of the point tubing and grouted in place minimize infiltration of water or ambient air, as well as to prevent accidental damage to he permanent point.
- The tubing top will be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

In cases where sub-slab sampling is impractical or infeasible, a surrogate location (attached garage, concrete patio, asphalt driveway, etc.) may be used if it is representative of sub-slab conditions. In surrogate locations, the vapor sampling point may be installed in accordance with SOP SG-002 Soil Vapor Collection.

2.3. Sub-Slab Soil Vapor Sample Collection

Sub-slab soil vapor samples will be collected as indicated in the site-specific Sampling and Analysis Work Plan and in accordance with state or Federal guidance documents. Specifically, sub-slab samples from the points will be collected as follows:

- Document pertinent field conditions prior to sampling as described above.
- A suction pump will be used to remove one to three implant volumes from the sub-slab soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute.
- Samples will be collected in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate will not exceed 0.2 liters per minute.
- A helium tracer gas will be used to identify any potential migration or short circuiting of ambient air during sampling as described below.

- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.
- Connect the tubing from the sub-slab soil vapor probe to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples will be analyzed for volatile organic compounds (VOCs) and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

2.4. Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the sub-slab soil vapor probe seal and assess the potential for introduction of indoor air into the sub-slab soil vapor sample. A tracer gas evaluation should be conducted on the each temporary sub-slab soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent sub-slab soil vapor probe during the initial sampling event and a minimum of 10% of the sub-slab soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

- Retain the tracer gas around the sub-slab sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >10%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the sub-slab soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract sub-slab soil vapor at a rate of no more than 0.2 lpm. Purge the tubing using the pump. Calculate the volume of air in the tubing and purge one to three tubing volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation will be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary:

If the evaluation on a probe indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement subsequent sample collection.

A non-detectable level of tracer gas is preferred; however, if the evaluation on a probe indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

4. Contact

Chris Berotti

STANDARD OPERATING PROCEDURE

SG-004 Ambient Air Sample Collection

1. Objective

Describe procedures to collect ambient air samples. The site-specific Work Plan should be consulted for proposed sample locations and sampling duration.

2. Execution

2.1. Document Field Conditions

Document pertinent field conditions prior to sample collection:

- Record weather information, if available (such as precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for at least the past 12 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North).
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sample Collection

- Samples should be collected in laboratory-certified clean SUMMA® canister (or equivalent) using a flow controller calibrated for the anticipated sample duration (1-hour, 8-hour, etc.). The regulator flow rate should not exceed 0.2 liters per minute.
- Place the canister at the sampling location. If the sample is collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet should be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.

- Connect the tubing to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- If possible, monitor the vacuum pressure in the canister routinely during sampling. During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, call the laboratory and discuss the sample viability with them. Determine whether another sample will be taken after sharing the laboratory's opinion with your project manager.
- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

4. Contacts

Chris Berotti
Bill Simons

STANDARD OPERATING PROCEDURE

SI-002 Ozone System Inspection

---

1. Objective

The purpose of this Standard Operating Procedure (SOP) is to identify key procedures needed to maintain maximum system uptime of the ozone injection and soil vapor extraction (SVE) systems, and to ensure the system inspections are conducted safely.

2. Important Documents

- The system operator should be familiar with the documents listed below prior to conducting system inspections or maintenance on the system.
- System Operations Maintenance and Monitoring (OM&M) Plan – This is a site-specific document. This document specifies inspection schedules, analytical monitoring schedules, and specific inspection procedures.
- Manufacturer's Owner's Manual – This is a system specific document created by the manufacturer. This document contains system component information, maintenance and troubleshooting information, and instructions on how to use the system control logic. A copy of this document is retained at the Ozone Building.
- Training Videos – System training videos are available and located on GEIs network under the link below:

H:\TECH\project\Keyspan\BayShore\OU-1Ozone System\Training\Training Videos

3. System Process

- The ozone Injection system is designed to generate a 1-3 percent ozone gas mixture and sparge it directly into the subsurface through a series of stainless steel injection wells**.**
- Compressed air is first generated by a compressor. The compressed air is then passed through a series of filters before it is dried and cooled by a refrigerated dryer and a desiccant dryer, effectively bringing the dew point down to a maximum of -70 degrees Fahrenheit. The compressed air is then passed through the ozone generator where the ozone concentration is increased to 1 to 3 percent ozone gas mixture. The injection process is controlled by the human machine interface (HMI), three remote system manifolds, solenoid valves, and the control logic.

- A SVE system is also in place to capture any fugitive ozone gas or impacted soil vapor. The system consists of 11 soil vapor extraction laterals spaced throughout the injection well field. Vacuum is applied by the regenerative blower. The extracted vapor is passed through the blower and through two 500-pound carbon vessels and an ozone destruct unit prior to discharge through the stack.
- There are two identical system trains in place for both the SVE and ozone injection system. If one system goes down the other system will automatically start, maintaining near 100 percent system uptime.

4. System Components

- System components for a complete system train are listed below. The operator should reference the manufactures Owners Manual for details on each component.
- Ozone Injection System
- Kaeser Rotary SX-6 Screw Air Compressor
- Coalescing Filter (x2)
- Particulate Filter (x2)
- Condensate Filter
- Kaeser refrigerated dryer
- Kaeser desiccant dryer
- Cold Shot Split Water Chiller
- Ozonia Ozone Generator
- Ozone Delivery Manifold
- Ozone Compressor Pumps
- Remote system manifolds (x3)
- Injection Control Logic – HMI
- SVE System
- Rentron Regenerative Blower
- 240 gallon moisture separator
- 500 pound TetraSolve Granular Activated Carbon Vessel (x2)
- 250 pound TetraSolve Liquid Granular Activated Carbon Vessel (x2)
- Swhift Ozone Destruct Unit
- 11 SVE Laterals
- 1 Exterior SVE Manifold

5. System Inspections

The SVE system and the ozone injection system are monitored at least once per week to confirm that the systems are operating according to design and manufacture.

The inspections include:

- Inspection of the mechanical components.
- Recording of the operational pressures, temperatures, flow rates, and operational hours of the system components. These values should be compared to historical values to determine if there are any discrepancies.
- Emptying any condensate collection basins into properly labeled drums.
- Maintaining the drum storage area.
- Recording the injection pressures and flow rates at each injection point during a normal operational cycle. These values should be compared to historical values to determine if there are any discrepancies (semi-annual).
- Recording the vacuum pressures and flow rates at the SVE manifold.
- Monitoring the SVE effluent with a photoionization detector (PID).
- Analytical sampling of the SVE effluent at three locations, Pre-treatment, Mid-treatment, and Post-treatment (monthly).
- All information will be recorded on the inspection logs.

6. Regular Maintenance

Manufacturer recommended maintenance is performed twice to three times annually by an approved mechanic. Maintenance includes changing of the oil, filter elements, belts, and filter mats, as specified in the individual system component manual which are provided in the manufacturers Operations Manual. The system operator should keep a log of anything out of the ordinary and provide to the appropriate maintenance personnel. Typical things that should be noted are listed below:

- Rattling of solenoid valves can indicate that the valve is dirty and needs to be replaced.
- Drifting O3 percentage could indicate a problem with the UV lamp within the ozone monitor.
- Record any potential fluid or air leaks.
- Irregularity in the typical system component sounds. Listen to the operation of the compressor, ozone generator, booster pump, and dryer. If something doesn't sound right, it probably isn't.
- Report any of the items listed above to the system manager.

7. Alarm Acknowledgement

The SVE and ozone injection systems are equipped with a telemetry function that notifies the operator when the system goes down. The alarm is transmitted by email. The system operator will investigate the problem once an alarm message is received. Once the problem is identified, the system operator should contact the system manager. A decision will then be made on how the problem will be resolved. The system manager will then inform National Grid of the problem and the steps being taken to resolve the problem.

8. Health and Safety

Anyone entering the system will comply with the site-specific Health and Safety Plan (HASP). Additional Health and Safety hazards include:

- Elevated ozone levels – The PEL for ozone is 0.1 parts per million (ppm). The system will shut itself down if concentrations within the Ozone Generation Room meet or exceed this value. The system operator should verify ozone levels prior to entering the Ozone Generation Room at the office computer. The system operator will scan the breathing air within the room with a hand held ozone analyzer.
- Mechanical hazards when working on equipment – The system operator will ensure that the power is disconnected from the system components when maintenance has to be completed. This will be completed by shutting down the individual circuit breakers. Proper lock out/tag out procedures will be implemented in accordance with the HASP.

9. Site Contacts

Key site personnel are listed below. Refer to site-specific work plan for updated list.

- **System Manager**
  Jeff Parillo
  GEI Consultants, Inc.
  Office – 860.368.5374
  Cell – 631.481.5949
- **System Operator**
  Chris Berotti
  GEI Consultants, Inc.
  Office – 631.759.2961
  Cell – 631.481.5868
- **System Manufacturer**
  PIPER Environmental
  Anthony Rutland, System Technician
  Office – 831.632.2700

- **Maintenance Vender**
  Fenley and Nicol Environmental, Inc.
  Office – 631.586.4900
  Mike Ryan, Mechanic
  Cell – 516.768.8765
  Mathew Schieferstein, Project Manager
  Cell – 516.702.0025
- **Kaeser Representative**
  Industrial Sales and Service
  Tom Nelan, President
  Cell – 631.420.4800
  Office – 516.807.0463
- **Cold Shot Chiller Representative**
  The TurboChyll Company
  Sean Libby
  Office – 516.223.6494
  Fax – 516.223.6496

STANDARD OPERATING PROCEDURE

SI-002A - Ozone Injection System Fresh Air Purge

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1. Objective

The purpose of this Standard Operating Procedure (SOP) is to identify the procedures needed to purge ozone from the injection lines and injection manifolds. Fresh air purges are a tool that the system operator can use to clear ozone gas from ozone generation equipment and piping.

Fresh air purges will be completed prior to conducting any maintenance on the ozone injection system and during any leak/pressure testing activities to ensure that the system maintenance is conducted safely with minimal chance of ozone exposure.

2. Fresh Air Purge Execution

The ozone Injection system is designed to generate a 1.0 to 3.0 percent ozone gas mixture and inject it directly into the subsurface through a series of stainless steel injection wells. There are two identical system trains in place for the Ozone injection system. Only one train is in operation at any given time. The injection process is controlled by the Human Machine Interface (HMI), three remote system manifolds, solenoid valves, and the control logic. The following steps will direct the system operator on how to conduct a fresh air purge.

2.1 Accessing the Ozone Generation Room and the HMI

- Follow proper health and safety procedures when entering the system from lobby area.
- Prior to entering, review ambient ozone levels and alarm history at the main computer.
- Before entering the ozone generation room, verify ambient ozone levels on the ozone monitor located outside of the doorway.
- Confirm the levels by using a handheld ozone monitor by screening through the fixed sampling port.
- If elevated ozone levels are present (0.1 parts per million (ppm) or above), do not enter the room. Once ozone levels reach 0.1 ppm, the system is programmed to shut down automatically. Wait until the ventilation system has had enough time to clear the room of ozone before entering.
- Enter the ozone generation room once you confirm that it is safe.
- The HMI is located on the eastern wall of the ozone generation room. Activate the touch screen by pressing anywhere on the screen.

2.2 Running the System in Rapid Cycle

- Access the Ozone System Run Screen* and shut off the operating ozone generation train. Follow the prompt on the screen and allow the system to purge.
- Access the Rapid Cycle Run Screen*, select all valves and desired purge time per valve. The default purge time is set at one minute per valve. Each of the 63 valves should be purged at least twice for a total purge time of 126 minutes. Choose the most recent ozone generation train in operation and turn rapid cycle on. The compressor on the injection skid will start running and compressed air will be injected though the lines. Confirm that the voltage reading on the ozone generators are reading 0 volts.
- The system should run in rapid cycle so that each injection point has been purged with air.
- Once the purge has completed, maintenance activities may begin.

*A security code is required to access the Ozone System Run Screen as well as the Rapid Cycle Run Screen. The security code will be provided by management as needed.

STANDARD OPERATING PROCEDURE

SI-002B - Ozone Injection Skid Maintenance

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1. Objective

The purpose of this Standard Operating Procedure (SOP) is to identify the procedures needed to safely perform maintenance on the ozone injection skid, and limit the potential for exposure to ozone.

2. Ozone Injection Skid Maintenance Execution

The ozone injection skid includes ozone compressors that pressurize the ozone enriched air and delivers it through stainless steel piping to the injection manifolds located in the outbuildings. There are two ozone compressors, one for each treatment train. One ozone compressor is in operation at a time. Maintenance is conducted on the manifolds twice a year and includes checking the pump seals for leakage or ware and replacement as necessary. Additional maintenance may be needed if leaks develop.

Please follow all health and safety protocols and SOPs (SI-002 and SI-002A) before entering the ozone generation room. All injection skid maintenance will be performed by a minimum of two trained personnel.

2.1 Ozone Compressor Maintenance

- Operate the ozone injection system in rapid cycle (please see SI – 002A for rapid cycle operation) for a minimum of 30 minutes per train to clear any ozone from the injection lines, injection skid manifold, and ozone compressors.
- Please note that both ozone injection trains will need to be purged individually prior to conducting any maintenance.
- Isolate the train operating in rapid cycle. On the dormant pump, close the valve between the pump and the injection piping.
- While the system is operating in rapid cycle, determine which outbuilding manifold is injecting. Close the valves on the ozone manifold that are not injecting. Turn off rapid cycle. Immediately following the ozone compressor shut down, close the last ozone manifold valve. This should prevent back flow of ozone enriched air back into the injection skid and ozone compressors.
- Ozone injection lines will remain pressurized. When breaking any connection in the ozone injection line, a handheld ozone monitor must be used to verify the presence of any ozone levels contained inside the lines. The handheld ozone monitor sampling intake should be held as close to the opening as work will allow. If ozone is present, proper health and

safety precautions will be taken. If ozone is not observed at or above 0.1 parts per million (ppm), work will continue as planned.

- Once the ozone compressor maintenance is complete, open all valves and restart the system in rapid cycle. Leak test the entire manifold. Once you confirm that there aren't any leaks, initiate ozone injection through the Human Machine Interface (HMI).
- Screen each joint of the ozone compressor with the hand held monitor during ozone operation to confirm that ozone is not leaking. Once confirmed, the maintenance is complete.

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Huntington Station, New York

STANDARD OPERATING PROCEDURE

SI-002C - Ozone Injection System Outbuilding Access

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1. Objective

The purpose of this Standard Operating Procedure (SOP) is to identify procedures used to physically enter the remote outbuildings and to ensure that maintenance tasks are conducted safely with minimal chance of exposure to ozone. Potential maintenance includes sensor calibration/repair/replacement, leak testing, and valve/plumbing replacement.

2. Ozone Outbuilding Access

Three ozone injection manifolds are located in the well field on the southern side of the Groundwater Treatment Building. Each ozone injection manifold is housed in an outbuilding that covers the manifold and a portion of the trenching.

Each outbuilding is considered a permit required confined space unless the roof is removed and the sliding door on the south side of each building is open. The outbuilding roofs are heavy and will require two people using proper lifting methods to open properly. No personnel will enter the building unless these requirements are met:

- There must be two trained personnel on-site for the duration of any maintenance inside the outbuildings.
- Complete a fresh air purge prior to entering the outbuildings (please see section SI-002A).
- Before removing the outbuilding roof, screen ozone levels using a hand held ozone monitor. Insert the monitor in the screening port located on the northern wall of the outbuilding. Once the outbuilding roof has been removed and the door is open, screen the area for the presence of ozone. Start from the top and work your way down to the trench.
- Ozone injection lines will remain pressurized. When breaking any connection in the ozone injection lines, use a handheld ozone monitor to verify any ozone levels contained inside lines. The handheld ozone monitor sampling intake should be held as close to the opening as work will allow. If ozone is present, proper health and safety precautions will be taken. If no ozone is present, work will continue as planned.
- Complete all necessary maintenance. If a connection is broken, once re-plumbed, conduct a leak test using a fresh air purge.

The outbuildings must be closed if no one is on-site. The entrance procedure must be followed each time access is required.

STANDARD OPERATING PROCEDURE

SM-002 VOC Soil Sample Collection and Preservation Method

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1. Objective

Describe methods to collect and preserve soil samples for analysis of Volatile Organic Compounds (VOCs) in accordance with the U.S. Environmental Protection Agency (EPA) Method 5035.

Some states have adopted soil sampling and preservation methods that vary from the procedures presented herein. Confirm that this method is appropriate for your project.

2. Execution

VOCs evaporate readily at normal temperatures and pressures. Care should be taken during sampling and preservation to limit the potential for VOCs to off-gas from the soil sample prior to being analyzed by the laboratory.

Soil samples should be obtained utilizing a small diameter core sampler such as a 10 milliliter (ml) plastic disposable syringe, an EnCore® sampler, an EasyDraw Syringe®. The EnCore® sampler is the only EPA-approved small diameter core sampler that can be used to collect the sample, store the sample, and transport the sample to the lab.

A separate soil sample must be collected and submitted to the laboratory for percent solids testing. At least approximately 20 grams of soil must be collected in a separate glass or plastic sampling container.

2.1. Collection and Preservation of Soil Samples

Three types of soil samples may be collected for VOCs analysis:

- High (typically >200 µg/kg) VOC concentration soil sample (Section 2.2 below)
- Low (typically 0.05-200 µg/kg) VOC concentration soil sample (Section 2.3 below)
- Synthetic Precipitation Leaching Procedure/Toxicity Characteristic Leaching Procedure (SPLP/TCLP) soil sample (Section 2.4 below)

2.2. Collection and Preservation of a Soil Sample with "High" Concentrations of VOCs (typically >200 µg/kg)

2.2.1. Option 1 – Methanol Preservation Method

Supplies include: an electronic field balance (in some cases), two VOC vials (per sample) with 10 ml methanol (the number of vials and amount of methanol might vary among labs), and a small diameter core sampler to collect an approximately 10 gram soil sample. Some labs, and EPA method 5035, specify a 5 gram soil sample. Check with the lab or project manager for the amount to collect.

Sampling Procedure:

- Weigh the VOC vials containing the methanol and record the weight. Some laboratories provide pre-weighed VOC vials.
- If you are weighing your samples, take a test sample with the sampler and weigh it to evaluate how close you are to the appropriate sample weight. If the laboratory VOC vial is pre-marked with a line, then you do not need to weigh the soil, just fill the VOC vial with soil until the methanol and soil mixture reaches the line.
- Collect the sample using the sampling device and extrude the sample into the preserved VOC vial. Be sure that the VOC vial and cap threads are free of soil, and then screw the cap tightly onto the VOC vial. Gently swirl the methanol in the VOC vial to coat the soil sample. Do not vigorously shake the vial.
- If necessary, weigh the VOC vial and record the weight. Some laboratories will weigh the vials at the lab, and it is not required in the field.
- Collect separate soil samples from the same area for percent solids and head space sampling.
- Samples must be frozen or analyzed within 14 days.

2.2.2. Option 2 – EnCore® Sampling Method

Supplies needed: One 5 or 10 ml EnCore® sampler.

Sampling Procedure:

- Label the EnCore® sampling container.
- Collect the soil sample quickly, wipe the sampler free of soil, and seal the sampler.
- Place sampler in a clean ziplock bag and place on ice in a cooler.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen, or preserved, or analyzed within 48 hours (requires coordination with the laboratory).

2.3. Collection and Preservation of a Soil Sample with "Low" Concentrations of VOCs (typically 0.5 to 200 µg/kg)

2.3.1. Option 1 – Water Preservation Method

Supplies required: an electronic field balance, two 40 ml VOC vials pre-weighed and containing 5 ml of water, a magnetic stirrer, and a sampling device.

Sampling Procedure:

- Use a small diameter core sampler to collect two soil samples (5 grams each) into pre-weighed 40 ml VOC vials with 5 ml of water and a magnetic stirrer. Wipe threads and cap and seal the VOC vial. Repeat for the second VOC vial.
- Weigh the VOC vials and record the weights.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen or analyzed within 14 days.

2.3.2. Option 2 – Collection into Unpreserved VOC Vials

Supplies required: electronic field balance, two 40 ml VOC vials pre-weighed, and a sampling device.

Sampling Procedure:

- Collect the sample using the sampling device and extrude the sample into the VOC vial. Be sure that the threads are free of soil, and cap and seal the VOC vial. Repeat for the second vial.
- Weigh the VOC vials and record the weights.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen or analyzed within 48 hours (requires coordination with the laboratory).

2.3.3. Option 3 – Collection in VOC Vials Preserved with Sodium Bisulfate

Supplies required: electronic field balance, two VOC vials pre-weighed with 5 ml of sodium bisulfate, a magnetic stir bar, and a sampling device.

Sampling Procedure:

- Collect the sample using the sampling device and extrude a 5 gram sample into the VOC vial containing the sodium bisulfate. Wipe threads and cap and seal the VOC vial. Repeat for the second VOC vial.
- Weigh the VOC vials and record the weights.

- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen or analyzed within 14 days.

2.3.4. Option 4 –EnCore® Sampling Method

Supplies required: two 5 gram EnCore® samplers.

Sampling Procedure:

- Label the EnCore® sampling container.
- Collect the soil sample quickly, wipe the sampler free of soil, and seal the sampler.
- Place sampler in a clean ziplock bag and place on ice in a cooler.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Repeat previous steps with the second EnCore® device.
  Samples must be frozen, or preserved, or analyzed within 48 hours (requires coordination with the laboratory).

2.4. Collection of samples being analyzed for VOCs by the TCLP or SPLP method

Sampling methods for TCLP or SPLP are similar to the methods presented above. The appropriate method is determined by local regulations. If using an EnCore® sampler, a 25 gram sampler should be used.

3. General Guidance

- Each state and federal regulatory agency has unique soil preservation requirements. Always verify collection and preservation methods with governing bodies.
- Verify preservation techniques with laboratory prior to sample collection.

4. Contacts

Lynn Willey
Mark Ensign

STANDARD OPERATING PROCEDURE

SM-003 Classification of Soil Samples in the Field

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1. Objective

Describe methods to classify soil samples collected in the field in a consistent manner.

2. Execution

- Describe soil samples according to *ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) and* Attachments A and B*.* This standard is the basis for the Unified oil Classification System.
- Identify and record the soil in terms of the major and minor constituents (i.e., sand gravel, silt, clay), Unified Soil Classification Symbol, sample structure, plasticity and dilatancy for fine-grained soils, color, local or geologic name if known (e.g., Boston Blue Clay or glacial till), odor, presence of iron or other staining, and presence of organic matter, shells, debris, or other unusual characteristics of the same.
- If a soil split-spoon sample contains more than one soil type (for example, the upper portion is silty sand and the lower portion is clay) describe each type separately.
- Record sampler type, blow counts, soil description, etc. on the boring log (see Attachment C).
- GEI consistently applies one modification to the ASTM standard: Use "widely graded" and "narrowly graded" instead of "well-graded" and "poorly graded," respectively.

3. Limitations

Certain projects or clients will require the use of other classification systems. Other classification systems should not be used unless specifically required by the client. If the client requires that we use the Burmister method, obtain the details from the client. An example breakdown is shown below, but some clients (MassDOT, for example) have their own breakdown.

- “and” = 35-50%
- “some” = 20-35%
- “little” = 10-20%
- “trace” = 1-10%

- Describing soil samples is often difficult during cold or wet weather. Make sure your field notes describe these conditions. When possible, collect archive samples and verify sample descriptions in the office.

- The ASTM Standard Practice for Classification of Soils for Engineering Purposes (D2487) may be used in conjunction with the Visual-Manual Method to confirm the soil classification. D2487 includes laboratory testing.

4. References

ASTM D2487-06e1, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM, 2006.

ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM, 2009.

Field Guide for Soil and Stratigraphic Analysis, Midwest Geosciences Group Press, 2001-2005.

Coarse-Grained Soils Visual-Manual Descriptions, GEI Consultants, Soil Description Chart.

Fine-Grained Soils Visual-Manual Descriptions, GEI Consultants, Soil Description Chart.

5. Attachments

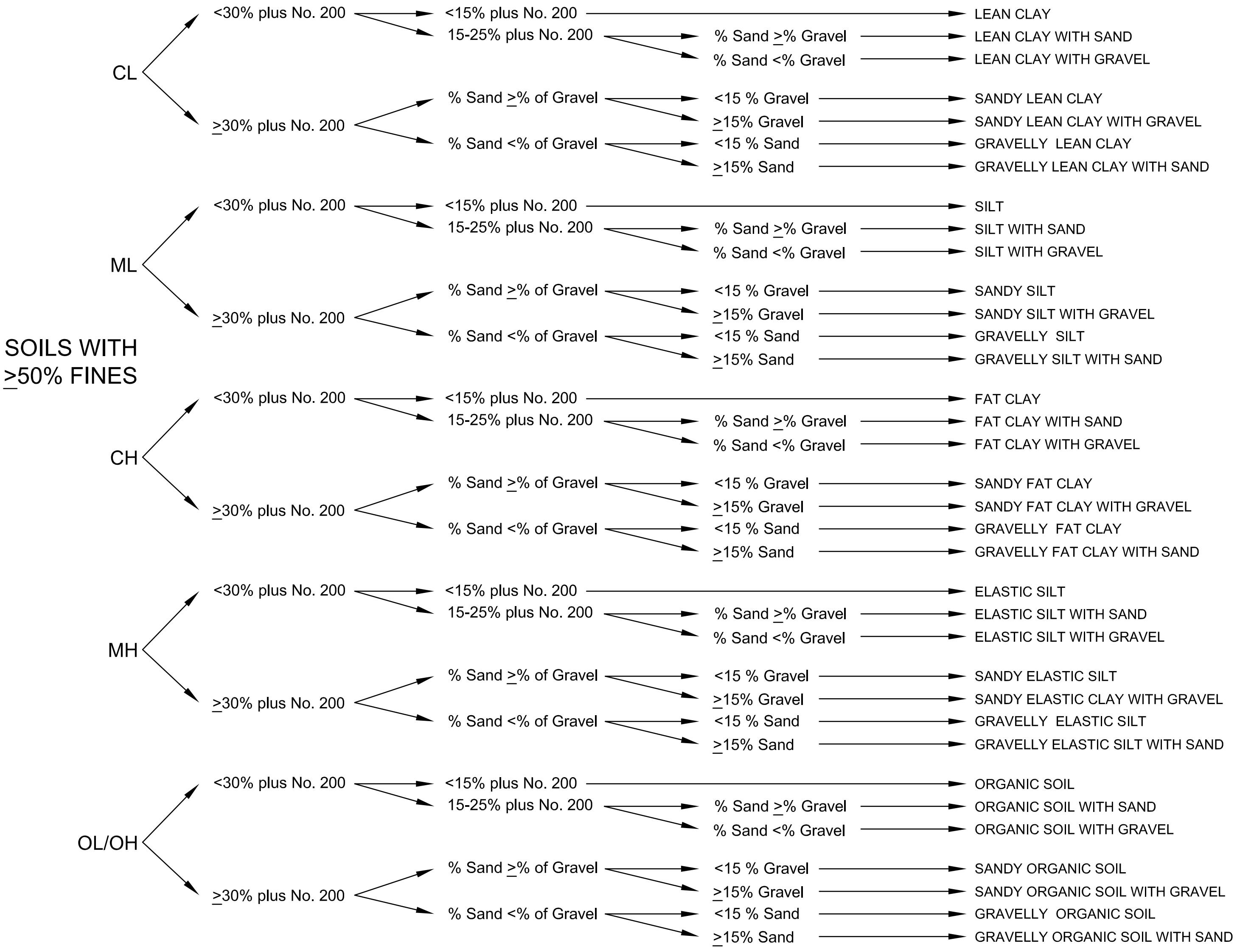
Attachment A – GEI Soil Description Charts (2007)
Attachment B – Visual Manual Descriptions with example boring log
Attachment C – Describing the Plasticity of Soil Samples

6. Contacts

Lynn Willey
Cathy Johnson

GEI Consultants

FINE-GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS



SOILS WITH ≥50% FINES

CL	<30% plus No. 200	<15% plus No. 200		LEAN CLAY
		15-25% plus No. 200	% Sand ≥% Gravel	LEAN CLAY WITH SAND
			% Sand <% Gravel	LEAN CLAY WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY LEAN CLAY
			≥15% Gravel	SANDY LEAN CLAY WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY LEAN CLAY
			≥15% Sand	GRAVELLY LEAN CLAY WITH SAND
ML	<30% plus No. 200	<15% plus No. 200		SILT
		15-25% plus No. 200	% Sand ≥% Gravel	SILT WITH SAND
			% Sand <% Gravel	SILT WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY SILT
			≥15% Gravel	SANDY SILT WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY SILT
			≥15% Sand	GRAVELLY SILT WITH SAND
CH	<30% plus No. 200	<15% plus No. 200		FAT CLAY
		15-25% plus No. 200	% Sand ≥% Gravel	FAT CLAY WITH SAND
			% Sand <% Gravel	FAT CLAY WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY FAT CLAY
			≥15% Gravel	SANDY FAT CLAY WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY FAT CLAY
			≥15% Sand	GRAVELLY FAT CLAY WITH SAND
MH	<30% plus No. 200	<15% plus No. 200		ELASTIC SILT
		15-25% plus No. 200	% Sand ≥% Gravel	ELASTIC SILT WITH SAND
			% Sand <% Gravel	ELASTIC SILT WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY ELASTIC SILT
			≥15% Gravel	SANDY ELASTIC CLAY WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY ELASTIC SILT
			≥15% Sand	GRAVELLY ELASTIC SILT WITH SAND
OL/OH	<30% plus No. 200	<15% plus No. 200		ORGANIC SOIL
		15-25% plus No. 200	% Sand ≥% Gravel	ORGANIC SOIL WITH SAND
			% Sand <% Gravel	ORGANIC SOIL WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY ORGANIC SOIL
			≥15% Gravel	SANDY ORGANIC SOIL WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY ORGANIC SOIL
			≥15% Sand	GRAVELLY ORGANIC SOIL WITH SAND

ID OF INORGANIC FINE SOILS FROM MANUAL TESTS

Symbol	Name	Dry Strength	Dilatancy	Toughness*
ML	Silt	None to low	Slow to rapid	Low or thread cannot be formed
CL	Lean Clay	Medium to high	None to slow	Medium
MH	Elastic Silt	Low to medium	None to slow	Low to medium
CH	Fat Clay	High to very high	None	High

1. GROUP NAME and (SYMBOL)
2. Describe fines, sand, and gravel components, in order of predominance. Include plasticity of fines. Include percentages of sand and gravel.
3. Color
4. Sheen, odor, roots, ash, brick, cementation, torvane and penetrometer results, etc.
5. "Fill," local name or geologic name, if known

PEAT

Peat refers to a sample composed primarily of vegetable matter in varying stages of decomposition. The description should begin: PEAT (PT) and need not include percentages of sand, gravel or fines.

CRITERIA FOR DESCRIBING PLASTICITY

Description	Criteria
Nonplastic ML	A 1/8-in. (3 -mm) thread cannot be rolled at any water content
Low Plasticity ML, MH	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit *
Medium Plasticity MH, CL	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High Plasticity CH	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

* Toughness refers to the strength of the thread near plastic limit. The lump refers to a lump of soil drier than the plastic, similar to dry strength.

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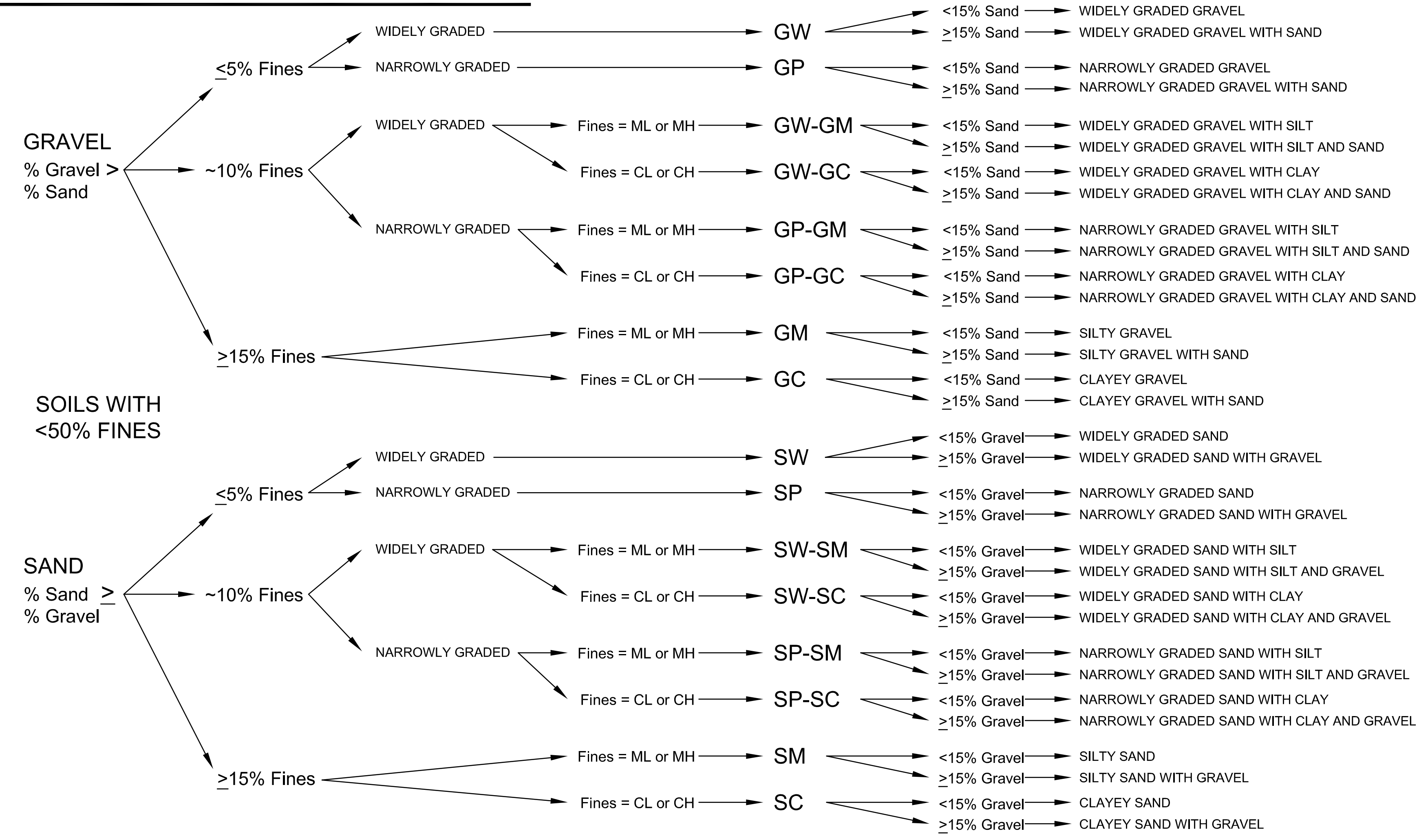
COARSE-GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS

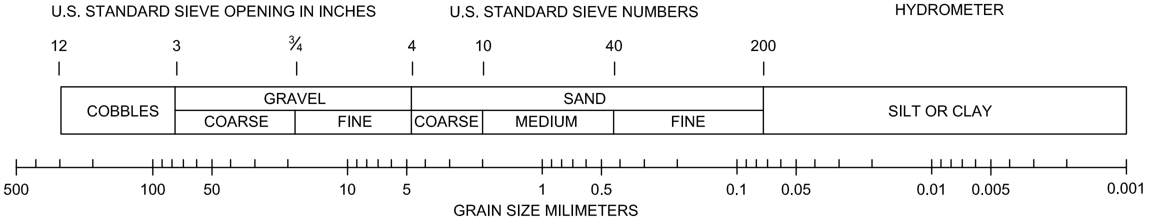
TYPICAL SOIL COLORS

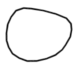
- 🟨 YELLOW
- 🟩 OLIVE
- 🟫 LIGHT BROWN
- 🟫 BROWN
- 🟫 REDDISH BROWN
- 🟥 RED
- ⬜ GRAY
- ⬛ BLACK



SOILS WITH <50% FINES

				GROUP SYMBOL		GROUP NAME
GRAVEL % Gravel > % Sand	≤5% Fines	WIDELY GRADED		GW	<15% Sand	WIDELY GRADED GRAVEL
					≥15% Sand	WIDELY GRADED GRAVEL WITH SAND
		NARROWLY GRADED		GP	<15% Sand	NARROWLY GRADED GRAVEL
					≥15% Sand	NARROWLY GRADED GRAVEL WITH SAND
	~10% Fines	WIDELY GRADED	Fines = ML or MH	GW-GM	<15% Sand	WIDELY GRADED GRAVEL WITH SILT
					≥15% Sand	WIDELY GRADED GRAVEL WITH SILT AND SAND
			Fines = CL or CH	GW-GC	<15% Sand	WIDELY GRADED GRAVEL WITH CLAY
					≥15% Sand	WIDELY GRADED GRAVEL WITH CLAY AND SAND
		NARROWLY GRADED	Fines = ML or MH	GP-GM	<15% Sand	NARROWLY GRADED GRAVEL WITH SILT
					≥15% Sand	NARROWLY GRADED GRAVEL WITH SILT AND SAND
			Fines = CL or CH	GP-GC	<15% Sand	NARROWLY GRADED GRAVEL WITH CLAY
					≥15% Sand	NARROWLY GRADED GRAVEL WITH CLAY AND SAND
	≥15% Fines		Fines = ML or MH	GM	<15% Sand	SILTY GRAVEL
					≥15% Sand	SILTY GRAVEL WITH SAND
			Fines = CL or CH	GC	<15% Sand	CLAYEY GRAVEL
					≥15% Sand	CLAYEY GRAVEL WITH SAND
SAND % Sand ≥ % Gravel	≤5% Fines	WIDELY GRADED		SW	<15% Gravel	WIDELY GRADED SAND
					≥15% Gravel	WIDELY GRADED SAND WITH GRAVEL
		NARROWLY GRADED		SP	<15% Gravel	NARROWLY GRADED SAND
					≥15% Gravel	NARROWLY GRADED SAND WITH GRAVEL
	~10% Fines	WIDELY GRADED	Fines = ML or MH	SW-SM	<15% Gravel	WIDELY GRADED SAND WITH SILT
					≥15% Gravel	WIDELY GRADED SAND WITH SILT AND GRAVEL
			Fines = CL or CH	SW-SC	<15% Gravel	WIDELY GRADED SAND WITH CLAY
					≥15% Gravel	WIDELY GRADED SAND WITH CLAY AND GRAVEL
		NARROWLY GRADED	Fines = ML or MH	SP-SM	<15% Gravel	NARROWLY GRADED SAND WITH SILT
					≥15% Gravel	NARROWLY GRADED SAND WITH SILT AND GRAVEL
			Fines = CL or CH	SP-SC	<15% Gravel	NARROWLY GRADED SAND WITH CLAY
					≥15% Gravel	NARROWLY GRADED SAND WITH CLAY AND GRAVEL
	≥15% Fines		Fines = ML or MH	SM	<15% Gravel	SILTY SAND
					≥15% Gravel	SILTY SAND WITH GRAVEL
			Fines = CL or CH	SC	<15% Gravel	CLAYEY SAND
					≥15% Gravel	CLAYEY SAND WITH GRAVEL

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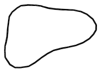
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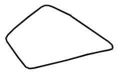
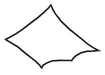

SUBANGULAR


ANGULAR

1. GROUP NAME and (SYMBOL)
2. Structure , if any. (stratified layer thicknesses, lenses, varves, gradational changes)
3. Describe sand, gravel and fines components, with percentages, in order of predominance. Include max gravel size. For test pits give percent cobbles and boulders, by volume, and include max size.
4. Color
5. Sheen, odor, roots, ash, brick, cementation, reaction with HCL, etc.
6. "Fill," local name or geologic name, if known

Describing the Plasticity of Soil Samples

M. Paster – November 2008

References ASTM D 2487 – Soil descriptions – lab
ASTM D 2488 – Soil descriptions – field
ASTM D 4318 – Atterberg limits testing

GEI Practice for Boring and Test Pit Logs

Describe the fines as:

Non-plastic
Low plasticity (The GEI laminated sheets incorrectly use "slightly plastic" for "low plasticity.")
Medium plasticity
High plasticity

Example: ~25% low plasticity fines

Toughness and dry strength:

You should use these tests to help decide how plastic the fines are. Record the results in the remarks column of the field log, but not in the soil description and not necessarily in the typed log.

On final logs, if Atterberg limits tests have been performed:

Do not use the descriptive terms non-plastic, low plasticity, etc. for samples on which Atterberg limits tests have been run. Instead, just give the percentage of fines and then report the actual Atterberg limits at the end of the description.

For example, the end of a silty sand description might be:
. . . ~25% fines, ~10% gravel max size ½ inch, gray. PL=23, LL=35.

(Atterberg limits tests are performed on the fraction of the sample finer than the No. 40 sieve, not just the fines. So the Atterberg limits data applies to the sample, not just to the fines.)

Hints:

High plasticity soils are rare in New England. If you think it's high plasticity, it's probably medium. Some Boston blue clay and some Connecticut River varved clays are high plasticity, but if you think you've found some, check with the project manager.

In New England, if ~10% fines or more, generally stick with GM, SM, ML, and CL. Occasionally GC, SC, CH. Don't use MH unless you have Atterberg limits data.

Estimating plasticity in the field, GEI guidance based on ASTM D 2488:

Plasticity	1/8-inch thread	Dry strength	Toughness
non	Cannot be rolled at any water content.	Dry specimen crumbles when handled.	Only slight pressure needed to roll thread near plastic limit.
low	Thread can barely be rolled.	Dry specimen crumbles with some finger pressure.	Slight to medium pressure needed to roll thread near plastic limit.
medium	Thread is easy to roll. Not much time needed to reach plastic limit.	Dry specimen crumbles with considerable finger pressure.	Medium pressure needed to roll thread near plastic limit.
high	Takes considerable time rolling and kneading to reach plastic limit.	Dry specimen cannot be broken with finger pressure.	Considerable pressure needed to roll thread near plastic limit.

Non-plastic vs. low plasticity:

ASTM D 2488 (soil descriptions - field) defines non-plastic and low plasticity based on the 1/8-inch thread as shown in the table above.

ASTM D 4318 (Atterberg limits testing) indicates that a sample should be called non-plastic for either of the following cases:

- The liquid limit test (dropping the cup) or the plastic limit test (rolling out the thread) cannot be performed because the plasticity is too low.
- The plastic limit is greater than or equal to the liquid limit.

Unfortunately, there are some soils that are low plasticity based on D 2488 (a thread can be rolled), but are non-plastic based on D 4318 (the liquid limit cannot be measured or PL≥LL).

GEI considers these soils to have low plasticity, because that is how they “look” and “feel.” We want to document this information so that other people will have a better feel for what the soil looks like and how it behaves. So, if the soil was low plasticity based on D 2488, but non-plastic based on D 4318, that should be explained in the letter or report, and possibly in a note on the log.

BORING LOCATION Maple Ave Sidewalk

GROUND ELEVATION (NGVD)

GROUNDWATER EL. DATE

DATE START/FINISH 2/14/07 - 2/15/07

DRILLED BY Geologic: M. Costigan

LOGGED BY T. Kahl/M. Yako TOTAL DEPTH (FT) 25

B101

PG. 1 OF 1

EL. FT.	DEPTH FT.	SAMPLE TYPE and NO.	SAMPLE BLOWS PER 6 IN.	SAMPLE PEN IN.	SAMPLE REC IN.	PID JAR HS / REMARKS	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
								4" pavement
	2.5	S1	13-9 17-14	24	0	0.5 ppm	FILL	S1: Redrove 0.5 to 3.5 ft. Recovery 11": WIDELY GRADED SAND (SW) ~85% sand, ~10% gravel to 1", <5% nonplastic fines, brown. Contains brick fragments and ash. Fill.
	5					hard drilling 3 to 4 ft, possible boulder		
		S2	7-7 11-13	24	8	2.0 ppm		S2: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) ~65% mostly fine sand, ~25% gravel to 3/4 inch ~10% non-plastic fines, brown. Fill.
	7.5	S3	9-10 2-1	24	16	0.0 ppm		S3 (0-10"): Similar to S2.
	10						ORGANICS	S3 (10"-16")": ORGANIC SILT (OL) ~100% slightly plastic fines, dark gray, organic odor, contains white shell fragments.
	12.5	S4	WOH 1-2 1	24	15	0.0 ppm		
	15					hard drilling at 15.5 ft		S4: Similar to S3, bot 6".
	17.5	S5	20-35 50/3"	15	8	Top of rock ~19 ft. Roller bit to 20 ft.	TILL	S5: SILTY SAND WITH GRAVEL (SM) ~60% mostly fine sand, ~25% slightly plastic fines, ~15% gravel to 1/2 inch, olive. Glacial Till.
	20 22.5 25	C1	RQD 70%	60	54	lost ~10 gallons drill fluid from 23 to 25 ft	ROCK	C1: SCHIST, hard, slight weathering at joint surfaces, joints at ~30 degrees from horizontal and generally parallel to foliation, gray. Marlborough Formation.
	27.5 30							Bottom of Boring 25 ft Truck-mounted drill rig. 4-inch casing to 19 ft. Safety-hammer with rope and cathead for SPT. Backfilled with drill cuttings.

BLOWS PER 6 IN.–140 LB. HAMMER FALLING 30 IN. TO DRIVE A 2.0 IN. OD SPLIT SPOON SAMPLER
PEN–PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC–RECOVERY LENGTH OF SAMPLE
RQD–LENGTH OF SOUND CORES > 4 IN./ LENGTH CORED, %
S–SPLIT SPOON SAMPLE
U–UNDISTURBED SAMPLES, UF–FIXED PISTON UO–OSTERBERG
⊻ GROUNDWATER

NOTES:
1: Groundwater at 10 ft depth at start of day 2/15/07.

PROJECT 07999-0
DATE

GEI Consultants

EXAMPLE SOIL DESCRIPTIONS

SANDY SILT (ML) ~60% slightly plastic fines, ~40% mostly fine sand, 1" thick layer of fine to medium sand with <20% fines, gray.

LEAN CLAY (CL) ~90% moderately plastic fines, ~10% fine sand, olive. Boston Blue Clay. Sv = 0.5, 0.5, 0.8 tsf, Qp = 1.0, 1.5, 1.6 tsf

Stratified CLAYEY SAND (SC) and WIDELY GRADED SAND (SW) SC layers 1 to 2 inches thick consist of fine sand with ~30% moderately plastic fines, gray. SW layers 1 to 4 inches thick consist of fine to coarse sand, ~10% gravel to 1/2 inch, <5% fines, brown. Hydraulic Fill.

EXAMPLE ROCK DESCRIPTIONS

(0-9"): GRANITE, hard, one piece, joint surface slightly weathered, pink.
(6-60"): PHYLLITE, joints ~ 45° generally parallel to foliation, 9" to 44" moderate to severe jointing and joint weathering. 44" to 60" single piece, green-gray.

ARGILLITE, medium hard, moderately weathered joints, gray. Cambridge Argillite.

GEOPROBE AND ROTOSONIC

When SPTs are not performed, note sample density (sands) or stiffness (clays) in description.

CRITERIA FOR DESCRIBING DILATANCY OF FINE-GRAINED SOILS

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

SPT: Standard Penetration Test

30-inch drop with 140-lb hammer
1 3/4 to 2 1/4 turns around cathead
2-inch O.D. split spoon sampler

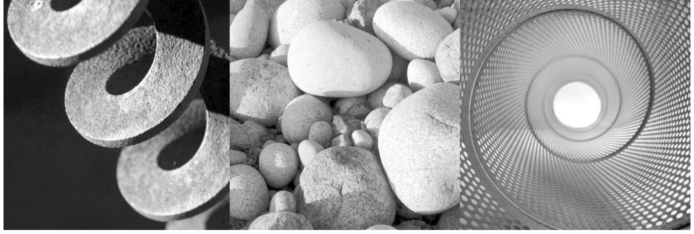
ENV'L TERMINOLOGY FOR SOIL DESCRIPTIONS

- **Ash** - Typically silt-size to medium sand-size.
- Do not use the term "cinders." This is not a technical term. Instead, use "ash," "burnt wood," "burnt material," or a similar term.
- **Coal-like material** - If it looks like coal but you aren't sure.
- **Clinker** - Vitrified (glass-like) or heat-fused material. Often burned impurities in coal. Often looks like pumice, but heavier.
- **Slag** - Similar to clinker, but normally refers to residue from metal ore processing.

- **Sheen** - Iridescent petroleum-like sheen. Not to be used for a "bacterial sheen," which can be distinguished by its tendency to break up on the water surface at angles. Petroleum sheen will be continuous and will not break up.
- **Stained** - Use with a color ("brown-stained") to indicate that the soil is stained a color other than its natural (unimpacted) color.
- **Coated** - Soil grains are coated with NAPL (oil, tar, etc.). There is not enough NAPL to saturate the pore spaces. ("Split spoon sampler coated with brown oil." "Soil grains coated with gray substance with slight gasoline-like odor.")
- **Saturated** - The entire sample pore space is saturated with NAPL. If you use this term, be sure it is not water saturating the pore spaces. Depending on viscosity, the NAPL may drain from a soil sample. ("Sample saturated with green, sticky substance.")
- **Blebs** - Discrete sphericals of NAPL in a soil matrix that was not visibly coated or saturated. ("Occasional blebs of reddish-brown tar.")
- **Oil** - Exhibits a petroleum odor, different from MGP odors.
- **Tar** - Exhibits an MGP odor (e.g. naphthalene-like odor).

- **Odors** - Use terms such as "naphthalene-like odor" or "petroleum-like odor." Use modifiers (strong, moderate, slight) to indicate odor intensity.

APPENDIX E. COMMUNITY AIR MONITORING PLAN



GEI Consultants

Consulting
Engineers and
Scientists

Community Air Monitoring Plan

Former Sag Harbor MGP Site

Sag Harbor, New York
AOC Index No. D1-0002-98-11
Site No. 1-52-159

Submitted to:
National Grid
175 East Old Country Road
Hicksville, NY 11801

Submitted by:
GEI Consultants, Inc., P.C.
110 Walt Whitman Road
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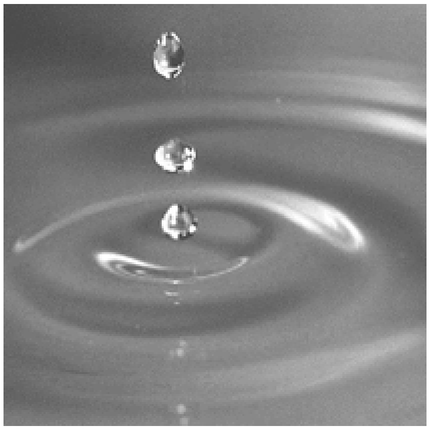
September 2019
Project 1702897



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Abbreviations and Acronyms

AMC	Air Monitoring Consultants
CAMP	Community Air Monitoring Plan
CLP	Contract Laboratory Program
CM	Construction Manager
DER-10	Technical Guidance for Site Investigation and Remediation
ELAP	Environmental Laboratory Approval Program
NEMA	National Electrical Manufacturers Association
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PM-10	Particulate Matter of 10 micrometers or less in diameter (*i.e.*, Respirable Particulate Matter)
ppm	Parts per million
TVOC	Total Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
$\mu g/m^3$	Micrograms per meter cubed
VOC	Volatile Organic Compound

Executive Summary

This Community Air Monitoring Plan (CAMP) has been developed to provide procedures for measuring, documenting, and responding to potential airborne contaminants during large-scale redevelopment activities below the site-wide building cover associated with the Sag Harbor Former Manufactured Gas Plant (MGP) Site (the Site). The procedures in this CAMP focus on air monitoring techniques and contingency measures designed to mitigate potential airborne contaminants. This CAMP is based on the CAMP guidelines established by the New York State Department of Health (NYSDOH) in the New York State Department of Environmental Conservation (NYSDEC) *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC, 2010).

The CAMP provides Air Monitoring Procedures, Alert Levels, Response Levels, and Action Levels, and it also provides contingency measures if Action Levels are approached. Alert Levels are National Grid established concentration levels for volatile organic compounds, only, and are not established by the NYSDOH or NYSDEC. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a screening tool to trigger contingent measures, if necessary, to assist in minimizing off-site transport of contaminants during remedial activities. A Response Level is a contaminant concentration level that triggers a temporary work stoppage, continued monitoring, and potential contingent measures. An Action Level is a contaminant concentration that triggers work stoppage and implementation of contingent measures to mitigate potential airborne contaminants prior to resuming work activities. Response Levels and Action Levels are NYSDOH threshold levels established in the November 2009 NYSDOH Generic CAMP presented in Appendix 1A of DER-10 (Appendix A). Exceedances of either Response Levels or Actions Levels will be reported to NYSDEC and NYSDOH.

During times of potential or actual ground intrusive activities below the site-wide building cover, perimeter air monitoring will be conducted using a combination of fixed-station, moveable tripod-mounted, and “walk-around” air monitoring equipment. Monitoring will be performed for total volatile organic compounds (TVOC) and dust along the perimeter of the work area 24 hours a day when fixed stations are used or during working hours when the movable tripod-mounted units are used. The CAMP defines Alert Levels, Response Levels, Action Levels, and specific contingency measures to be implemented. The response actions, potentially including work stoppage and work area controls by various methods, are intended to prevent or significantly reduce the migration of airborne contaminants from the Site.

An air monitoring consultant (AMC) will implement the CAMP and will report any exceedance of Response Levels and Action Levels to the General Contractor, the Construction Manager, National Grid and/or the property owner, NYSDOH, and NYSDEC. As specified in the DER-10, all 15-minute readings will be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. The contractor conducting intrusive activities below the building cover will be responsible for enacting contingency measures to respond to exceedances of Alert Levels, if necessary, and to exceedances of Response and Action Levels, if they occur. The AMC will provide data summary reports to the General Contractor, the Construction Manager (if applicable), National Grid and/or the property owner, and NYSDEC each week during ground intrusive activity below the building cover.

1. Introduction

The New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP), as presented in New York State Department of Environmental Conservation's (NYSDEC) document *DER-10 Technical Guidance for Site Investigation and Remediation*, recommends that real-time monitoring for total volatile organic compounds (TVOC) and particulates (*i.e.* dust) be conducted at the downwind perimeter of each designated work area during ground intrusive activities at contaminated sites. As such, this CAMP describes the proposed air monitoring means and methods that will be implemented during intrusive activities below the site-wide building cover at the Sag Harbor Former Manufactured Gas Plant Site (the Site). A site location map is shown in Figure 1.

The purpose of the CAMP is to provide early detection in the field of potential short-term emissions and will be conducted in accordance with the generic NYSDOH CAMP.

The objectives of the CAMP are as follows:

- Provide an early warning system to alert the property owner and/or its representative, National Grid and its representative, and the NYSDEC that concentrations of TVOC or dust in ambient air are approaching Action Levels due to site activities.
- Provide potential contingency measures to be enacted by the contractor conducting intrusive activities below the building cover and related contractors that are designed to reduce the off-site migration of contaminants if established Action Levels are approached or exceeded.
- Determine whether construction controls are effective in reducing ambient air concentrations to below Action Levels and make appropriate and necessary adjustments.
- Develop a permanent record that includes a database of perimeter air monitoring results, equipment maintenance, calibration records, and other pertinent information.

1.1. Roles and Responsibilities

The air monitoring consultant (AMC) will implement the monitoring and reporting components of this CAMP under contract with National Grid and/or the property owner. The contractor performing intrusive activities below the building cover is responsible for the selection and implementation of appropriate contingency measures that will mitigate the off-site migration of contaminants in response to Action Levels being approached or exceeded. The remainder of this section specifies the roles and responsibilities of each entity relative to the CAMP. A communication flowchart is shown in Figure 2 with each entity and lines of communication for the CAMP.

1.1.1 Contractor

The Contractor is the lead contractor responsible for site activities pertaining to the ground intrusive activities below the building cover. The Contractor will be responsible for taking contingent actions in response to Response Level and Action Level exceedances. The Contractor will be responsible for taking contingent actions for Alert Levels, if required by the AMC, Construction Managers (CMs), the property owner, and/or National Grid. The Contractor is responsible for the Health and Safety of its employees.

1.1.2 National Grid

National Grid is ultimately responsible for the remediation of site-related contamination at the Site under an approved work plan with NYSDEC.

1.1.3 New York State Department of Environmental Protection

NYSDEC is responsible for the environmental regulatory enforcement for all activities conducted at the Site including compliance with this CAMP; storm water runoff mitigation (erosion and sediment control); and all environmental and remediation regulations, policies, and guidance applicable to the Site. NYSDEC may provide on-site oversight personnel for the work being conducted.

1.1.4 Construction Managers

CMs are National Grid's and/or the property owner's representatives on site and are responsible for day to day operations on the Site, as applicable[*]. The CM overseeing the ground intrusive activities will be responsible for directing the Contractor to take contingent actions in response to Alert Level (volatile organic compounds [VOCs] only), Response Level, and/or Action Level exceedances. The CMs are responsible for the Health and Safety of their own employees and subcontractors.

---

[*] When the construction manager for ground intrusive work is retained by the property owner, National Grid also may retain an environmental construction manager to oversee the AMC and other environmental aspects of the work.

1.1.5 The Air Monitoring Consultant

The scope of the AMC activities will be limited to CAMP monitoring and reporting used for the CAMP. The AMC is responsible for the Health and Safety of their employees. The AMC CAMP roles and responsibilities are as follows:

- The AMC will monitor and record TVOC and dust at various locations around the Site as described in the following sections of this CAMP.
- On a daily basis, the AMC will communicate to the following entities whether TVOC or dust exceeded Response Levels or Action Levels specified in Section 2.1. Corrective actions will be required to address the situation. The AMC will convey the CAMP results to the entities listed below and inform them if the Alert or Response Levels have been exceeded. The AMC will direct contractors at the Site to take action if, warranted.
    - **Contractor – TBD**
    - **New York State Department of Environmental Conservation**
      Mr. Doug MacNeal
      Division of Environmental Remediation, NYSDEC
      Office: (518) 402-9662
      625 Broadway, 11th Floor
      Albany, New York 12233-7014
    - **National Grid**
      Sarah Aldridge, Project Manager
      Office: (516) 545-2568
      175 East Old Country Road
      Hicksville, NY 11801
    - **Construction Manager - TBD (if applicable)**
- The AMC will provide, maintain, and operate the equipment used to implement the CAMP.
- The AMC will provide data summary reports to the Contractor, CMs, National Grid and/or the property owner, and NYSDEC each week during intrusive activity. The reports will identify Response Level and Action Level exceedances and will include data summary reports for all TVOC and dust data collected.

2. Sampling and Analytical Procedures

This section of the CAMP presents a detailed description of the air monitoring sampling and analytical procedures, including data management that will be used during intrusive activities. The intent of the real-time monitoring program is to provide early detection in the field of short-term emissions and off-site migration of site-related TVOC and dust.

Real-time sampling methods will be utilized to determine ambient air concentrations during the project. Monitoring for TVOC and respirable particulate matter (*i.e.*, particulate matter of 10 micrometers or less in diameter, or PM-10) will occur at a minimum of two locations. Wind direction will be monitored under all approaches to community air monitoring that may be employed at the Site. A meteorological station will be established if a centralized data logger system is implemented. Supplemental walk-around perimeter monitoring for TVOC and PM-10, will occur along the perimeter of the project site on an as-needed basis. In the event of an exceedance of a Response Level or Action Level for TVOC or PM-10 at a down-wind monitoring station, the AMC will compare upwind to downwind 15-minute average concentrations. Concentrations within 60 minutes of the exceedance will also be reviewed to determine if activity at the Site is causing the Response Level or Action Level exceedance. The air monitoring procedures and equipment are detailed below.

2.1 Alert Level, Response Level, and Action Levels

Alert Levels are not established by the NYSDOH or NYSDEC and are National Grid-established concentration levels for TVOC only. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a screening tool to trigger contingent measures, if necessary, to assist in minimizing off-site transport of contaminants during remedial activities.

A Response Level is a contaminant concentration level that triggers a temporary work stoppage, continued monitoring, reporting, and contingent measures. A Response Level serves as a screening tool for both TVOC and PM-10 to trigger contingent measures to assist in minimizing off-site transport of contaminants during remedial ground intrusive activities. Response Levels are NYSDOH thresholds levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of *Technical Guidance for Site Investigation and Remediation* DER-10 (Appendix A).

An Action Level is a contaminant concentration that triggers work stoppage and implementation of contingent measures to mitigate measured concentrations of potentially airborne contaminants prior to resuming work activities. Action Levels are

NYSDOH threshold levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of DER-10 (Appendix A). For example, if high concentrations of dust are detected on the Site, contingent measures such as the use of spraying water may be required to reduce the concentrations and keep them below Response Levels.

The following table presents target compounds and corresponding Alert, Response Levels, and Action Levels. The Response Levels and Action Levels are from the NYSDOH Generic CAMP. Alert Levels are National Grid-established concentration levels for TVOC, only.

Target Compounds	**Alert Level**
TVOC (15-minute average concentration)	3.7 ppm greater than background*
Target Compounds	**Response Level**
TVOC (15-minute average concentration)	5.0 ppm greater than background*
Respirable Particulate Matter (PM-10)	100 µg/m^3 greater than background*
Target Compounds	**Action Level (**)**
TVOC (15-minute average concentration)	25 ppm greater than background*
Respirable Particulate Matter (PM-10)	150 µg/m^3 greater than background*

ppm - parts per million
µg/m^3 - micrograms per meter cubed
TVOC – total Volatile Organic Compounds
* Background is defined as the current upwind fifteen-minute average concentration.
** Action Level Exceedance requires work stoppage and mitigation of the condition causing the exceedance.

2.2 Air Monitoring Procedures

During times of intrusive activities below the building cover, perimeter air monitoring will be conducted using a combination of fixed-station, moveable tripod-mounted, and/or “walk-around” air monitoring equipment (as appropriate). Monitoring will be performed for TVOC and dust along the perimeter of the work area 24 hours a day when fixed stations are used or during working hours if the movable tripod-mounted units are used.

Monitoring for TVOC and PM-10 will occur at a minimum of two locations using real-time sampling equipment. Readings will be checked manually on a predetermined, periodic basis if tripod-mounted units are used or transmitted to a centralized data logger system station once per minute. Depending on the units used, monitoring will be conducted during working hours or 24 hours a day, 7 days a week during construction activity along the perimeter of the work area. Supplemental “walk-around” perimeter monitoring for TVOC and PM-10, and odor will occur along the perimeter of the project site on an as-needed basis. Each approach is detailed below.

It is anticipated that tripod-mounted stations will be used for minimally intrusive work such as installation of soil borings or monitoring wells and during shallow intrusive work. It is anticipated that fixed stations will only be used in the event of significant excavation work below the building cover at the Site.

2.2.1 Fixed-Station Monitoring Procedures

Real-time air monitoring for TVOC and suspended particulates will be conducted upwind and downwind of the work area along the perimeter of the Site during significant excavation below the building cover. Instruments will be positioned to monitor at a minimum of two locations adjacent to the work area based on the scale and location of the activities. Real-time monitors will continuously gather data 24 hours a day, 7 days a week. The air monitoring system consists of a minimum of two air monitoring stations, one meteorological tower, and one central computer system. The central computer system will be located in a project trailer or similar work area.

The real-time fixed air monitoring stations will be positioned between the work zone and the largest number of potential off-site receptors or sensitive off-site receptors, such as a school. Therefore, the placement of the fixed air monitoring stations is based on the need to document all potential off-site migration on the perimeter, but also recognizes the potential off-site receptors and the location of the proposed construction activities. Figure 3 displays a typical arrangement of fixed air monitoring stations around the site.

Each real-time air monitoring station will contain the following:

1. Station enclosure,
2. An organic vapor analyzer,
3. A particulate monitor, and
4. A radio telemetry device.

Each monitoring station will be housed in a weather-tight National Electrical Manufacturers Association (NEMA)-4 type enclosure. Each monitoring station will continuously measure and record TVOC and PM-10 at a rate of one sample per minute and record 15-minute time-weighted running averages. Figure 4A shows an example of a typical fixed air monitoring station.

In addition to the air monitoring stations, a Campbell Scientific, Inc. Met Data1 meteorological monitoring system, or equivalent, will be established on site. The meteorological system will continuously monitor temperature, relative humidity, wind speed, and wind direction. Fifteen-minute average values for each meteorological parameter will be stored in the meteorological system and downloaded once per week. Wind direction and wind speed will be displayed on the central computer in real-time to determine upwind and downwind stations for assessing Alert, Response, and Action

Levels. Upwind and downwind stations will be reduced real-time. Wind socks and/or flags will be placed at locations around the site, as necessary, to obtain real-time site-specific wind direction.

All TVOC, PM-10, and meteorological data will be stored in data loggers located within each monitoring/meteorological station. Stored analytical data along with system performance data from each station will be sent in real-time, via radio telemetry, to the central computer system for monitoring and analysis. An automated alarm system will alert AMC personnel of concentrations exceeding the Alert, Response, and Action Levels. The meteorological station will be downloaded at a minimum of once per week. A battery backup will be used, but in the event of severe weather or power loss at the Site, data recording and/or recovery may be affected.

2.2.2 Tripod Mounted Monitoring Procedures

It is anticipated that tripod-mounted stations will be used for minimally intrusive work such as installation of soil borings or monitoring wells and during shallow intrusive work. Instruments will be positioned upwind and downwind of the work area or along the Site perimeter to monitor the air, based on ground intrusive activities, at a minimum of two locations (upwind and downwind). Real-time monitors will continuously gather data during periods of intrusive activity during working hours. The equipment will be manually read on a predetermined periodic cycle during the work activity.

The readings will be collected at a minimum of 15-minute intervals during periods of intrusive activities. Wind direction may be determined by using a wind sock or flagging placed on a pole at the Site.

Each air monitoring station will include the following:

1. Station Tripod and enclosure,
2. An organic vapor analyzer, and
3. A particulate monitor.

Figure 4B shows an example of a typical tripod-mounted air monitoring station.

Each monitoring station will continuously measure and record TVOC and PM-10. All TVOC and PM-10 will be stored in data loggers located within each monitoring station. Data from each piece of equipment will be downloaded daily at the completion of intrusive activities and stored on a central computer system. The location of each station, the work zone, and the wind direction will be noted daily. At each monitoring station location, the 15-minute average value of TVOC and PM-10 will be recorded. The 15-minute average value of TVOC and PM-10 data from the upwind and downwind station will be compared and resultant downwind concentration will be calculated and recorded.

2.2.3 Supplemental Perimeter Walk-around Monitoring

Supplemental walk-around perimeter monitoring for TVOC and PM-10 will occur along the perimeter of the project site on an as-needed basis. Specific site conditions that may trigger walk-around perimeter monitoring include:

- Visible dust;
- Detection of TVOC and/or PM-10 at an air monitoring station at concentrations exceeding an Alert Level, Response Level, and Action Levels; and/or
- Direction by National Grid and/or the property owner, their construction managers, or NYSDEC.

Fifteen-minute average TVOC and PM-10 readings will be collected continuously at a downwind location between the work area and the nearest receptors.

When a triggering condition is observed during ground intrusive activity, the supplemental downwind perimeter monitoring will occur continuously until the conditions that triggered the monitoring have subsided. TVOC concentrations will be monitored and recorded using an organic vapor analyzer. PM-10 will be measured and recorded using a portable aerosol monitor equipped with a PM-10 impactor.

At each monitoring point, the 15-minute average value of TVOC and PM-10, sample time, and sample location will be collected and recorded. Additional temporary monitoring points may be established due to changing site or meteorological conditions.

2.2.4 Equipment Calibration

Equipment calibration will be performed according to manufacturer’s instructions. Each organic vapor analyzer will be calibrated once daily using a certified standard isobutylene gas. Particulate monitors for PM-10 will be zeroed daily. Other hand-held portable equipment will be calibrated before each use, or a minimum of once per week when not in use.

2.3 VOC Analytical Sampling

For significant excavation below the building cover when fixed stations are used, 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 (USEPA) Method TO-15 modified to include naphthalene. A New York State Environmental Laboratory Approval Program (ELAP)-certified 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 in accordance with the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review, EPA 540/R-99/008 (October 1999) and the USEPA Region II Functional Guidelines for Evaluating Organic Analyses (September 2006), modified as necessary to accommodate the non-CLP methodologies used.

2.4 Pre-Construction Baseline Sampling

For significant excavation below the building cover, pre-construction sampling will be completed to establish baseline ambient air concentrations prior to the start of excavation activities. Baseline conditions will be developed for TVOC and PM-10 in ambient air using real-time fixed station sampling methods. Sample collection and analysis methods will follow those described in subsection 2.2.1. Pre-construction real-time sampling will take place at the fixed air monitoring station locations to determine TVOC and PM-10 baseline conditions. TVOC and PM-10 data will be recorded 24 hours per day for a minimum of three days.

2.5 Data Management Procedures

This section of the Plan discusses the data management procedures that will be used during the remedy. Data may be generated from a variety of sources, including real-time fixed station analytical monitoring, supplemental walk-around monitoring, tripod-mounted monitoring stations, and meteorological monitoring.

These data must be reduced, evaluated, verified, and presented to relevant parties in a timely manner to facilitate decision-making. The data management process for each source of data is discussed below.

The AMC will review all real-time data in a timely manner following collection and transmit the final summary report (see Section 4) to National Grid and/or the property owner.

2.5.1 Fixed Station Monitoring

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 following daily charts or tables will be prepared:

- Instantaneous and averaged TVOC concentrations compared to the TVOC Action Level

- Instantaneous and averaged PM-10 concentrations compared to the PM-10 Action Level
- Supplemental Perimeter Walk-Around PM-10 concentrations compared to the Action Level (if any)
- Supplemental Perimeter Walk-Around TVOC concentrations compared to the TVOC Action Level (if any)
- Air monitoring station locations

The following weekly charts or tables will be prepared:

- Meteorological conditions
- Maximum 15-minute average concentrations of TVOC and PM-10
- Upwind and downwind comparison of Response Level and Action Levels reached during the week
- Summary of site activities
- Air monitoring station locations

2.5.2 Tripod Mounted/Supplemental Perimeter Walk-around Monitoring

Analytical data generated at each tripod mounted station and from any supplemental perimeter walk-around monitoring will be manually downloaded daily for data evaluation. The following daily table(s) will be prepared:

- Daily maximum instantaneous and averaged TVOC concentrations compared to the TVOC Action Level
- Daily maximum instantaneous and averaged PM-10 concentrations compared to the PM-10 Action Level
- Supplemental Perimeter Walk-Around PM-10 concentrations compared to the Action Level (if any)
- Supplemental Perimeter Walk-Around TVOC concentrations compared to the TVOC Action Level (if any)
- Air monitoring station locations

The following weekly table(s) will be prepared:

- Maximum 15-minute average concentrations of TVOC and PM-10
- Upwind and downwind comparison of Response Level and Action Levels reached during the week if the daily maximum 15-minute average concentrations of TVOC and PM-10 exceeded a Response Level or Action Levels
- Summary of site activities
- Air monitoring station locations

3. Alert Responses

The purpose of this section is to identify the procedures to be followed in response to elevated levels of target compounds measured during intrusive activities below the building cover. Response actions will be enacted by the Contractor, CMs, and National Grid and/or the property owner. The AMC will report occurrences where a Response Level or Action Level is exceeded, which would require response actions to be enacted. The NYSDEC will be notified of any occurrence where a Response Level and/or Action Level (NYSDOH threshold) is exceeded. If there is a verified exceedance, The AMC will inform the CM (if applicable) and/or Contractor, National Grid and/or the property owner, and NYSDEC within 60 minutes of the exceedance via e-mail at a minimum. In general, a tiered approach to site conditions with corresponding response actions will be implemented during the air monitoring program. The four tiers of site conditions are defined as follows.

- **Site Condition 1.** Normal or ambient air-conditions where all target concentrations are less than the Alert Level for TVOC and the Response Levels for PM-10.
- **Preliminary Site Condition 2.** (TVOC, only.) TVOC concentration is equal to or greater than the Alert Level, but less than the Response Level.
- **Site Condition 2.** Concentration of TVOC and/or PM-10 is less than the Action Level.
- **Site Condition 3.** Concentration of TVOC and/or PM-10 is equal to or greater than the Action Level.

The response plan will rely on real-time data generated from the fixed-station monitoring and/or portable-equipment monitoring and meteorological monitoring. These data sources will be evaluated together in order to make appropriate decisions concerning site conditions and potential control measures.

An explanation of the notification system, specific conditions, and response actions for TVOC and PM-10 is presented below.

3.1 Total Volatile Organic Compounds

TVOC concentrations in air will be measured and recorded by station monitors. Figure 5 presents the TVOC decision diagram that will be used to determine the appropriate site condition based on contaminant concentrations.

Specific TVOC target concentrations for Site Condition 1, Preliminary Site Condition 2, Site Condition 2, and Site Condition 3 are summarized in Table 1.

3.1.1 Site Condition 1

Site Condition 1 will be in effect when the average TVOC concentration, measured over a 15-minute period, is less than the Alert Level (3.7 ppm). Under a Site Condition 1, each organic vapor analyzer located at the monitoring stations (tripod or fixed) will collect and analyze a TVOC sample at a frequency of one sample per minute.

3.1.2 Preliminary Site Condition 2

Preliminary Site Condition 2 will be in effect if the average TVOC concentration, measured over a 15-minute period, is greater than or equal to the Alert Level (3.7 ppm) but less than the Response Level (5.0 ppm). The Contractor, CM, and National Grid and/or the property owner will be notified by the AMC of elevated measurements and a Preliminary Site Condition 2.

At this time, the upwind and downwind concentrations will be compared to determine if the Preliminary Site Condition 2 is due to site activities. If downwind TVOC concentrations are greater than upwind concentrations, then it will be assumed that the Preliminary Site Condition 2 is due to site activities.

If the above condition is true, then a Preliminary Site Condition 2 will be verified. Under a verified Preliminary Site Condition 2, a contingency meeting attended by the AMC, the Contractor, CM, and National Grid and/or the property owner will be held. The Contractor, CM, and National Grid and/or the property owner will determine appropriate response actions. This meeting will be held within 60 minutes of the Preliminary Site Condition 2 verification. Possible Preliminary Site Condition 2 response actions are listed in Table 2. Preliminary Site Condition 2 will remain as long as the TVOC concentration is between 3.7 ppm (Alert Level) and 5.0 ppm (Response Level), based on 15-minute averages.

The Site Condition will return to Site Condition 1 if the following condition is true.

- The 15-minute average concentrations for TVOC at each of the monitoring stations are less than 3.7 ppm (Alert Level).

3.1.3 Site Condition 2

Site Condition 2 will be in effect if average TVOC concentrations increase to greater than the Response Level of 5.0 ppm. Site Condition 2 will remain in effect if the average

TVOC concentration, measured over a 15-minute period, is greater than or equal to 5.0 ppm (Response Level).

Under Site Condition 2, construction activities will be temporarily halted. A meeting attended by the AMC, the Contractor, CM, National Grid and/or the property owner, and NYSDEC (by phone, if not onsite and if available), will be held within 60 minutes of the Site Condition 2. The Contractor, CM, National Grid and/or the property owner, and NYSDEC will determine appropriate response actions. Possible Site Condition 2 corrective measures/actions are listed in Table 2. After appropriate corrective measures/actions are taken, work activities may resume provided that the TVOC concentration at the perimeter of the work area is no more than 5.0 ppm above background for the 15-minute average.

If average TVOC concentrations fall below the Response Level, then the Site Condition will be returned to Preliminary Site Condition 2, at which time work activities may resume. Preliminary Site Condition 2 will remain in effect as long as the following condition is true.

- The 15-minute average concentration for TVOC is greater than 3.7 ppm (Alert Level) and less than 5.0 ppm (Response Level).

The Site Condition will return to Site Condition 1 if the following condition is true.

- The 15-minute average concentrations for TVOC at each of the monitoring stations are less than 3.7 ppm (Alert Level).

3.1.4 Site Condition 3

Site Condition 3 will be in effect if average TVOC concentrations increase to greater than the Action Level of 25.0 ppm at the perimeter of the work area. Site Condition 3 will remain in effect if one of the following conditions is true.

- The average TVOC concentration, measured over a 15-minute period, is greater than 25 ppm (Action Level) at the work zone.

Under Site Condition 3, all construction activities will be halted. A meeting attended by the AMC, the Contractor, CM, National Grid and/or the property owner, and NYSDEC (by phone, if not onsite and if available), will be held within 60 minutes of the Response Level notification. The Contractor, CM, National Grid and/or the property owner, and NYSDEC will determine appropriate response actions. Possible Site Condition 3 corrective measures/actions are listed in Table 2.

If average TVOC concentrations fall below the Action Level, then the Site Condition will be returned to a Site Condition 2. If average TVOC concentrations fall below the

Response Level, then the Site Condition will be returned to Preliminary Site Condition 2, at which time work activities may resume. Preliminary Site Condition 2 will remain in effect as long as the following condition is true.

- The 15-minute average concentration for TVOC is greater than 3.7 ppm (Alert Level) and less than 5.0 ppm (Response Level).

The site will return to Site Condition 1 if the following condition is true.

- The 15-minute average concentrations for TVOC at each of the monitoring stations are less than 3.7 ppm (Alert Level).

3.2 Respirable Particulate Matter

PM-10 concentration in air will be measured and recorded by the station monitors and may be temporarily suspended during periods of rain. Figure 6 presents the PM-10 decision diagram.

Specific PM-10 target concentrations for Site Condition 1, Preliminary Site Condition 2, Site Condition 2, and Site Condition 3 are summarized in Table 1.

3.2.1 Site Condition 1

Site Condition 1 will be in effect when the downwind 15-minute average PM-10 concentration is less than 100 $\mu g/m^3$ above the contemporary average upwind conditions (Response Level).

3.2.2 Site Condition 2

Site Condition 2 will be in effect if the difference between the downwind and background average 15-minute PM-10 concentration is greater than 100 $\mu g/m^3$ above the contemporary upwind concentration (Response Level), less than 150 $\mu g/m^3$ (Action Level), and related to ground intrusive activities or if visible dust is observed leaving the work area. The Contractor, CM, National Grid and/or the property owner, and NYSDEC will be notified by the AMC of elevated measurements and a possible Site Condition 2. The upwind and downwind PM-10 concentrations will be compared to determine if the elevated PM-10 concentrations are due to site activities. If downwind PM-10 concentrations are 100 $\mu g/m^3$ greater than upwind concentrations (Response Level), then it will be assumed that the Site Condition 2 is due to site activities.

The Site Condition 2 will remain in effect as long as the average PM-10 concentration is greater than or equal to 100 $\mu g/m^3$ above upwind conditions (Response Level), and less than or equal to 150 $\mu g/m^3$(Action Level) provided that no visible dust is observed leaving the work area. Under a verified Site Condition 2, dust suppression techniques must be implemented by the Contractor. At this point, routine monitoring continues and 15-minute averages continue to be evaluated. Work may continue with dust suppression techniques provided that downwind PM-10 levels do not exceed 150 $\mu g/m^3$ above the upwind level (Action Level) and provided that no visible dust is migrating offsite from the work area.

A contingency meeting attended by the AMC, the Contractor, CM, National Grid and/or the property owner, and NYSDEC will be held within 60 minutes of the verified Site Condition 2 if the condition is not mitigated by dust suppression techniques. Possible response actions for dust control are listed in Table 2.

3.2.3 Site Condition 3

Site Condition 3 will be in effect if the average 15-minute PM-10 concentration exceeds 150 $\mu g/m^3$ above the contemporary average upwind concentration (Action Level) or if visible dust is migrating from the work area and the difference between the average and background concentrations is greater than or equal to 100 $\mu g/m^3$. Under Site Condition 3, work must be stopped and a meeting attended by the AMC, the Contractor, CM, National Grid and/or the property owner, and NYSDEC (by phone, if not onsite and if available) will be held within 60 minutes of the Action Level notification. The Contractor, CM, National Grid and/or the property owner, and NYSDEC will determine appropriate response actions. Possible Site Condition 3 response actions for PM-10 are listed in Table 2. Work may resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration and provided that no visible dust is migrating from the work area.

4. Reporting

The AMC will prepare and submit weekly reports to the Contractor, CM, National Grid and/or the property owner, and NYSDEC summarizing the CAMP monitoring data. Each weekly report will be letter-style and will include charts/tables summarizing the following:

- Maximum 15-minute average concentrations of TVOC, and PM-10
- Upwind and downwind comparison of Response Levels and Action Level reached during the weekly period
- Summary of site activities
- Air monitoring station locations
- Meteorological conditions (for fixed stations only)

Following the completion of all work, a final summary report of the CAM activities and data will be prepared and submitted to NYSDEC.

References

New York State Department of Environmental Conservation. 2010. DER-10/Technical Guidance for Site Investigation and Remediation. Division of Environmental Remediation. May 3, 2010. Appendix 1A. pp. 204-206.

Tables

Table 1. Target Concentrations for Site Conditions
Community Air Monitoring Plan
Sag Harbor Manufactured Gas Plant Site
Site Management Plan
Sag Harbor, New York

Table 1. Target Concentrations for Site Conditions
Community Air Monitoring Plan
Sag Harbor Manufactured Gas Plant Site
Site Management Plan
Sag Harbor, New York

	Alert Level[1]	NYSDOH generic CAMP[2]		Site Condition 1	Preliminary Site Condition 2	Site Condition 2	Site Condition 3
		Response Level	Action Level				
TVOC	3.7 ppm	5.0 ppm	25 ppm	< 3.7 ppm	≥ 3.7 ppm, < 5.0 ppm	≥ 5.0 ppm, < 25.0 ppm	≥ 25.0 ppm
PM-10	NA	100 $\mu g/m^3$	150 $\mu g/m^3$	< 100 $\mu g/m^3$	NA	≥ 100 $\mu g/m^3$, < 150 $\mu g/m^3$	≥ 150 $\mu g/m^3$

Notes:

[1] Alert Levels are not established by the NYSDOH or NYSDEC and are internally established concentration levels for total volatile organic compounds. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a screening tool to trigger contingent measures, if necessary, to assist in minimizing off-site transport of contaminants during remedial activities.

[2] Response Levels and Action Levels are defined in Appendix 1A of the New York State Department of Environmental Conservation *DER-10/Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010)

NYSDOH - New York State Department of Health
$\mu g/m^3$ - micrograms per cubic meter
ppmv - parts per million by volume
TVOC - total volatile organic compounds
PM-10 - particulate matter (i.e. dust) less than 10 microns in diameter
NA - not applicable

Table 2. Site Conditions and Response Actions
Community Air Monitoring Plan
Sag Harbor Manufactured Gas Plant Site
Site Management Plan
Sag Harbor, New York

Site Condition	Control Measure
Site Condition 1	Normal site activities - No control measures required
Site Condition 2	Establish trend of data and determine if evaluation/wait period is warranted Temporarily stop work Temporarily relocate work to an area with potentially lower emission levels Apply water to area of activity or haul roads to minimize dust levels Reschedule work activities Cover all or part of the excavation area Apply VOC emission suppressant foam over open excavation areas Slow the pace of construction activities Change construction process or equipment that minimize air emissions Install a perimeter barrier fence Apply water on haul roads* Wet equipment and excavation faces* Spray water on buckets during excavation and dumping* Haul materials in properly tarped or watertight containers* Restrict vehicle speeds to 10 mph* Cover excavated areas and material after excavation ceases* Reduce the excavation size and/or number of excavations*
Site Condition 3	Halt work Encapsulate construction area and treat air exhaust Perform work during cold weather Cease construction activities Re-evaluate air monitoring work plan

Notes:

The control measures specified under each site condition can be implemented in any order that is most appropriate under the existing site conditions.

* Control measures suggested in the New York State Department of Environmental Conservation *DER-10/Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010)

Figures

SOURCE:
Map created with TOPO! ® © 2001 National Geographic
(www.nationalgeographic.com/topo)

0 2000 4000

SCALE: 1" = 2000'

Community Air Monitoring Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

nationalgrid

GEI Consultants

SITE LOCATION MAP

Project 1702897

September 2019

Fig. 1

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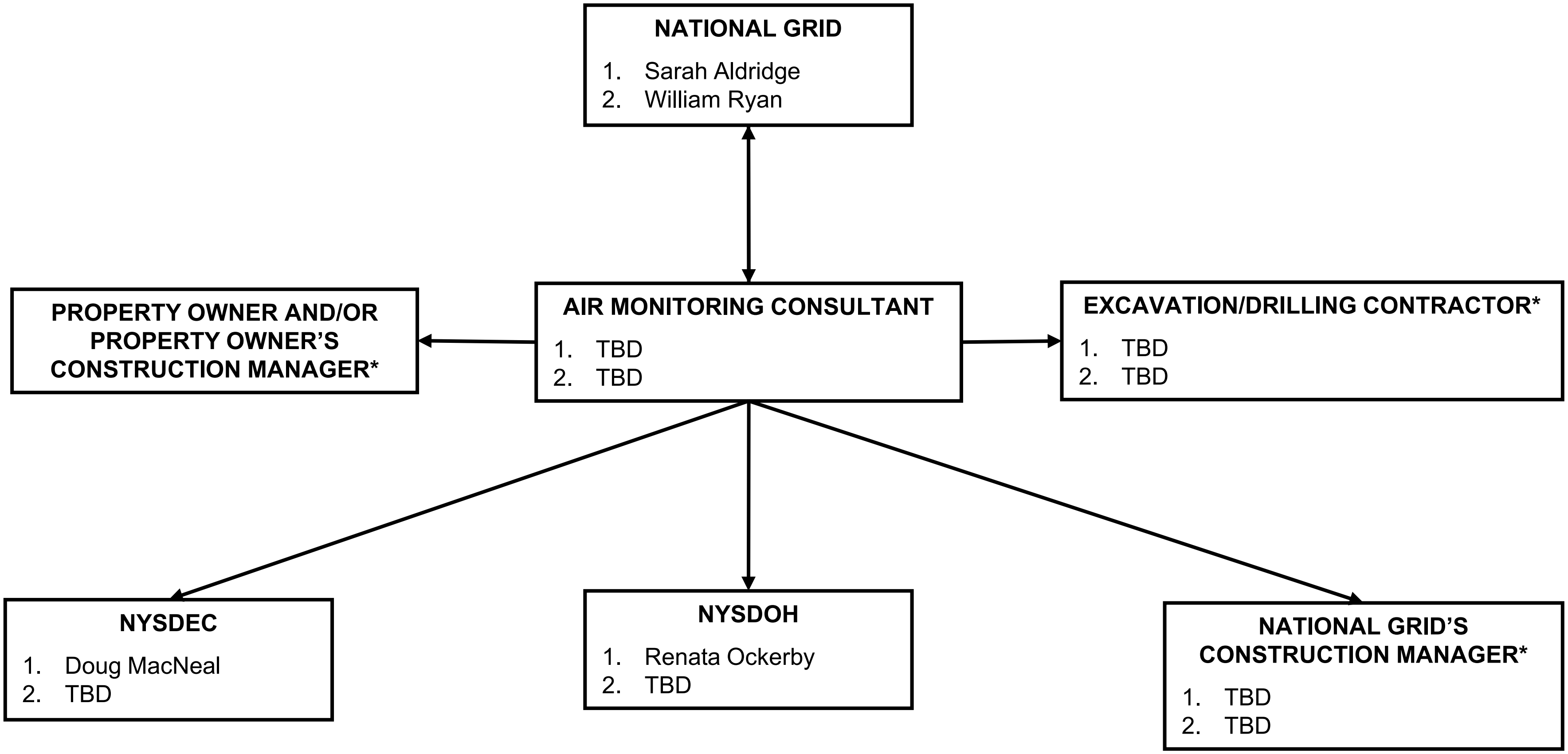

NATIONAL GRID
1. Sarah Aldridge
2. William Ryan

PROPERTY OWNER AND/OR PROPERTY OWNER'S CONSTRUCTION MANAGER*

AIR MONITORING CONSULTANT
1. TBD
2. TBD

EXCAVATION/DRILLING CONTRACTOR*
1. TBD
2. TBD

NYSDEC
1. Doug MacNeal
2. TBD

NYSDOH
1. Renata Ockerby
2. TBD

NATIONAL GRID'S CONSTRUCTION MANAGER*
1. TBD
2. TBD

National Grid, Air Monitoring Consultant, Excavation/Drilling Contractor*, Construction Manager*, and NYS Representatives

Meet at the Field Office and/or Confer by Phone Within 60 Minutes of the Alert

If the primary contact is unavailable, contact alternatives in the order noted, or as shown on the contact list.

NOTE:

1. To be used for work that will likely encounter MGP Impacts.

TBD To Be Determined

* May not be applicable to all work completed at the site

Community Air Monitoring Plan
Sag Harbor Former MGP Site
Brooklyn, New York

nationalgrid

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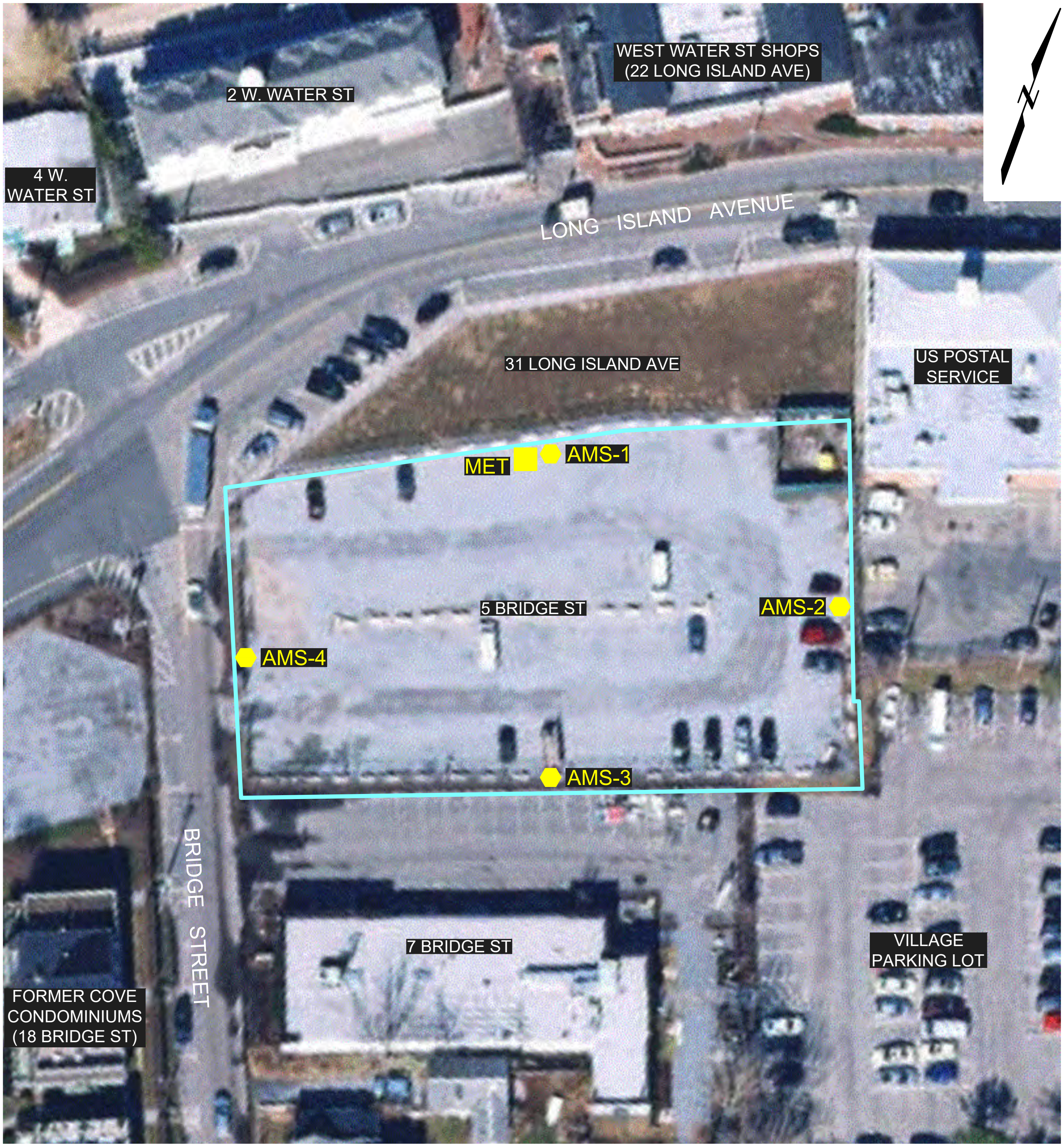
COMMUNICATION FLOWCHART

Project 1702897

September 2019

Fig. 2

I:\Project\National Grid\Sag Harbor\CAD\Figures\CAMP\1702897_CAMP_FIGS.ppt



SOURCE:

AERIAL IMAGERY DATE: 02/26/2016, OBTAINED FROM WORLD IMAGERY LAYER ACCESSED VIA ARCGIS ONLINE.

0 60 120

SCALE: 1" = 60'

LEGEND:

— FORMER MGP BOUNDARY

⬢ AIR MONITORING STATION

■ METEOROLOGICAL STATION

Community Air Monitoring Plan
Sag Harbor Former MGP Site
Sag Harbor, New York

nationalgrid

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TYPICAL AIR MONITORING
STATION LOCATION PLAN

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Fig. 3

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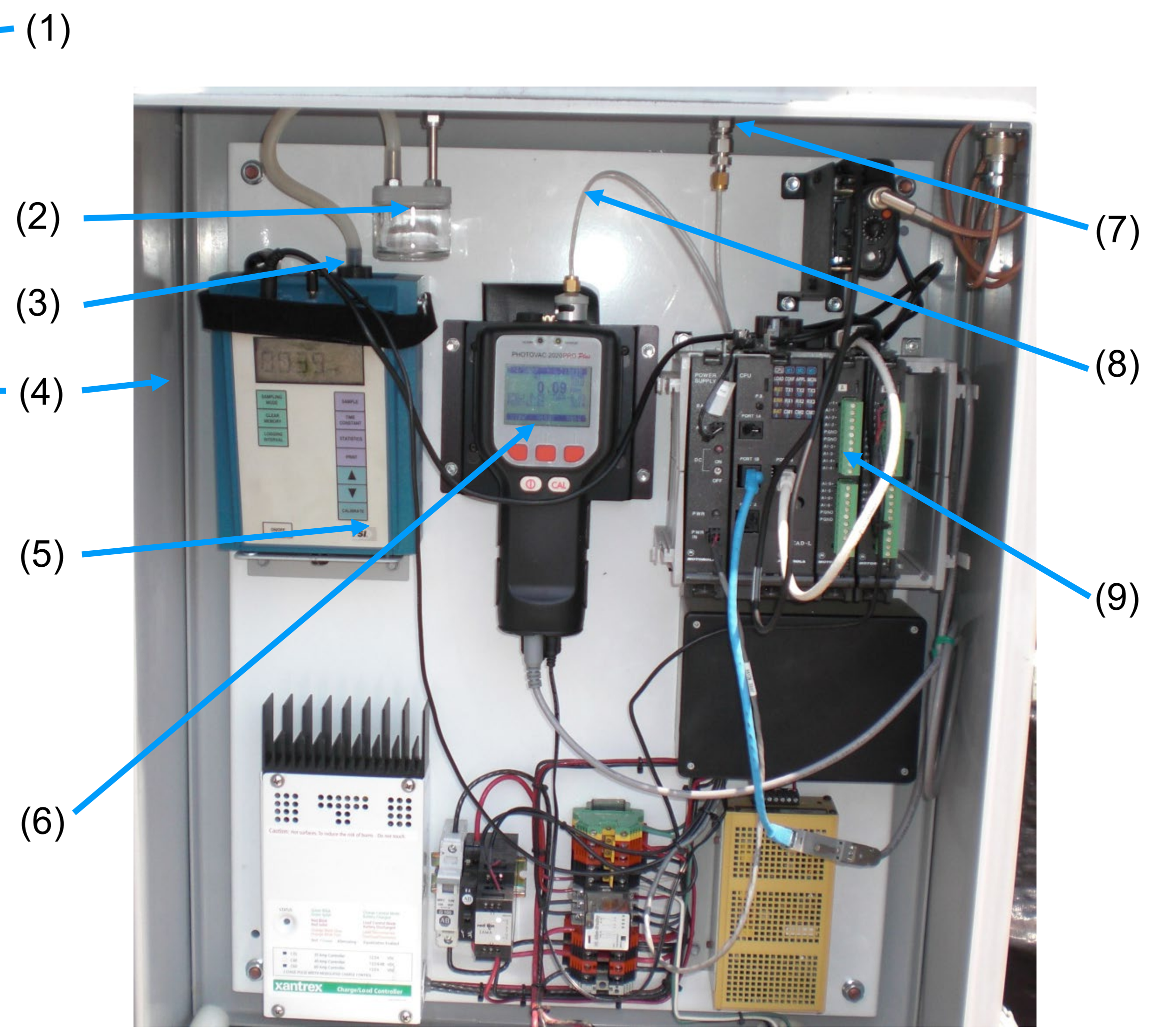

1. Solar Panel
2. DustTrak™ sample tubing with in-line condenser
3. DustTrak™ sample inlet with PM-10 impactor
4. Station enclosure
5. DustTrak™ Aerosol Monitor
6. PhotoVac™ 20/20 PID
7. PhotoVac™ 20/20 PID sample inlet
8. PhotoVac™ 20/20 PID sample inlet tubing
9. Data communications device

NOTE:
Figure depicts an AirLogics^{TM}, LLC Light air monitoring station as an example and may not be representative of the actual system or components that will be employed at the site

Community Air Monitoring Plan
Sag Harbor Former MGP Site
Brooklyn, New York

nationalgrid

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EXAMPLE FIXED STATION
INTERNAL COMPONENTS

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Fig. 4A

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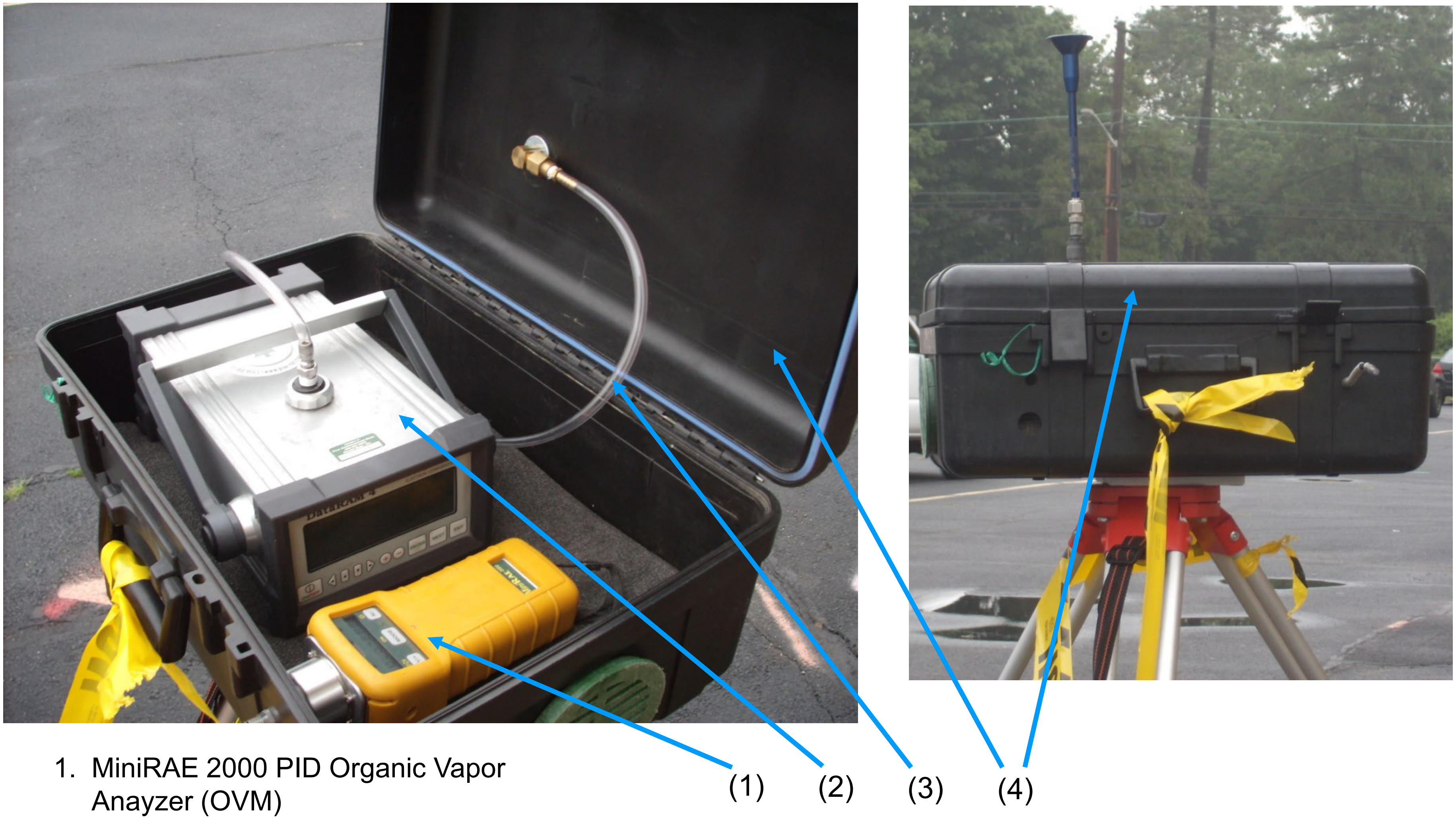

1. MiniRAE 2000 PID Organic Vapor Anayzer (OVM)
2. DataRAM Particulate Monitor
3. DataRAM sample tubing
4. Station enclosure

NOTE:
Figure depicts a Pine Environmental air monitoring station as an example and may not be representative of the actual system or components that will be employed at the site

Community Air Monitoring Plan
Sag Harbor Former MGP Site
Brooklyn, New York

nationalgrid

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EXAMPLE TRIPOD MOUNTED STATION
INTERNAL COMPONENTS

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Fig. 4B

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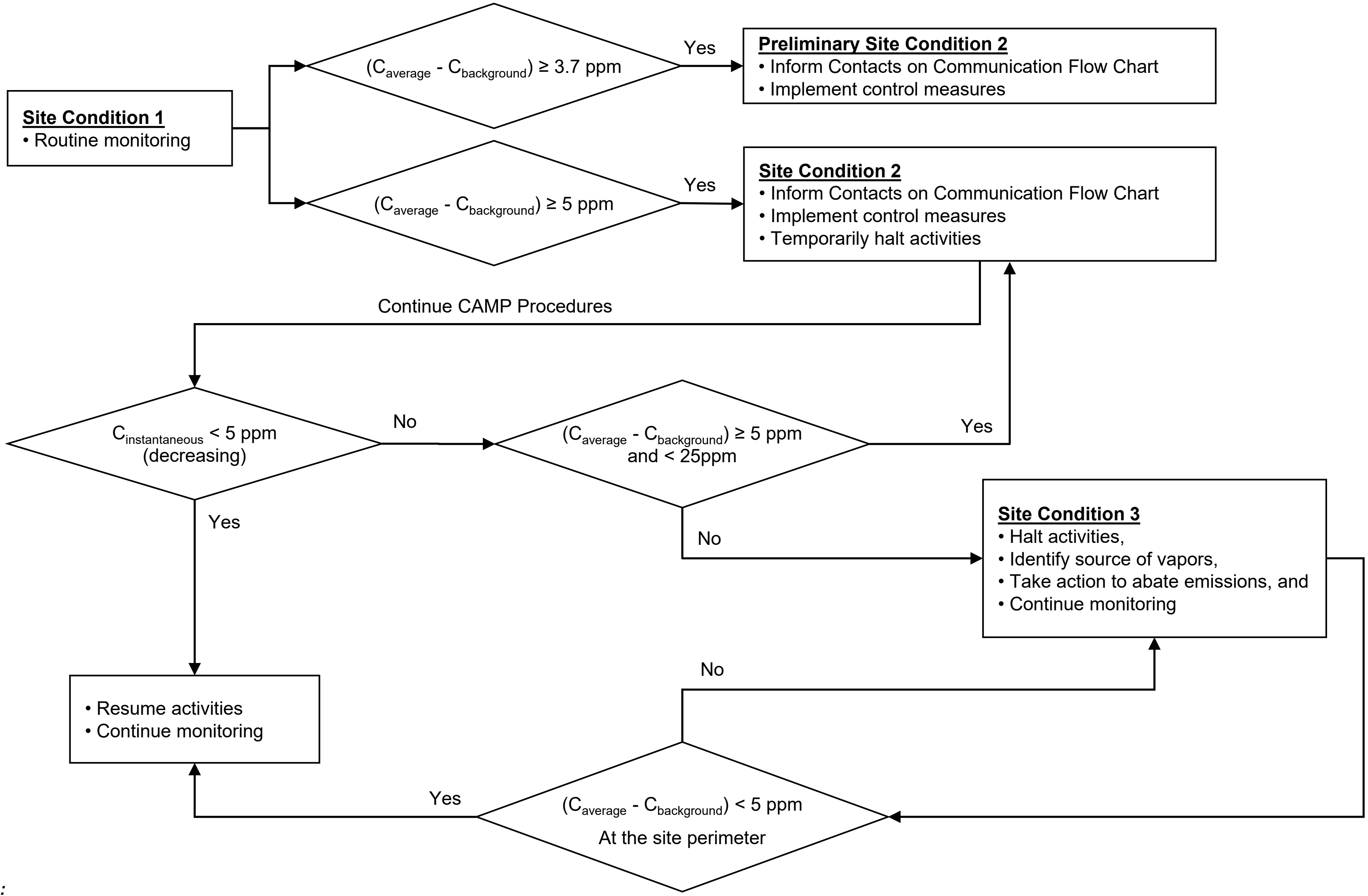

NOTES:

1. TVOC – Total Volatile Organic Compound
2. ppm – parts per million
3. $C_{average}$ = 15-minutes average concentration
4. $C_{background}$ = 15-minutes average concentration upwind
5. $C_{instantaneous}$ = 1-minute measured concentration

Community Air Monitoring Plan
Sag Harbor Former MGP Site
Brooklyn, New York

nationalgrid

GEI Consultants

TVOC
DECISION DIAGRAM

Project 1702897

September 2019

Fig. 5

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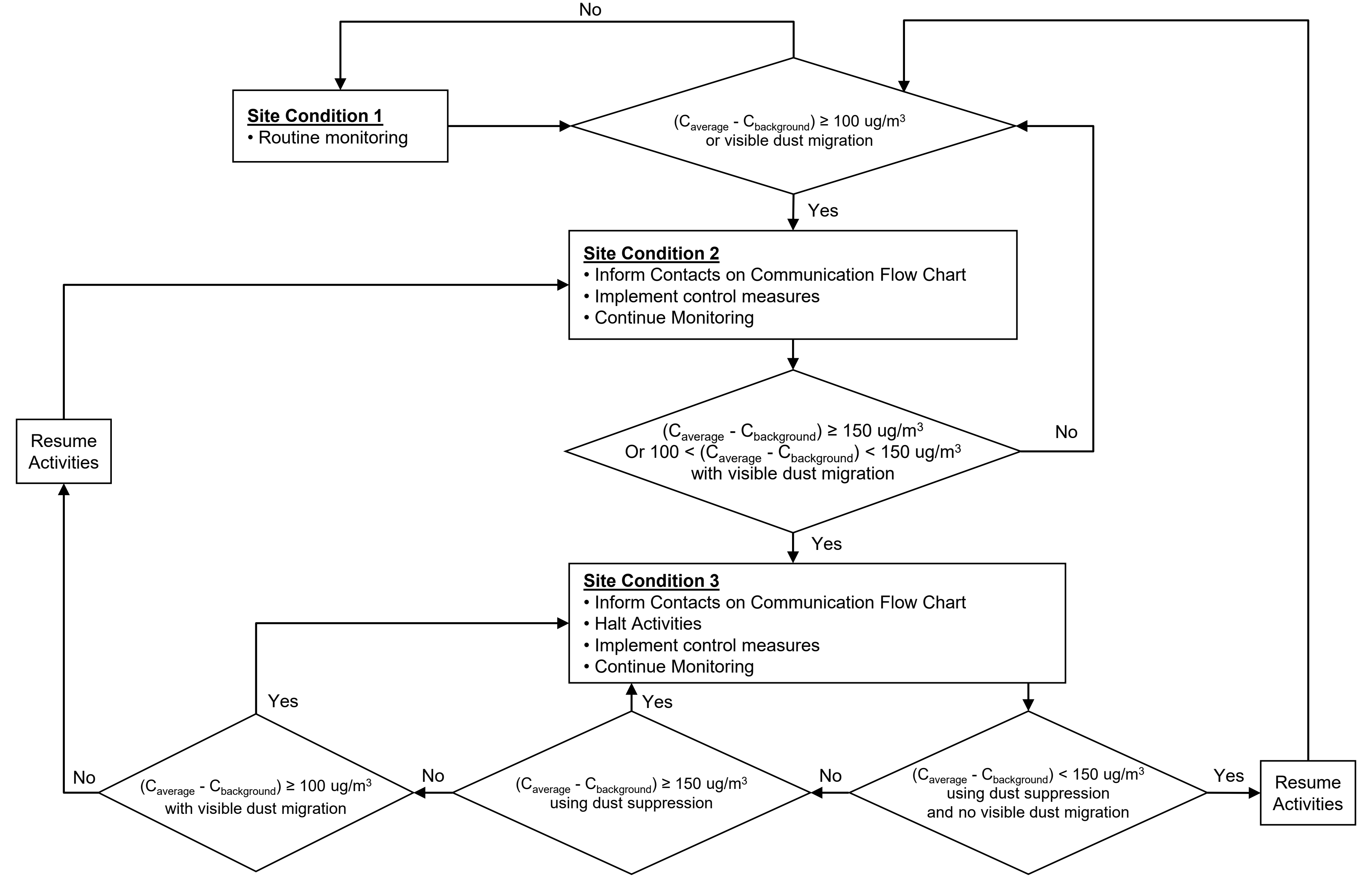

NOTES:

1. µg/m³ – micrograms per cubic meter
2. $C_{average}$ = 15-minutes average concentration
3. $C_{background}$ = 15-minutes average concentration upwind

Community Air Monitoring Plan
Sag Harbor Former MGP Site
Brooklyn, New York

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GEI Consultants

PARTICULATE MATTER
DECISION DIAGRAM

Project 1702897

September 2019

Fig. 6

Appendix A

NYSDOH Generic CAMP from DER-10 Appendix 1A

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 F. QUALITY ASSURANCE PROJECT PLAN

Consulting
Engineers and
Scientists

Quality Assurance Project Plan

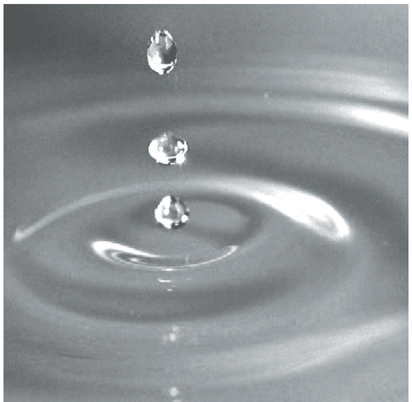
Former Sag Harbor MGP Site

Sag Harbor, New York
AOC Index No. D1-0002-98-11
Site No. 1-52-159

Submitted to:
National Grid
175 East Old Country Road
Hicksville, NY 11801

Submitted by:
GEI Consultants, Inc.
110 Walt Whitman Road
Huntington Station, NY 11746

September 2019
1702897



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Tables

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Abbreviations and Acronyms

ASP	Analytical Service Protocols
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
CAS	Chemical Abstract Service
CHMM	Certified Hazardous Materials Manager
CMS	Chip Measurement System
CLP	Contract Laboratory Program
COC	Chain-of-Custody
DQO	Data Quality Objective
DO	Dissolved Oxygen
DUSR	Data Usability Summary Report
ECs	Engineering Controls
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc., P.C.
ICs	Institutional Controls
ID	Identification
LCS	Laboratory Control Sample
LEL	Lower Explosive Limit
LEP	Licensed Environmental Professional (Connecticut)
MDL	Method Detection Limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
mg/m^3	milligram per cubic meter
MGP	Manufactured Gas Plant
MPH	Master of Public Health
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	Operations, Maintenance and Monitoring
PCB	Polychlorinated Biphenyls
P.G.	Professional Geologist
%R	Percent Recovery
PID	Photoionization Detector
PM	Project Manager
PQL	Practical Quantification Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation Recovery Act
RL	Reporting Limit
RPD	Relative Percent Difference
SC	Site Characterization
SD	Standard Deviation

Abbreviations and Acronyms (cont.)

SMP	Site Management Plan
SOP	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TCN	Total Cyanide
TestAmerica	TestAmerica Laboratories, Inc.
TIC	Tentatively Identified Compounds
TOX	Total Organic Halides
TPH	Total Petroleum Hydrocarbons
USDOT	United States Department of Transportation
VOC	Volatile Organic Compound

Quality Assurance Glossary

“Analytical Services Protocol” or “ASP” means the NYSDEC’s compendium of approved EPA and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

“Confirmatory Sample” means a sample taken after remedial action is expected to be complete to verify that the cleanup requirements have been met. This term has the same meaning as “post remediation sample”.

“Contract laboratory program” or “CLP” means a program of chemical analytical services developed by the EPA to support CERCLA.

“Data Usability Summary Report (DUSR)” is a document that provides a thorough evaluation of the analytical data to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and use.

“Effective solubility” means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate phase mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure phase solubility.

“Environmental Laboratory Accreditation Program” or “ELAP” means a program conducted by the NYSDOH which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing.

“Intermediate Sample” means a sample taken during the investigation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

“Method detection limit” or “MDL” means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

“Non-targeted compound” means a compound detected in a sample using a specific analytical method that is not a targeted compound, a surrogate compound, a system monitoring compound or an internal standard compound.

“Practical quantitation level” or “PQL” means the lowest quantitation level of a given analyte that can be reliably achieved among laboratories within the specified limits of precision and accuracy of a given analytical method during routine laboratory operating conditions.

“PAH” means polycyclic aromatic hydrocarbon as defined by EPA Method 8270.

“Quality assurance” means the total integrated program for assuring the reliability of monitoring and measurement data, which includes a system for integrating the quality planning, quality assessment and quality improvement efforts to meet data end-use requirements.

“Quality assurance project plan” or “QAPP” means a document which presents in specific terms the policies, organization, objectives, functional activities and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of a specific project or operation.

“Quality control” means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

“Semivolatile organic compound” means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semivolatiles are those target compound list compounds identified in the statement of work in the current version of the EPA Contract Laboratory Program.

“Target analyte list” or “TAL” means the list of inorganic compounds/elements designated for analysis as contained in the version of the EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/ elements.

“Targeted compound” means a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

“Target compound list plus 30” or “TCL+30” means the list of organic compounds designated for analysis (TCL) as contained in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis, and up to 30 non-targeted organic compounds (plus 30) as detected by gas chromatography/mass spectroscopy (GC/MS) analysis. For the purposes of this chapter, a Target Compound List+30 scan means the analysis of a sample for Target Compound List compounds and up to 10 non-targeted volatile organic compounds and up to 20 non-targeted semivolatile organic compounds using GC/MS analytical methods. Non-targeted compound criteria should be pursuant to the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"Tentatively identified compound" or "TIC" means a non-targeted compound detected in a sample using a GC/MS analytical method which has been tentatively identified using a mass spectral library search. An estimated concentration of the TIC is also determined.

"Unknown compound" means a non-targeted compound which cannot be tentatively identified. Based on the analytical method used, the estimated concentration of the unknown compound may or may not be determined.

"Volatile organics" means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of volatile organics means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 624 or those target compounds identified as volatiles in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"**Waste oil"** means used and/or reprocessed engine lubricating oil and/or any other used oil, including but not limited to: fuel oil, engine oil, gear oil, cutting oil, transmission fluid, oil storage tank residue, animal oil and vegetable oil, which has not subsequently been refined.

1. Purpose

GEI Consultants, Inc., P.C. (GEI) has prepared this Quality Assurance Project Plan (QAPP) for the Former Sag Harbor MGP site located in Sag Harbor, New York (Site). The Site Management Plan (SMP) is a required element of the remedial program and addresses the means for implementing the institutional controls (ICs) and engineering controls (ECs) that are required by the Environmental Easements and Access Agreements for the Site. The QAPP and the Field Sampling Plan (FSP) were prepared as companion documents to the SMP. The project location is shown in Figure 1 of the SMP. The QAPP presents the project scope and goals, organization, objectives, sample handling procedures and specific quality assurance/quality control (QA/QC) procedures associated with the Site's SMP future investigations and Operations, Maintenance and Monitoring (OM&M) program.

Furthermore, this QAPP identifies project responsibilities, prescribes guidance and specifications to make certain that:

- Samples are identified and controlled through sample tracking systems and chain-of-custody (COC) protocols

- Field and laboratory analytical results are valid and usable by adherence to established protocols and procedures

- Laboratory data are validated so they can be applied to developing a conceptual understanding of the nature and extent of contamination of soils and ground waters at the Site

- All aspects of the investigation, from field to laboratory are documented to provide data that are technically sound and legally defensible

The requirements of this QAPP apply to all contractor activities as appropriate for their respective tasks.

This QAPP was prepared based upon guidance provided by the United States Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) including:

- *DER-10, Technical Guidance for Site Investigation and Remediation.* New York State Department of Environmental Conservation. May 2010.

2. Project Goals and Objectives

On behalf of National Grid, GEI prepared a SMP to manage remaining impacts at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This QAPP was prepared to provide quality assurance guidelines for any additional sampling that may be required for further investigation at the Site and for the OM&M program.

3. Project Organization and Responsibility

GEI is responsible for the implementation of sampling activities, including the supervision of contractors, field activities, and the evaluation and interpretation of data. GEI will direct the sampling activities and coordinate submittal of samples to testing laboratories. The project organization and key personnel for GEI are listed below:

In-House Consultant: Errol Kitt
Program Manager: Chris Morris, P.G.
Project Manager (PM)/Field Team Leader: Mike Quinlan
Quality Assurance Officer: Lorie MacKinnon
GEI Corporate Health & Safety Officer: Steven Hawkins
Data Validator: Lorie Mackinnon
Data Manager: Jaimie Wargo

The primary responsibilities of each of these personnel are described in the following table.

Key Project Personnel and Responsibilities

Position	GEI Personnel	Areas of Responsibilities
In-House Consultant	Errol Kitt	• Provide strategic guidance of project activities • Client contact regarding strategic issues • Review of project deliverables
Program Manager	Chris Morris	• Overall program oversight • Project management • Project schedule • Client contact regarding project related issues • Personnel and resource management • Review of project submittals • Budgeting
Project Manager/ Field Team Leader	Mike Quinlan	• Project management • Client contact regarding project related issues on day to day basis • Coordination of contractors • Technical development and implementation of Work Plan and Field Sampling Plan • Personnel and resource management • Preparation and review of project submittals • Budgeting

Key Project Personnel and Responsibilities		
Position	**GEI Personnel**	**Areas of Responsibilities**
Quality Assurance Officer	Lorie MacKinnon	• QA/QC for sampling and laboratory performance
Data Validator	Lorie MacKinnon	• Perform data validation activities • Prepare data usability summary reports • Evaluate data with regards to quality objectives
Data Manager	Jaimie Wargo	• Manage raw data from the laboratory

TestAmerica, located in Edison, New Jersey, is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-approved laboratory and will perform standard analytical chemistry parameters for groundwater samples, soil vapor and ambient air, and confirmation soil samples including:

- Volatile Organic Compounds (VOCs) according to EPA Method 8260C
- Semivolatile Organic Compounds (SVOCs) according to EPA Method 8270D
- Target Analyte List (TAL) Metals according to EPA Method 6000/7000 series
- Total Cyanide (TCN) according to EPA Method 9012
- Disposal Parameters (total metals, Toxicity Characteristic Leaching Procedure Metals, Resource Conservation Recovery Act (RCRA) 8 metals, Toxicity Characteristic Leaching Procedure (TCLP) pesticides, TCLP herbicides, TCLP VOC, TCLP SVOC, paint filter test, ignitability, corrosivity, reactivity, total petroleum hydrocarbons (TPH), total polychlorinated biphenyls (PCBs), flashpoint, total organic halides (TOX), and % solids)
- VOCs according to EPA Method TO-15 (including naphthalene)
- Helium by American Society for Testing and Materials (ASTM) Method 1945

TestAmerica's relevant certifications are summarized in the following table.

TestAmerica Certifications		
Location	**Responsible Agency**	**Certification**
New York	New York State Department of Health	ELAP for potable water/non-potable water, solid and hazardous waste) Contract Laboratory Program (CLP)
	New York State Department of Conservation	Analytical Service Protocol (ASP)
United States	United States Environmental Protection Agency	CLP-Lab:10602 [VOCs/SVOCs/Inorganics]

Tables 1 through 3 provide a summary of analysis by media (subsurface soil, groundwater, soil vapor and ambient air). Table 4 provides a summary of quality assurance samples, holding times, and analysis for each media.

4. Quality Assurance Objectives

This section establishes the QA objectives for measurements that are critical to the project. The QA objectives are developed for relevant data quality indicators. These indicators include the method detection limit, reporting limit, precision, accuracy, completeness, representativeness, and comparability. The data quality objectives (DQOs) are based on project requirements and ensure: (1) that the data generated during the project are of known quality, and (2) that the quality is acceptable to achieve the project's technical objectives. All analytical data will be provided by the laboratory using the New York State ASP Category B deliverable format.

Quantitation Limits are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness. The analytical methods to be used at this site will provide a level of data quality and can be used to evaluate potential impacts to soil and groundwater from the former holder operation, compared to New York State Standards, Criteria and Guidance values, and also for purposes of risk assessment.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain-of-custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of the QAPP.

The data quality indicators are presented in subsections 4.1 through 4.6. Procedures to assess the data quality indicators are given in Section 13.

4.1 Required Quantification Limit

The required quantification limit is the quantitative analytical level for individual analytes needed to make decisions relative to the objectives of the project. Quantitative limits may be expressed as the method detection limit or some quantitative level defined in terms relative to the program. It should be noted that there is some ambiguity in the definitions and use of terms that define quantification limits. The method detection limit (MDL) presented herein is a well-defined and accepted entity, although attainable only under ideal laboratory conditions.

Method Detection Limit: The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDL is determined from analysis of a sample in a given matrix type containing the analyte.

Practical Quantitation Limit: The practical quantitation limit (PQL) [also referred to as the reporting limit (RL)] is the concentration in the sample that corresponds to the lowest concentration standard of the calibration curve.

Laboratory MDLs and PQLs for soils, groundwater, soil vapor, and ambient air are located in Tables 5 through 7, respectively.

4.2 Accuracy

Accuracy is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., sample liners, drilling shoe, or stainless–steel sampling implements).

The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of “standards,” materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds in matrix spikes (MSs), matrix spike duplicates (MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. The laboratory accuracy will be evaluated in accordance with laboratory quality assurance plan and standard operating procedures located in Appendix A.

4.3 Precision

Precision is the agreement among a set of replicate measurements without consideration of the “true” or accurate value: i.e., variability between measurements of the same material for the same analyte. In environmental sampling, precision is the result of field sampling and analytical factors. Precision in the laboratory is easier to measure and control than precision in the field. Replicate laboratory analyses of the same sample provide information on analytical precision; replicate field samples provide data on overall measurement precision. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision.

Precision in the field is assessed through the collection and measurement of field duplicates. Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter, with the exception of the waste characterization parameters. Precision will be measured through the calculation of relative percent differences (RPDs) as described in subsection 13.2. The resulting information will be used to assess sampling and analytical variability. Duplicate samples are described in subsection 5.1.6. Table 4 summarizes the number of duplicates per media sampled.

Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicate pairs and field duplicate pairs. MS/MSD samples or matrix duplicate pairs will be performed at a frequency of one per 20 primary samples per matrix. Duplicate samples are described in below in subsection 5.1.6. Table 4 summarizes the number of duplicates per media sampled.

4.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. “Normal conditions” are defined as the conditions expected if the sampling plan was implemented as planned. The objective for completeness is a sufficient amount of valid data to achieve a predetermined statistical level of confidence. Critical samples must be identified and plans must be formulated to secure requisite valid data for these samples.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project, and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

To ensure that these percentages are met, materials for crucial parameters will be retained if re-sampling is required and strict adherence to holding times will be required.

4.5 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represent either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that procedures are followed and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample-holding times. These are provided in Table 4 and within Appendix A.

4.6 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the procedures are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. To facilitate data comparison, the data-reporting format as presented below will be used:

- Conventions (units reported as): for solids (weight/unit weight [i.e., milligram per kilogram (mg/kg)]); for liquids (weight/unit volume [i.e. milligrams per liter (mg/L)]); for air (weight/unit volume [i.e., milligrams per cubic meter (mg/m^3)]).
- Use common chemical name with corresponding chemical abstract system (CAS) code.
- Report all data for soils on a dry-weight basis.

5. Sampling Plan

Environmental sampling may include subsurface soil, groundwater, soil vapor and ambient air, confirmation soil and waste characterization sampling. Direct push drilling (Geoprobe®) will be the preferred method for obtaining subsurface soil samples. Groundwater samples will be collected utilizing low-flow sampling methods, peristaltic pumps, bailers, whale pumps, or bladder pumps. Performing grab or composite sampling by appropriate hand-held sampling equipment will be the preferred method for waste characterization sampling. Analytical samples and analysis methods will be described further in the future sampling program's work plan. Sampling methods and procedures will be described in the FSP.

5.1 Sample Type, Location, and Frequency

5.1.1 Subsurface Soil Samples

Subsurface soil sample locations may be sampled using Geoprobe® drilling methods. If difficult drilling conditions are encountered alternative drilling methods such as rotosonic or hollow stem auger drilling methods may be considered. The actual number of subsurface soil samples and their location will be summarized in the future Work Plan and FSP and may be modified based upon subsurface utilities and property access. The number and location of samples will vary based upon access and subsurface obstructions. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in general accordance with the Work Plan and the FSP. A summary of subsurface soil samples and analysis are located in Table 1.

5.1.2 Groundwater Samples

Groundwater monitoring will be performed to evaluate trends in the groundwater quality. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Groundwater samples will be collected from seven monitoring wells and/or temporary groundwater sampling points using low-flow methods. Groundwater samples will be collected from wells screened across the water table or targeted intervals at the proposed sample locations. Ground water samples will be collected and submitted for laboratory analysis in general accordance with the FSP and future work plans. Water quality parameters including temperature, pH, turbidity, dissolved oxygen (DO), and specific conductance, will be collected prior to laboratory analysis in general accordance with the program work plan and the FSP. A summary of groundwater samples and analysis are located in Table 2.

5.1.3 Soil Vapor Samples

Soil vapor sample points may be installed and sampled in general accordance with the New York State Department of Health's "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" and National Grid's "Draft Standard Operating Procedure - Soil Vapor Intrusion for MGP Sites in New York. Sub-slab soil vapor points will be installed to evaluate the soil vapor conditions. Soil vapor samples will be collected in certified clean SUMMA canisters and submitted for laboratory analysis in general accordance with the FSP and program work plans. A summary of soil vapor samples and analysis are located in Table 3.

5.1.4 Ambient Air Samples

Indoor and outdoor air samples may be collected. Ambient air samples are used to assess the potential for soil vapor intrusion into buildings. A summary of ambient air samples and analysis are located in Table 3.

Ambient air samples will be collected from the approximate breathing height (approximately 3 to 5 feet above ground). Indoor air and outdoor air samples will be collected utilizing an individually certified 6-Liter SUMMA canister with a laboratory-supplied flow controller that is calibrated to an 8-hour period. The regulator flow rate will not exceed 0.2 liters per minute. Each SUMMA canister will be shipped to an approved NYSDOH ELAP-registered laboratory for analysis. The samples will be analyzed for VOCs and naphthalene by the modified EPA Method TO-15. QA/QC samples will include one blind duplicate ambient air sample (indoor or outdoor air sample). The ambient air sampling will target the winter heating season between November 15 and March 31 in accordance with NYSDOH Soil Vapor Guidance.

Property information will also be collected in general accordance with the NYSDOH Center of Environmental Health's Indoor Air Quality Questionnaire and Building Form that is provided as Appendix B of the NYSDOH soil vapor guidance and National Grid's Draft Standard Operating Procedures for Soil Vapor Intrusion for Manufactured Gas Plant (MGP) Sites in New York which are located in the FSP.

5.1.5 Investigation-Derived Waste Sample Collection

Waste classification sampling will be conducted as needed for soils and liquid wastes. The purpose of characterizing a waste is for its proper off-site disposal. Composite samples will be collected from the on-site waste storage vessels (drums or roll-off) for parameters required by the approved disposal facility. Soil samples will be collected utilizing stainless steel sampling tools, shovel, or auger that had been decontaminated. Liquid samples will be collected utilizing disposable bailer, peristaltic pump, a pump with tubing, or other similar methods.

These samples will be handled in general accordance with sample handling procedures presented in the FSP. Investigation-derived waste samples will be analyzed for parameters listed in Section 3 or other analyses that are required by the National Grid-approved facility.

5.1.6 Field QC Sample Collection

Field QC samples are used to monitor the reproducibility and representativeness of field sampling activities. The field QC samples are handled transported and analyzed in the same manner as the associated field samples. Field QC samples will include equipment blanks, trip blanks, field duplicates and MS/MSDs. The quantity, field QC sample type and analysis is detailed in Table 4.

Equipment Blank Samples are used to monitor the adequacy of decontamination procedures and possible sources of contamination such as potential laboratory methodologies. Equipment blanks will consist of laboratory-supplied, distilled or de-ionized water and will be used to check for potential contamination of the equipment which may cause sample contamination. Equipment blanks will be collected by routing the distilled water through decontaminated piece of sampling equipment or disposable sampling equipment into laboratory supplied bottles. Non-dedicated field equipment will be decontaminated as specified below in subsection 4.3. Equipment blanks will be submitted to the laboratory at a frequency of one per 20 samples per matrix per type of equipment being used per parameter. Equipment blanks will not be completed for waste characterization sampling activities.

Trip Blank Samples will consist of analyte free water and will be prepared by the laboratory. (Trip blanks are used to assess the potential for VOC contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the project location unopened, stored with the site characterization samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler which contains samples submitted for VOC analysis.

Field Duplicate Samples, also referred to as blind duplicate samples, are two samples that are submitted form the same interval using the same sample procedures. Field duplicates will be used to assess the sampling and analytical reproducibility. Both samples are collected utilizing the same methods and are submitted for the same laboratory analysis however different sample identification numbers are used. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters. Field duplicates will not be completed for waste characterization sampling activities.

MS/MSD Samples are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for organic and inorganic parameters. MS/MSDs will not be completed for waste characterization sampling activities.

Refer to Table 4 for a summary of QC sample preservation and container requirements.

5.2 Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest United States EPA's Specifications and Guidance for Contaminant- Free Sample Containers. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to EPA specifications. The containers will be pre-preserved, where appropriate (Table 4).

5.3 Equipment Decontamination

All non-dedicated sampling equipment shall be cleaned between each use in the following manner:

- Wash/scrub with a biodegradable degreaser ("Simple Green") if there is oily residue on equipment surface
- Tap water rinse
- Wash and scrub with Alconox (or non-phosphate soap) and water mixture
- Tap water rinse
- All equipment used to collect samples for VOCs and SVOC analysis will then receive a methanol rinse followed by a de-ionized water rinse
- All equipment used to collect samples for metals analysis will then receive a 10% nitric acid solution rinse followed by a de-ionized water rinse
- 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

The drilling equipment will be decontaminated in general accordance with methods described in the FSP.

Decontamination fluids will be containerized into United States Department of Transportation (USDOT)/UN-approved 55-gallon drums or containment vessels and will be characterized and disposed of by National Grid at an approved disposal facility.

6. Documentation and Chain-of-Custody

6.1 Sample Collection Documentation

6.1.1 Field Notes

Field notes documenting field activities will be maintained in a field notebook in general accordance with subsection 2.2 of the FSP. Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. Each page of the logbook will be signed in permanent ink and dated. No erasures or obliterations of field notes will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field logbooks will be reviewed at regular intervals by the field team leader, site manager, and PM for completeness and representativeness. Logbooks will be supported by daily activity reports as described in subsection 2.3 of the FSP.

6.1.2 Chain-of-Custody Records

Sample custody is discussed in detail below in subsection 6.2. Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include:

- The project name
- Signature(s) of sampler (s) responsible for sample custody
- Sample identification (ID) number
- Date and time of collection
- Whether the sample is grab or composite
- Names of individuals involved in sampling
- Air bill or other shipping number (if applicable)

On a regular basis (daily or on such a basis that all holding times will be met), samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service. Sample packaging and shipping procedures, and field chain-of-custody procedures are described below in subsection 6.2.1 of this Plan.

Sample receipt and log-in procedures at the laboratory are described below in subsection 6.2.2 of this Plan.

6.1.3 Sample Labeling

Each sample will be labeled with a pre-printed adhesive label using indelible ink. The label should include the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identification.

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the Data Manager and/or the GEI Project QA Officer.

6.1.4 Sample Handling

Samples will be handled in general accordance with Section 5 of the FSP.

6.2 Sample Custody

The chain-of-custody provides a record of the custody of any environmental field sample from the time of collection to the delivery to the laboratory. Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law.

Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample is considered to be under a person's custody if:

- the item is in the actual possession of a person
- the item is in the view of the person after being in actual possession of the person
- the item was in the actual physical possession of the person but is locked up to prevent tampering
- the item is in a designated and identified secure area

6.2.1 Field Custody Procedures

Samples will be collected following the sampling procedures indicated in the Work Plan and the FSP. A summary of samples and collection methods are provided above in Section 5 of this QAPP. Documentation of sample collection is described above in subsection 6.1. Sample chain-of-custody and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented above in subsection 6.1.3.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions.
- Samples will be accompanied by a completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, and to the laboratory facility.
- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.
- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the cooler and covered with clear plastic tape after being signed by field personnel.
- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.
- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

6.2.2 Laboratory Custody Procedures

After accepting custody of the shipping containers, the laboratory will document the receipt of the shipping containers by signing the chain-of-custody record. The laboratory will:

- Examine the shipping containers to verify that the custody tape is intact
- Examine all sample containers for damage
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the chain-of-custody records

- Compare samples received against those listed on the chain-of-custody
- Verify that sample holding times have not been exceeded
- Examine all shipping records for accuracy and completeness
- Determine sample pH (if applicable) and record on chain-of-custody forms
- Sign and date the chain-of-custody immediately (if shipment is accepted) and attach the air bill
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the laboratory project manager, who will be responsible for contacting the GEI data manager
- Attach laboratory sample container labels with unique laboratory identification and test
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.

- The completed chain-of-custody, air bills, and any additional documentation will be placed in the final evidence file.

7. Calibration Procedure

7.1 Field Instruments

Field instruments will be calibrated according to the manufacturer's specifications. Air monitoring instruments will be calibrated to a known reference gas standard and ambient air outside the work zone. Calibration will be completed daily. If concentrations of VOCs are encountered above the reference gas standard, the soil screening photoionization detectors (PID) may be calibrated or re-checked against the reference gas standard. Water quality meters will be calibrated with known reference solutions. All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, and the readings. The following equipment has been identified for future use to implement the sampling.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), lower explosive limit (LEL), percent oxygen, hydrogen sulfide and hydrogen cyanide
- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp
- Drager Chip Measurement System (CMS) and compound specific chips (including benzene, hydrogen sulfide, hydrogen cyanide, etc.)
- MIE pDR 1200 with cyclone and pump [particulate monitor]
- MSA LC Pump or SKC 224-PCXR4 [air pump for dust monitoring]
- BIOS Dry Cal DC Lite Primary Flow Meter Model ML [air pump calibration]
  Groundwater Sampling Activities:
- In-Situ Multi-Parameter Troll 9000
- YSI 6280 XLM water quality meter

Soil Vapor and Ambient Air Sampling Activities:

- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp

Similar field equipment can be substituted that perform the same functions can be substituted if selected equipment is not available from equipment supplier.

7.2 Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and/or continuing calibration verification. Detailed descriptions of the calibration procedures for a specific laboratory instrument are included in the laboratory's quality assurance plan, which describe the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. These procedures are as required in the respective analytical methodologies summarized in Tables 1 through 3 of this QAPP.

8. Sample Preparation and Analytical Procedures

Analytical samples will be collected in general accordance with the FSP and as specified in the program work plan. Tables 1 through 3 provide a sample collection matrix that is separated by media. Analytical samples will be collected into laboratory-preserved sample containers and will be preserved as indicated in Table 4.

9. Data Reduction, Validation, and Reporting

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation to support the generation of a Data Usability Summary Report (DUSR) according to NYSDEC requirements will be provided by the analytical laboratory.

9.1 Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Reviews of the field records by the field team leader, site manager, and PM will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the FSP and Work Plan, and that any deviations were documented and approved by the appropriate personnel.

9.2 Analytical Data Validation

GEI will be responsible for performing an independent validation of the analytical data. Project-specific procedures will be used to validate analytical laboratory data. The basis for the validation will be the EPA CLP National Functional Guidelines for Organic Data Review (January 2005) and the EPA CLP National Functional Guidelines for Inorganic Data Review (October 2004), modified to accommodate the criteria in the analytical methods used in this program, and Region II Standard Operating Procedures (SOPs) for CLP Organic Data review (Revision 11, June 1996) and Evaluation of Metals for the CLP Program (Revision 11, January 1992). Critical functions for determining the validity of generated data are: (1) strict adherence to the analytical methods, (2) assurance that the instrumentation employed was operated in accordance with defined operating procedures, (3) assurance that quality parameters built into the analytical procedures have been adhered to, and (4) confirmation that the DQOs have been met.

Table 4 highlights the QC criteria and holding time requirements for all analyses conducted under this program. These criteria will be used to evaluate and qualify the data during validation.

GEI or qualified contracted personnel will validate all analytical samples collected as part of the Site investigations. Samples collected for waste classification will not be validated. Validation will include all technical holding times, as well as QC sample results (blanks, surrogate spikes, laboratory duplicates, MS/MSDs, and LCSs), tunes, internal standards, calibrations, target compound identification, and results calculations.

For all analyses, the laboratory will report results which are below the laboratory's reporting limit; these results will be qualified as estimated (J) by the laboratory. The laboratory may be required to report tentatively identified compounds (TICs) for the VOC and SVOC analyses; this will be requested by GEI on an as-needed basis.

The overall completeness of the data package will also be evaluated by the data validator. Completeness checks will be administered on all data to determine whether full data deliverables were provided. The reviewer will determine whether all required items are present and request copies of missing deliverables.

Upon completion of the validation, a report will be prepared. This report will summarize the samples reviewed, elements reviewed, any nonconformance with the established criteria, and validation actions. Data qualifiers will be consistent with EPA National Functional Guidelines. This report will be in a format consistent with NYSDEC's DUSR.

9.3 Analytical Data Deliverable

Laboratory deliverables will consist of original hard copy data packages that are in general accordance with NYSDEC ASP Category B data deliverable requirements.

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^{TM} database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

10. Internal Quality Control

Laboratory and field quality internal control checks will be used to ensure the data quality objectives. At a minimum, this will include:

- Matrix spike and/or matrix spike duplicate samples
- Matrix duplicate analyses
- Laboratory control spike samples
- Instrument calibrations
- Instrument tunes for VOC 8260B and SVOC 8270C analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for VOC 8260B and SVOC 8270C analyses
- Detection limit determination and confirmation by analysis of low-level calibration standard

The laboratory quality plan for TestAmerica is located in Appendix A.

Field quality control samples will include:

- Equipment blanks as outlined in Table 4
- Field duplicate samples as outlined in Table 4
- Trip blanks as outlined in Table 4
- MS/MSDs as outlined in Table 4

11. Performance and System Audits

Audits are an independent means of: 1) evaluating the operation or capability of a measurement system, and 2) documenting the use of QC procedures designed to generate data of know and acceptable quality.

Field audits may be completed to assess sample collection protocols, determine the integrity of COC procedures, and evaluate sample documentation and data handling procedures. Field audits may be scheduled by the QA officer, PM, site manager or in-house consultant, at their discretion. Written records of audits and any recommendations for corrective action will be submitted to the PM.

The QA officer is the interface between management and project activities in matters of project quality. The QA officer will review the implementation of the QAPP. Reviews will be conducted at the completion of field activities and will include the results of any audits and an evaluation of the data quality.

12. Preventive Maintenance

Preventative maintenance will be performed on field equipment in accordance with the manufacturer's recommendations. Preventative maintenance to field will be provided by equipment vendor, U.S. Environmental Rental Corporation, Pine Environmental Services, or other selected vendors. The following equipment has been identified for use to implement the sampling.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), LEL, percent oxygen, hydrogen sulfide and hydrogen cyanide.
- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp.
- RAE Systems VRAE Surveying Monitor with LEL, hydrogen cyanide, hydrogen sulfide, carbon monoxide, and percent oxygen.
- Drager CMS and compound specific chips.
- MIE pDR 1200 with cyclone and pump.
- MSA LC Pump.
- BIOS DCL-5k pump calibrator.

Groundwater Sampling Activities:

- In-Situ Troll 9000
- YSI 600 XLM

Soil Vapor and Ambient Air Sampling Activities:

- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp

Similar equipment will be substituted that perform the same functions can be substituted if selected equipment is not available from equipment supplier.

Laboratory equipment calibration and maintenance procedures are specified in TestAmerica's laboratory quality manual located in Appendix A.

13. Specific Procedures to Assess Data Quality Indicators

QC analyses conducted as a part of the testing program will provide a quantitative quality assessment of the data generated and their adherence to the data quality indicators. The data quality indicators ensure that the quality assurance objectives for the project are met.

13.1 Detection Limits

13.1.1 Method Detection Limit

The MDL is defined as follows for all measurements:

$$\text{MDL} = (t[n-1,1-a=0.99]) \text{ x } (s)$$

where: s = standard deviation of the replicate analysis,
t(n-1, 1-a=0.99) = student's t-value for a one-sided, 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom

The MDLs calculated by the laboratory are determined under ideal conditions. MDLs for environmental samples are dependent on the sample aliquot, the matrix, the concentration of analyte, and interference present in the matrix, the percent of moisture, dilution factor, etc. The MDL for each sample analysis will be adjusted accordingly.

13.1.2 Reporting Limit

The RL is the concentration of an analyte in the sample that corresponds to the lowest concentration standard of the calibration curve. As with the MDLs, the RLs are dependent on the sample aliquot, the final sample volume, the percent of moisture, dilution factor, etc.

$$RL = \frac{\text{Lowest conc. std (ng)}}{\text{Volume injected (uL)}} \text{ x } \frac{\text{Sample aliquot (mL or g)}}{\text{Final volume (mL)}} \text{ x } DF \text{ x } \frac{100}{(100 - \%M)}$$

The RL is determined as follows:

where: DF = dilution factor, including all dilutions or lost samples not accounted for in a sample aliquot/final volume ratio
%M = percent moisture for solid samples.

13.2 Precision

Variability will be expressed in terms of the RPD when only two data points exist. The RPD is calculated as:

$$RPD = \frac{(Larger\ Value - Smaller\ Value)}{[(Larger\ Value + Smaller\ Value)/2]} x\ 100\%$$

For data sets greater than two points, the percent relative standard deviation (percent RSD) is used as the precision measurement. It is defined by the equation:

$$Percent\ RSD = \frac{Standard\ Deviation}{Mean} x\ 100\%$$

Standard deviation (SD) is calculated as follows:

$$SD = \sqrt{\sum_{i=1}^{n} \frac{(y_i - y)^2}{n - 1}}$$

where: SD = standard deviation
yi = measured value of the ith replicate
y = mean of replicate measurements
n = number of replicates

For measurements such as pH, where the absolute variation is more appropriate, precision is usually reported as the absolute range (D) of duplicate measurements:

$$D = \left| \text{first measurement - second measurement} \right|$$

or as the absolute standard deviation previously given. RPD, %RSD, and D are independent of the error of the analyses and reflect only the degree to which the measurements agree with each other, not the degree to which they agree with the true value for the parameter measured.

13.3 Accuracy

Accuracy is related to the bias in a measurement system. Accuracy describes the degree of agreement of a measurement with a true value. Accuracy will be expressed as percent recovery for each matrix spike analyte by using the following equation:

$$\%\,Recovery = \frac{Css - Cus}{\text{Csa}}\ X\ 100\%$$

where: Css = measured concentration in spiked sample
Cus = measured concentration in unspiked sample
Csa = known concentration added to the sample

Accuracy for a measurement such as pH is expressed as bias in the analysis of a standard reference sample according to the equation:

$$\text{Bias} = \text{pH}_\text{m} - \text{pH}_\text{t}$$

where: pH_m = measured pH
pH_t = the true pH of the standard reference sample

13.4 Completeness

Data completeness is a measure of the amount of usable data resulting from a measurement effort. For this program, completeness will be defined as the percentage of valid data obtained compared to the total number of measurements necessary to achieve our required statistical level of confidence for each test. The confidence level is based on the total number of samples proposed in the Work Plan.

Data completeness is calculated as:

$$Completeness = \frac{Number\ of\ valid\ data\ points}{Number\ of\ data\ points\ necessary\ for\ confidence\ level} x\,100\%$$

The completeness goal is to generate a sufficient amount of valid data. GEI anticipates that 95 percent of the data will be complete. Data validation criteria discussed in the work plan and Section 10 of this QAPP will be used to determine data completeness. Any data deficiencies and their effect on project goals will be evaluated in the DUSR.

13.5 Representativeness

Representativeness is a qualitative statement that expresses the extent to which the sample accurately and precisely represents the characteristics of interest of the study. Representativeness is primarily concerned with the proper design of the sampling program and is best ensured by proper selection of sampling locations and the taking of a sufficient number of samples. It is addressed by describing the sampling techniques, the matrices sampled, and the rationale for the selection of sampling locations, which are discussed in the field sampling plan and Work Plan

13.6 Comparability

Comparability is a qualitative parameter expressing the confidence that one set of data can be compared to another. Comparability is possible only when standardized sampling and analytical procedures are used.

14. Corrective Action

If unacceptable conditions are identified as a result of audits or are observed during field sampling and analysis, the PM, Field Team Leader, and QA officer will document the condition and initiate corrective procedures. The specific condition or problem will be identified, its cause will be determined, and appropriate action will be implemented.

The entire sampling program will be under the direction of the PM and QA officer. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data collection, laboratory analysis, and interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the program work plan and FSP. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the PM. The corrective action will usually involve recalculation, reanalysis, or repeating a sample run.

14.1 Immediate Corrective Action

Corrective action in the field may be needed when the sample requirements are changed (i.e., more/less samples, sampling locations other than those specified in the program work plan), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader, Site Manager and PM will approve the corrective action and notify the QA officer. The PM and QA officer will approve the corrective measure. The Field Team Leader and Site Manager will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action
- The action taken in response
- The final resolution
- Any necessary approvals

No staff member will initiate corrective action without prior communication of findings through the proper channels.

Corrective action in the laboratory will be completed in accordance with the quality assurance procedures located in the Appendix A. Any corrective actions completed by the laboratory will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the PM. If the corrective action does not rectify the situation, the laboratory will contact the PM, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action if necessary.

Tables

Table 1. Subsurface Soil Field Sampling Matrix

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Sample I.D.	Sample Location	Laboratory Sample Description	Sample Rationale	Sampling Medium		TCL VOCs (EPA 8260C)	TCL SVOCs (EPA 8270D)	TAL Metals (EPA 6010)	Total Cyanide (EPA 9012)	Free Cyanide (EPA 9016)
				Field Observations[1]	Soil[2]					
TBD	TBD	TBD	TBD	X	X	X	X	X	X	X

NOTES:

[1] : Field observations include visual (e.g. staining, sheen, and discolorization) and olfactory observations. Field observations will be recorded in field notes.

[2] : Soil samples may also be analyzed for forensic analyses including alkylated polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH).

Chemical analysis test methods specified are from U.S. EPA SW-846 test methods
EPA - Environmental Protection Agency
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TCL - target compound list
TAL - target analyte list
TBD - to be determined

Table 2. Groundwater Field Sampling Matrix

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Sample I.D.	Sampling Medium		Water Quality Measurements							BTEX/MTBE (EPA 8260C)	PAHs (EPA 8270D)	TCL VOCs (EPA 8260C)	TCL SVOCs (EPA 8270D)	TAL Metals (EPA 6010)	Total Cyanide (EPA 9012)
	Field Observations[1]	Groundwater	pH	Specific Conductance	Temperature	Oxidation Reduction Potential (ORP)	Turbidity	Salinity	Dissolved Oxygen						
SHMW-03S	X	X	X	X	X	X	X	X	X	X	X				
SHMW-03I	X	X	X	X	X	X	X	X	X	X	X				
SHMW-04SR	X	X	X	X	X	X	X	X	X	X	X				
SHMW-05SR	X	X	X	X	X	X	X	X	X	X	X				
SHMW-05IR	X	X	X	X	X	X	X	X	X	X	X				
SHMW-08S	X	X	X	X	X	X	X	X	X	X	X				
SHMW-08I	X	X	X	X	X	X	X	X	X	X	X				
SHMW-09S	X	X	X	X	X	X	X	X	X	X	X				
SHMW-09I	X	X	X	X	X	X	X	X	X	X	X				
SHMW-11I	X	X	X	X	X	X	X	X	X	X	X				
SHMW-12S	X	X	X	X	X	X	X	X	X	X	X				
TBD	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

NOTES:

[1] : Field observations include visual (e.g. staining, sheen, and discolorization) and olfactory observations. Field observations will be recorded in field notes.

Chemical analysis test methods specified are from U.S. EPA SW-846 test methods
BTEX - benzene, toluene, ethylbenzene and xylene
MTBE - methyl tert-butyl ether
EPA - Environmental Protection Agency
PAHs - polycyclic aromatic hydrocarbons
TCL - total compound list
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
TBD - to be determined

Table 3. Soil Vapor and Ambient Air Field Sampling Matrix

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Sample I.D.	Sample Location	Laboratory Sample Description	Sample Rationale	Sampling Medium		VOCs (EPA TO-15)
				Field Observations[1]	Soil Vapor / Air	
TBD	TBD	TBD	TBD	X	X	X

SAMPLE SELECTION PROTOCOL:

1. Collect one soil vapor sample at the installed soil vapor point depth.
2. Collect indoor and outdoor air samples from the height of the breathing zone, approximately 3-5 feet above the ground surface.

NOTES:

[1] :Field observations include visual (e.g. staining, sheen, and discoloration) and olfactory observations. Field observations will be recorded in field notes.

Chemical analysis test methods specified are from U.S. EPA Expanded Modified Method TO-15
VOCs - volatile organic compounds
EPA - Environmental Protection Agency
TBD - to be determined

Table 4. Analytical Methods/Quality Assurance Summary Table
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

		QA/QC Samples									
Media	**Number of Primary Samples**	**TB**	**FB^2**	**DUP**	**MS/MSD**	**Total Number of Samples**	**Analytical Parameters**	**Method**	**Preservative**	**Holding Time**	**Container**
Soil	TBD	TBD	TBD	TBD	TBD	TBD	VOCs	8260	Cool to 4°C	28 days to analysis	40 mL VOA vials
	TBD	0	TBD	TBD	TBD	TBD	SVOCs	8270	Cool to 4°C	28 days to analysis	8 oz glass jar
	TBD	0	TBD	TBD	TBD	TBD	TAL Metals	6000/7000	Cool to 4°C	28 days to analysis	8 oz glass jar
	TBD	0	TBD	TBD	TBD	TBD	Free Cyanide	9016	Cool to 4°C	28 days to analysis	8 oz glass jar
	TBD	0	TBD	TBD	TBD	TBD	Alkylated PAHs/TPH	8270 SIM	Cool to 4°C	14 days chilled, 1 year frozen to analysis	8 oz glass jar
Groundwater^1	11	1	1	1	1	15	BTEX and MTBE	8260	pH<2 with HCl, Cool to 4°C	14 days to analysis	(2) 40 mL VOA vials
	11	0	1	1	1	14	PAHs	8270	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(2) 1 L amber glass jar
	TBD	TBD	TBD	TBD	TBD	TBD	VOCs	8260	pH<2 with HCl, Cool to 4°C	14 days to analysis	(2) 40 mL VOA vials
	TBD	0	TBD	TBD	TBD	TBD	SVOCs	8270	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(2) 1 L amber glass jar
	TBD	0	TBD	TBD	TBD	TBD	TAL Metals	6000/7000	pH<2 with HNO_3; Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	(1) 500 mL polyethylene container
	TBD	0	TBD	TBD	TBD	TBD	Total Cyanide	9012	NaOH to pH>12/Cool to 4°C	14 days to analysis	(1) 500 mL polyethylene container
Soil Vapor	TBD	0	0	TBD	0	TBD	VOCs	TO-15	None	30 days to analysis	Summa canister
Indoor/Outdoor Air	TBD	0	0	TBD	0	TBD	VOCs	TO-15	None	30 days to analysis	Summa canister

NOTES:
[1]: Groundwater samples summary based upon only one annual sampling event. The number of samples will vary between events.
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
ASTM - American Society for Testing and Materials
°C - Degrees Celsius
L - Liter
mL - Milliliter
HNO3 - Nitric acid
HCl - Hydrochloric Acid
NAOH - Sodium Hydroxide

Table 5. Quantification Limits for Subsurface Soil

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Volatile Organic Compounds (VOCs) by EPA Method 8260C			
1,1,1-Trichloroethane	5	0.84	µg/Kg
1,1,2,2-Tetrachloroethane	5	1.21	µg/Kg
1,1,2-Trichloroethane	5	1.04	µg/Kg
1,1-Dichloroethane	5	0.81	µg/Kg
1,1-Dichloroethene	5	1.09	µg/Kg
1,2,3-Trichloropropane	5	1.62	µg/Kg
1,2,4-Trichlorobenzene	5	0.61	µg/Kg
1,2-Dichloroethane	5	0.99	µg/Kg
1,2-Dichloropropane	5	1.06	µg/Kg
2-Butanone (MEK)	10	1.78	µg/Kg
2-Chloroethylvinylether	5	1.37	µg/Kg
2-Hexanone	10	2.53	µg/Kg
4-Methyl-2-pentanone (MIBK)	5	1.18	µg/Kg
Acetone	20	3.15	µg/Kg
Acrolein	20	3.1	µg/Kg
Acrylonitrile	5	1.19	µg/Kg
Benzene	5	0.86	µg/Kg
Bromodichloromethane	5	0.84	µg/Kg
Bromoform	5	0.99	µg/Kg
Bromomethane	5	0.82	µg/Kg
Carbon disulfide	5	0.61	µg/Kg
Carbon tetrachloride	5	0.78	µg/Kg
Chlorobenzene	5	0.79	µg/Kg
Chloroethane	5	1.89	µg/Kg
Chloroform	5	0.53	µg/Kg
Chloromethane	5	0.9	µg/Kg
cis-1,2-Dichloroethene	5	1.04	µg/Kg
cis-1,3-Dichloropropene	5	0.78	µg/Kg
Dibromochloromethane	5	0.41	µg/Kg
Dichlorodifluoromethane	5	1.25	µg/Kg
Ethylbenzene	5	0.79	µg/Kg
Isopropyl ether	5	0.44	µg/Kg
Methylene chloride	20	2.21	µg/Kg
Methyl-tert-butyl-ether (MTBE)	5	0.93	µg/Kg
Styrene	5	1.06	µg/Kg
tert-Butyl alcohol	20	4.69	µg/Kg
Tetrachloroethene	5	0.7	µg/Kg
Toluene	5	0.84	µg/Kg
trans-1,2-Dichloroethene	5	0.58	µg/Kg
trans-1,3-Dichloropropene	5	0.92	µg/Kg
Trichloroethene	5	0.68	µg/Kg
Trichlorofluoromethane	5	0.6	µg/Kg
Trichlorotrifluoroethane	5	0.63	µg/Kg
Vinyl acetate	10	2.7	µg/Kg
Vinyl chloride	5	0.87	µg/Kg
Xylenes (total)	5	1.96	µg/Kg
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D			
1,2,4-Trichlorobenzene	333	55.96	µg/Kg
1,2-Dichlorobenzene	333	56.43	µg/Kg
1,2-Diphenylhydrazine	333	32.86	µg/Kg
1,3-Dichlorobenzene	333	50.49	µg/Kg
1,4-Dichlorobenzene	333	52.75	µg/Kg
2,2-oxybis (1-chloropropane)	333	47.18	µg/Kg
2,4,5-Trichlorophenol	1667	120.96	µg/Kg
2,4,6-Trichlorophenol	333	85.18	µg/Kg
2,4-Dichlorophenol	333	108.95	µg/Kg
2,4-Dimethylphenol	333	172.3	µg/Kg
2,4-Dinitrophenol	1667	114.87	µg/Kg
2,4-Dinitrotoluene	333	60.09	µg/Kg
2,6-Dinitrotoluene	333	60.57	µg/Kg
2-Chloronaphthalene	333	48.46	µg/Kg
2-Chlorophenol	333	86.27	µg/Kg
2-Methylnaphthalene	333	52.92	µg/Kg
2-Methylphenol	333	89.03	µg/Kg
2-Nitroaniline	1667	42.32	µg/Kg
2-Nitrophenol	333	115.71	µg/Kg
3,3-Dichlorobenzidine	667	88.96	µg/Kg
3-Nitroaniline	1667	68.54	µg/Kg
4,6-Dinitro-2-methylphenol	1667	239.28	µg/Kg
4-Bromophenyl phenyl ether	333	51.16	µg/Kg
4-Chloro-3-methylphenol	333	112.76	µg/Kg
4-Chloroaniline	333	107.34	µg/Kg
4-Chlorophenyl phenyl ether	333	45.74	µg/Kg
4-Methylphenol	333	179.39	µg/Kg

Table 5. Quantification Limits for Subsurface Soil

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D (Continued)			
4-Nitroaniline	667	48.17	µg/Kg
4-Nitrophenol	1667	141.69	µg/Kg
Acenaphthene	333	55.32	µg/Kg
Acenaphthylene	333	40.59	µg/Kg
Aniline	333	73.83	µg/Kg
Anthracene	333	54.55	µg/Kg
Benzidine	3333	1134.9	µg/Kg
Benzo(a)anthracene	333	45.31	µg/Kg
Benzo(a)pyrene	333	41.16	µg/Kg
Benzo(b)fluoranthene	333	93.11	µg/Kg
Benzo(ghi)perylene	333	36.99	µg/Kg
Benzo(k)fluoranthene	333	37.12	µg/Kg
Benzoic acid	1667	90.33	µg/Kg
Benzyl alcohol	333	62.93	µg/Kg
Bis(2-chloroethoxy)methane	333	57.03	µg/Kg
Bis(2-chloroethyl)ether	333	44.86	µg/Kg
Bis(2-ethylhexyl)phthalate	333	44.37	µg/Kg
Butyl benzyl phthalate	333	43.04	µg/Kg
Carbazole	333	48.63	µg/Kg
Chrysene	333	41.6	µg/Kg
Dibenzo(a,h)anthracene	333	36.71	µg/Kg
Dibenzofuran	333	52.67	µg/Kg
Diethyl phthalate	333	48.88	µg/Kg
Dimethyl phthalate	333	51.27	µg/Kg
Di-n-butyl phthalate	333	43.98	µg/Kg
Di-n-octyl phthalate	333	34.97	µg/Kg
Fluoranthene	333	41.87	µg/Kg
Fluorene	333	43.39	µg/Kg
Hexachlorobenzene	333	48.52	µg/Kg
Hexachlorobutadiene	333	67.85	µg/Kg
Hexachlorocyclopentadiene	333	247.96	µg/Kg
Hexachloroethane	333	59.22	µg/Kg
Indeno(1,2,3-cd)pyrene	333	33.74	µg/Kg
Isophorone	333	60.02	µg/Kg
Naphthalene	333	56.66	µg/Kg
Nitrobenzene	333	40.4	µg/Kg
n-Nitrosodimethylamine	333	48.87	µg/Kg
n-Nitroso-di-n-propylamine	333	44.63	µg/Kg
n-Nitrosodiphenylamine	333	49.76	µg/Kg
Pentachlorophenol	1667	287.85	µg/Kg
Phenanthrene	333	38.58	µg/Kg
Phenol	333	96.98	µg/Kg
Pyrene	333	45.56	µg/Kg
Pyridine	667	39.9	µg/Kg
Metals by EPA Method 6000/7000 series			
Aluminum	258	20	mg/Kg
Antimony	11.7	1.14	mg/Kg
Arsenic	8	1.22	mg/Kg
Barium	2	0.18	mg/Kg
Beryllium	2	0.5	mg/Kg
Cadmium	3	1	mg/Kg
Calcium	85	11.6	mg/Kg
Chromium	3	0.34	mg/Kg
Cobalt	2	0.42	mg/Kg
Copper	5	0.8	mg/Kg
Iron	145	10.2	mg/Kg
Lead	9	0.76	mg/Kg
Magnesium	35	9.2	mg/Kg
Manganese	2.5	0.64	mg/Kg
Mercury	0.05	0.02	mg/Kg
Nickel	6.25	0.44	mg/Kg
Potassium	200	40	mg/Kg
Selenium	16	1.6	mg/Kg
Silver	3	0.32	mg/Kg
Sodium	94	20	mg/Kg
Thallium	20	4.17	mg/Kg
Vanadium	4	0.36	mg/Kg
Zinc	20	3.8	mg/Kg
Free Cyanide by EPA Method 9013/ASTM D4282-02			
Free Cyanide	TBD	TBD	µg/Kg

NOTES:
mg/kg - miligrams per killogram
µg/kg - micrograms per killogram
TBD - To Be Determined
EPA - Environmental Protection Agency
ASTM - American Standard for Testing and Materials

Table 6. Quantification Limits for Groundwater

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Volatile Organic Compounds (VOCs) by EPA Method 8260C			
1,1,1-Trichloroethane	5	0.4	μg/L
1,1,2,2-Tetrachloroethane	5	0.4	μg/L
1,1,2-Trichloroethane	5	0.6	μg/L
1,1-Dichloroethane	5	0.6	μg/L
1,1-Dichloroethene	5	0.7	μg/L
1,2,3-Trichloropropane	5	1.1	μg/L
1,2,4-Trichlorobenzene	5	0.9	μg/L
1,2-Dichloroethane	5	0.6	μg/L
1,2-Dichloropropane	5	0.9	μg/L
1,3-Dichloropropane	5	0.4	μg/L
2-Butanone (MEK)	5	1.2	μg/L
2-Chloroethylvinylether	5	0.6	μg/L
2-Hexanone	5	0.8	μg/L
4-Methyl-2-pentanone (MIBK)	5	0.7	μg/L
Acetone	5	1.4	μg/L
Acrolein	10	7.8	μg/L
Acrylonitrile	5	1.6	μg/L
Benzene	5	0.4	μg/L
Bromodichloromethane	5	0.4	μg/L
Bromoform	5	0.8	μg/L
Bromomethane	5	1.2	μg/L
Carbon disulfide	5	0.9	μg/L
Carbon tetrachloride	5	1	μg/L
Chlorobenzene	5	0.4	μg/L
Chloroethane	5	0.8	μg/L
Chloroform	5	0.7	μg/L
Chloromethane	5	0.5	μg/L
cis-1,2-Dichloroethene	5	0.6	μg/L
cis-1,3-Dichloropropene	5	0.5	μg/L
Dibromochloromethane	5	0.5	μg/L
Dichlorodifluoromethane	5	0.6	μg/L
Ethylbenzene	5	1	μg/L
Isopropyl ether	5	N/A	μg/L
Methylene chloride	5	0.4	μg/L
Methyl-tert-butyl-ether (MTBE)	5	0.3	μg/L
Styrene	5	0.5	μg/L
Tetrachloroethene	5	0.5	μg/L
Toluene	5	0.3	μg/L
trans-1,2-Dichloroethene	5	0.5	μg/L
trans-1,3-Dichloropropene	5	0.3	μg/L
Trichloroethene	5	0.7	μg/L
Trichlorofluoromethane	5	0.6	μg/L
Trichlorotrifluoroethane	5	0.5	μg/L
Vinyl acetate	5	0.2	μg/L
Vinyl chloride	5	0.8	μg/L
Xylenes (total)	5	1	μg/L
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D			
1,2,4-Trichlorobenzene	10	0.68	μg/L
1,2-Dichlorobenzene	10	0.74	μg/L
1,2-Diphenylhydrazine	10	0.84	μg/L
1,3-Dichlorobenzene	10	0.68	μg/L
1,4-Dichlorobenzene	10	0.46	μg/L
2,2-oxybis (1-chloropropane)	10	0.62	μg/L
2,4,5-Trichlorophenol	50	0.78	μg/L
2,4,6-Trichlorophenol	10	0.79	μg/L
2,4-Dichlorophenol	10	0.84	μg/L
2,4-Dimethylphenol	10	0.73	μg/L
2,4-Dinitrophenol	50	5.13	μg/L
2,4-Dinitrotoluene	10	0.8	μg/L
2,6-Dinitrotoluene	10	0.59	μg/L
2-Chloronaphthalene	10	0.73	μg/L
2-Chlorophenol	10	0.6	μg/L
2-Methylnaphthalene	10	0.64	μg/L
2-Methylphenol	10	0.59	μg/L
2-Nitroaniline	50	1.12	μg/L
2-Nitrophenol	10	0.75	μg/L
3,3-Dichlorobenzidine	10	0.98	μg/L
3-Nitroaniline	50	0.67	μg/L
4,6-Dinitro-2-methylphenol	50	4.24	μg/L
4-Bromophenyl phenyl ether	10	0.91	μg/L
4-Chloro-3-methylphenol	10	0.51	μg/L

Table 6. Quantification Limits for Groundwater

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D (Continued)			
4-Chloroaniline	10	0.43	µg/L
4-Chlorophenyl phenyl ether	10	0.82	µg/L
4-Methylphenol	10	0.33	µg/L
4-Nitroaniline	20	1.05	µg/L
4-Nitrophenol	50	1.85	µg/L
Acenaphthene	10	0.8	µg/L
Acenaphthylene	10	0.75	µg/L
Aniline	10	0.63	µg/L
Anthracene	10	0.99	µg/L
Benzidine	100	2.15	µg/L
Benzo(a)anthracene	10	1.19	µg/L
Benzo(a)pyrene	10	1.08	µg/L
Benzo(b)fluoranthene	10	1.54	µg/L
Benzo(ghi)perylene	10	1.04	µg/L
Benzo(k)fluoranthene	10	0.91	µg/L
Benzoic acid	50	5.88	µg/L
Benzyl alcohol	10	0.99	µg/L
Bis(2-chloroethoxy)methane	10	0.87	µg/L
Bis(2-chloroethyl)ether	10	0.87	µg/L
Bis(2-ethylhexyl)phthalate	10	1.31	µg/L
Butyl benzyl phthalate	10	0.96	µg/L
Carbazole	10	1.11	µg/L
Chrysene	10	0.97	µg/L
Dibenzo(a,h)anthracene	10	1.34	µg/L
Dibenzofuran	10	0.82	µg/L
Diethyl phthalate	10	0.82	µg/L
Dimethyl phthalate	10	0.63	µg/L
Di-n-butyl phthalate	10	1.14	µg/L
Di-n-octyl phthalate	10	1.3	µg/L
Fluoranthene	10	1.08	µg/L
Fluorene	10	0.77	µg/L
Hexachlorobenzene	10	1.07	µg/L
Hexachlorobutadiene	10	0.84	µg/L
Hexachlorocyclopentadiene	10	2.21	µg/L
Hexachloroethane	10	1.06	µg/L
Indeno(1,2,3-cd)pyrene	10	1.17	µg/L
Isophorone	10	0.66	µg/L
Naphthalene	10	0.66	µg/L
Nitrobenzene	10	0.79	µg/L
n-Nitroso-di-n-propylamine	10	0.7	µg/L
n-Nitrosodiphenylamine	10	1.08	µg/L
n-Nitrosomethylethylamine	10	0.5	µg/L
Pentachlorophenol	50	5.04	µg/L
Phenanthrene	10	0.66	µg/L
Phenol	10	0.35	µg/L
Pyrene	10	1.01	µg/L
Pyridine	20	2.31	µg/L
Target Analyte List (TAL) Metals by EPA Method 6000/7000 series			
Aluminum	500	92	µg/L
Antimony	20	5.4	µg/L
Arsenic	40	3.9	µg/L
Barium	5	0.74	µg/L
Beryllium	5	0.54	µg/L
Cadmium	10	1.1	µg/L
Calcium	300	56	µg/L
Chromium	10	1.3	µg/L
Cobalt	10	1.8	µg/L
Copper	10	4.3	µg/L
Iron	100	54	µg/L
Lead	10	3	µg/L
Magnesium	100	26	µg/L
Manganese	15	6.9	µg/L
Mercury	0.4	0.07	µg/L
Nickel	10	1.9	µg/L
Potassium	400	191	µg/L
Selenium	30	5	µg/L
Silver	6	1.1	µg/L
Sodium	400	98	µg/L
Thallium	40	10	µg/L

Table 6. Quantification Limits for Groundwater

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Target Analyte List (TAL) Metals by EPA Method 6000/7000 series (Continued)			
Vanadium	6	1.5	µg/L
Zinc	50	11	µg/L
Cyanide by EPA Method 9012			
Cyanide, Total	10	1	µg/L

NOTES:
µg/L - micrograms per liter
EPA - Environmental Protection Agency

Table 7. Quantification Limits for Soil Vapor and Ambient Air

Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

	ppb		µg/m^3	
Analytes	**Reporting Limit**	**Method Detection Limit**	**Reporting Limit**	**Method Detection Limit**
Volatile Organic Compounds (VOCs) by Modified TO-15				
1,1,1-Trichloroethane	0.080	0.012	0.44	0.065
1,1,2,2-Tetrachloroethane	0.080	0.024	0.55	0.16
1,1,2-Trichloro-1,2,2-trifluoroethane	0.080	0.012	0.61	0.092
1,1,2-Trichloroethane	0.080	0.021	0.44	0.11
1,1-Dichloroethane	0.080	0.010	0.32	0.040
1,1-Dichloroethene	0.080	0.014	0.32	0.056
1,2,4-Trichlorobenzene	0.40	0.039	3.0	0.29
1,2,4-Trimethylbenzene	0.080	0.025	0.39	0.12
1,2-Dibromoethane (EDB)	0.080	0.018	0.61	0.14
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.080	0.013	0.56	0.091
1,2-Dichlorobenzene	0.080	0.028	0.48	0.17
1,2-Dichloroethane	0.080	0.019	0.32	0.077
1,2-Dichloropropane	0.080	0.021	0.37	0.097
1,3,5-Trimethylbenzene	0.080	0.026	0.39	0.13
1,3-Butadiene	0.16	0.025	0.35	0.055
1,3-Dichlorobenzene	0.080	0.026	0.48	0.16
1,4-Dichlorobenzene	0.080	0.026	0.48	0.16
1,4-Dioxane	0.20	0.032	0.72	0.12
2,2,4-Trimethylpentane	0.20	0.016	0.93	0.075
2-Butanone (MEK)	0.40	0.080	1.2	0.24
2-Chlorotoluene	0.16	0.025	0.83	0.13
2-Hexanone	0.20	0.023	0.82	0.094
3-Chloropropene	0.080	0.019	0.25	0.059
4-Ethyltoluene	0.16	0.026	0.79	0.13
4-Methyl-2-pentanone (MIBK)	0.20	0.018	0.82	0.074
Acetone	2.0	0.54	4.8	1.3
Benzene	0.080	0.023	0.26	0.073
Benzyl chloride	0.16	0.031	0.83	0.16
Bromodichloromethane	0.080	0.018	0.54	0.12
Bromoform	0.080	0.019	0.83	0.20
Bromomethane	0.080	0.013	0.31	0.050
Carbon disulfide	0.20	0.012	0.62	0.037
Carbon tetrachloride	0.080	0.015	0.50	0.094
Chlorobenzene	0.080	0.020	0.37	0.092
Chloroethane	0.080	0.014	0.21	0.037
Chloroform	0.080	0.015	0.39	0.073
Chloromethane	0.20	0.064	0.41	0.13
cis-1,2-Dichloroethene	0.080	0.024	0.32	0.095
cis-1,3-Dichloropropene	0.080	0.029	0.36	0.13
Cyclohexane	0.20	0.016	0.69	0.055
Dibromochloromethane	0.080	0.017	0.68	0.14
Dichlorodifluoromethane	0.080	0.027	0.40	0.13
Ethanol	0.80	0.80	1.5	1.5
Ethylbenzene	0.080	0.027	0.35	0.12
Heptane	0.20	0.019	0.82	0.078
Hexachlorobutadiene	0.40	0.049	4.3	0.52
Hexane	0.20	0.013	0.70	0.046
Isopropyl alcohol	0.80	0.094	2.0	0.23
Methyl tert-butyl ether	0.40	0.068	1.4	0.25
Methylene Chloride	0.20	0.13	0.69	0.45
m-Xylene & p-Xylene	0.080	0.053	0.35	0.23
Naphthalene	0.20	0.040	1.0	0.21
o-Xylene	0.080	0.024	0.35	0.10
Styrene	0.080	0.023	0.34	0.098
tert-Butyl alcohol	0.80	0.015	2.4	0.045
Tetrachloroethene	0.080	0.016	0.54	0.11
Toluene	0.12	0.12	0.45	0.45
trans-1,2-Dichloroethene	0.080	0.020	0.32	0.079
trans-1,3-Dichloropropene	0.080	0.019	0.36	0.086
Trichloroethene	0.040	0.014	0.21	0.075
Trichlorofluoromethane	0.080	0.0098	0.45	0.055
Vinyl bromide	0.080	0.014	0.35	0.061
Vinyl chloride	0.080	0.029	0.20	0.074

NOTES:
ppb - parts per billion
µg/m^3 - micrograms per cubic meter

Appendix A

TestAmerica Laboratories, Inc. Quality Assurance Manual

Cover Page:

Quality Assurance Manual

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CA-L-P-002	Contract Compliance Policy
CW-L-S-004	Subcontracting Procedures
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recall Process
CA-C-S-001	Work Sharing Process

REFERENCED LABORATORY SOPs

SOP Reference	Title
BF-GP-001	Calibration of Autopipettes and Repipetters
BF-GP-002	Support Equipment: Maintenance, Record Keeping and Corrective Actions
BF-GP-005	Sample Homogenization and Subsampling
BF-GP-012	Technical Data Review
BF-GP-013	Manual Integration
BF-GP-015	Record Storage and Retention
BF-GP-018	Strict Internal Chain or Custody
`BF-GP-019	Standard Traceability and Preparation

BF-GP-020	Thermometer Calibration
BF-PM-001	Project Information Requirements
BF-PM-003	Bottle Order Set-up
BF-PM-005	Correctness of Analysis
BF-PM-008	Massachusetts DEP Notification Procedures
BF-QA-001	Determination of Method Detection Limits
BF-QA-002	Quality Control Limits
BF-QA-003	Procedure for Writing, Reviewing and Revising Controlled Documents
BF-QA-004	Laboratory Personnel Training
BF-QA-005	Preventative and Corrective Action
BF-QA-006	Data Quality Review
BF-SR-001	Cooler Shipping - Bottle Kits and Samples
BF-SR-002	Receipt of Analytical Samples

- The full list of Laboratory SOPs is maintained in the Quality Assurance Department
- The full list of analytical methods performed in the Laboratory is can be exported from the Laboratory Information Management System’s Total Access Database

SECTION 3

INTRODUCTION, SCOPE AND APPLICABILITY

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Buffalo's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards, The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025(E) In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- ANSI/ASQC, E4-1994, "Specifications and Guidelines for Quality Management Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995, or most recent version)
- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition September 1986, Final Update I, July 1992, Final Update II A, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261. New York State Analytical Services Protocol, July 2005
- Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005).
- Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th, and on-line Editions. 21st.

- *U.S. Department of Energy* Order 414.1B, *Quality Assurance*, Approved April 29, 2004.
- *U.S. Department of Energy* Order 414.1C, *Quality Assurance*, June 17, 2005.
- *U.S. Department of Energy Order 414.1D, Quality Assurance, Aril, 25, 2011.*
- Toxic Substances Control Act (TSCA).

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Section 19.0. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director/Manager and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director/Manager and the QA Manager must determine if it is in the lab’s best interest to follow the less stringent requirements.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. The manual itself is reviewed every two years by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & updating procedures (refer to BF-QA-003)

SECTION 4

MANAGEMENT REQUIREMENTS

4.1 OVERVIEW

TestAmerica Buffalo is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President and Chief Executive Officer (CEO), Chief Operating Officer (COO), Executive VP Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Buffalo is presented in Figure 4-1.

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Buffalo laboratory.

4.2.2 Laboratory Director

TestAmerica Buffalo's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

The Laboratory Director has the authority to affect those policies and procedures to ensure that only data of the highest level of excellence are produced. As such, the Laboratory Director is responsible for maintaining a working environment which encourages open, constructive problem solving and continuous improvement.

Specific responsibilities include, but are not limited to:

- Provides one or more department managers for the appropriate fields of testing. If the Department Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Department Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary NELAP accrediting authority must be notified in writing.

- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Leads the management team, consisting of the QA Manager, the Technical Manager, and the Operations Manager as direct reports.

4.2.3 Quality Assurance (QA) Manager or Designee

The QA manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. This position is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA department to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.

- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems, data authenticity and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a subset of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, evaluate manual calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Leads the QA team to enable communication and to distribute duties and responsibilities.

- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.

- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.

- Evaluation of the thoroughness and effectiveness of training.

- Compliance with ISO 17025.

4.2.4 Technical Manager or Designee

The Technical Manager(s) report(s) directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision and for compliance with the ISO 17025 Standard. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.

- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from “cradle to grave,” insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc..
- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.

4.2.5 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. He/She reports directly to the Laboratory Director. He/She assists the Technical Manager in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Manager and QA Manager and in compliance with regulatory requirements.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.6 Department Managers

Department Managers report to the Operations Manager. The Department Managers serve as the technical experts on assigned projects, provide technical liaison, assist in resolving any technical issues within the area of their expertise; and implement established policies and procedures to assist the Operations Manager in achieving section goals. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to analysts, participates in the selection, training, and development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Human Resources

Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager, Technical Manager, Operations Manager, and/or Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.7 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties consist of:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.

4.2.8 Environmental Health & Safety Coordinator

The Environmental Health and Safety Coordinator reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The Safety Officer is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Safety Data Sheet (SDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica’s medical consultants.

4.2.9 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.

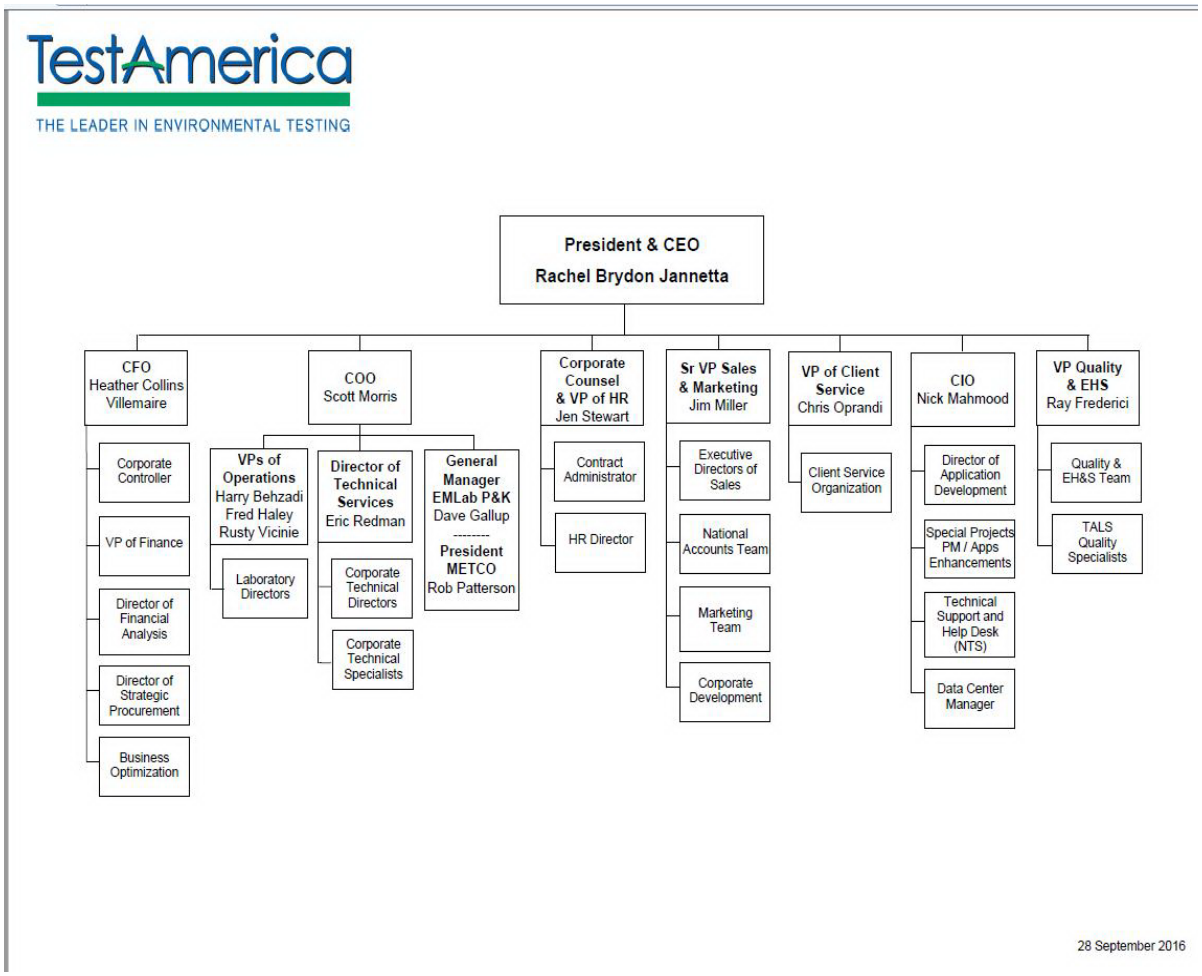
- Suggest method improvements to their supervisor, the Technical Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

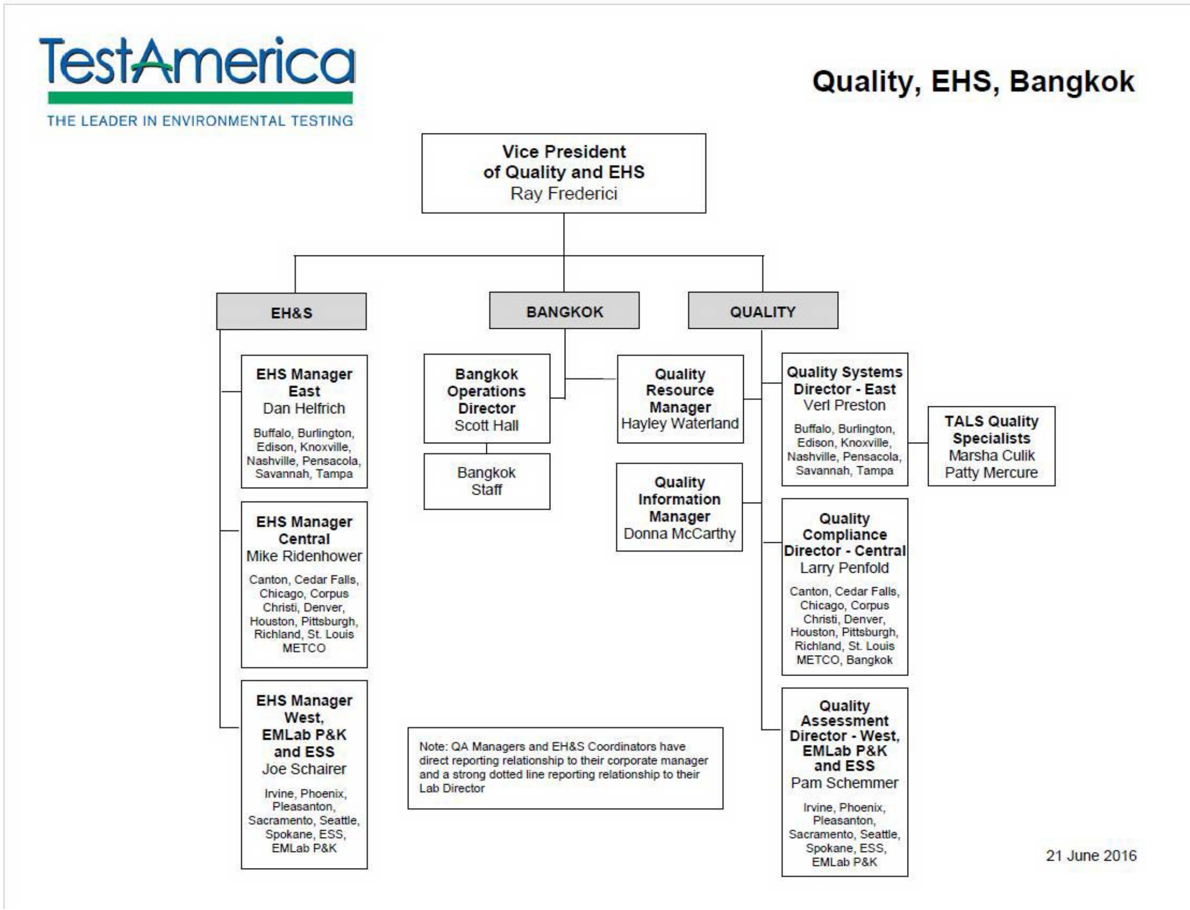
4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director	Operations Manager (1) Technical Manager (2)	
QA Manager	QA Specialist (1) Operations Manager (2)	
Technical Manager	Laboratory Director (1) Operations Manager (2)	
Operations Manager	Department Manager (1) Department Manager (2)	Selected based on availability
Manager of Project Management	Project Manager (1) Client Services Director (2)	Selected based on availability
Project Manager	Project Manager (1) Project Management Asst. (2)	(1) 2° team PM (2) Team PMA
Organic Department Manager	Analyst (1) Analyst (2)	Selected based on department, experience and availability
Inorganic Department Manager	Analyst (1) Analyst (2)	Selected based on department, experience and availability
Data Validation / Data Packaging Manager	Data Validation Specialist Data Packaging Specialist	Selected based on department and availability
EHS Coordinator	Laboratory Director (1) EHS Manager (2)	
Sample Management Manager	Sample Custodian (1) EHS Coordinator (2)	
Bottle Preparation / Shipping Manager	Bottle Prep Technician (1) Sample Mng’t Manager (2)	

Figure 4-1.
Corporate and Laboratory Organization Charts





TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Quality, EHS, Bangkok

Vice President of Quality and EHS
Ray Frederici

EH&S

- **EHS Manager East**
  Dan Helfrich
  Buffalo, Burlington, Edison, Knoxville, Nashville, Pensacola, Savannah, Tampa
- **EHS Manager Central**
  Mike Ridenhower
  Canton, Cedar Falls, Chicago, Corpus Christi, Denver, Houston, Pittsburgh, Richland, St. Louis METCO
- **EHS Manager West, EMLab P&K and ESS**
  Joe Schairer
  Irvine, Phoenix, Pleasanton, Sacramento, Seattle, Spokane, ESS, EMLab P&K

BANGKOK

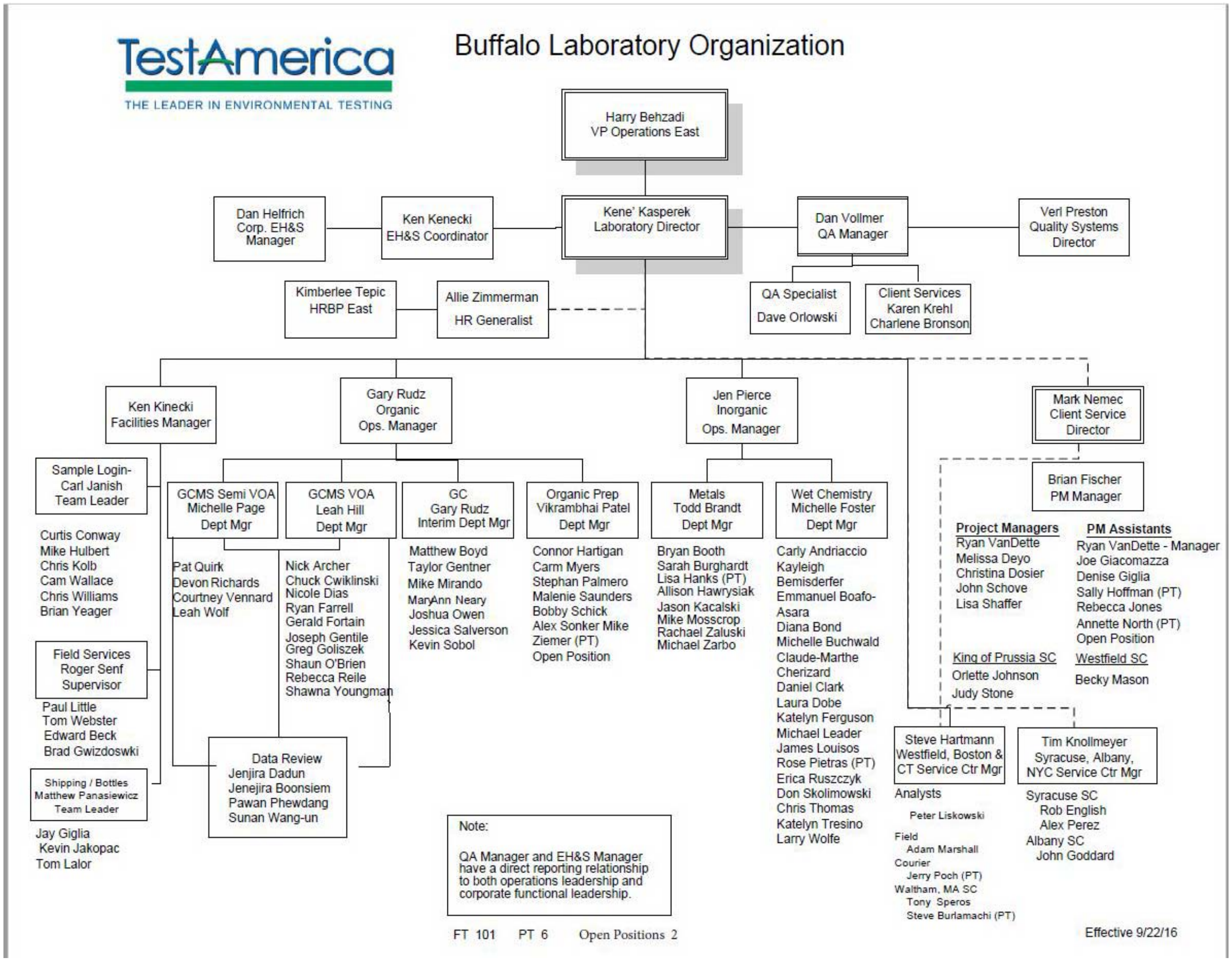
- **Bangkok Operations Director**
  Scott Hall
  - Bangkok Staff

QUALITY

- **Quality Resource Manager**
  Hayley Waterland
- **Quality Information Manager**
  Donna McCarthy
- **Quality Systems Director - East**
  Verl Preston
  Buffalo, Burlington, Edison, Knoxville, Nashville, Pensacola, Savannah, Tampa
  - **TALS Quality Specialists**
    Marsha Culik
    Patty Mercure
- **Quality Compliance Director - Central**
  Larry Penfold
  Canton, Cedar Falls, Chicago, Corpus Christi, Denver, Houston, Pittsburgh, Richland, St. Louis METCO, Bangkok
- **Quality Assessment Director - West, EMLab P&K and ESS**
  Pam Schemmer
  Irvine, Phoenix, Pleasanton, Sacramento, Seattle, Spokane, ESS, EMLab P&K

Note: QA Managers and EH&S Coordinators have direct reporting relationship to their corporate manager and a strong dotted line reporting relationship to their Lab Director

21 June 2016



Note: Organizational Charts are current at the date of publication of this manual. Updated charts may be obtained by contacting the TestAmerica Buffalo Quality Department.

SECTION 5

QUALITY SYSTEM

5.1 QUALITY POLICY STATEMENT

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the NELAC Standards (2003), ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The 7 elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A training program.
- Self-governance through disciplinary action for violations.
- A confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-Q-S-005).

- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents:

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratories normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory maintains Quality Control Limit Data in their LIMS system*.* A summary report is generated from LIMS to check the precision and accuracy acceptability limits for performed analyses on request. The summary report is generated and is managed by the laboratory's QA department. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits are contained in Section 24.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The procedure for determining the statistical limits may be found in SOP BF-QA-002, Quality Control Limits. The analysts are instructed to use the current limits in the laboratory (dated and approved the QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory through date sensitive tables within the LIMs System. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Surrogate recoveries are determined for a specific time period as defined above. The resulting ranges are entered in LIMS.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

The QA Manager periodically evaluates these to determine if adjustments need to be made or for corrective actions to methods (SOP No. BF-QA-002). All findings are documented and kept on file.

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. BF-QA-003.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action notices. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item, or an 'end of document' page, the effective date, revision number and the laboratory's name. The Quality personnel are responsible for the maintenance of the system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a Department Manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retain that document as the official document on file. That document is then provided to all applicable operational units. Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years for the majority of procedures. Exceptions include review every 1 year for Drinking Water programs and the Kentucky CWA program. Changes to documents occur when a procedural change warrants.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QA Manual, refer to SOP No. BF-QA-003, “Writing, Reviewing and Revising Controlled Documents”. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. A controlled electronic copy of the current version is maintained on the laboratory Intranet site and is available to all personnel.

For changes to SOPs, refer to SOP No. BF-QA-003, “Writing, Reviewing and Revising Controlled Documents”.

Forms, worksheets, work instructions and information are organized by department and are maintained electronically by QA. There is a table of contents. As revisions are required, a new version number and revision date is assigned. Controlled electronic copies are made available on a public server for laboratory staff to access.

6.4 OBSOLETE DOCUMENTS

When revisions are implemented for an SOP, form or work instruction, the previous document becomes obsolete and is archived. All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are destroyed. At least one copy of the obsolete document is archived according to SOPs No. BF-GP-015 and BF-QA-003. All archived SOPs, manuals, forms or work instructions are considered obsolete.

SECTION 7

SERVICE TO THE CLIENT

7.1 OVERVIEW

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relations Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Contact Administrator
- VP of Operations
- Laboratory Project Manager
- Laboratory and/or Corporate Technical Managers
- Corporate Information Technology Managers/Directors
- Regional and/or National Account representatives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The Sales Director, Contract Administrator, Account Executive or Proposal Coordinator then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Contracts Department maintains copies of all signed contracts. The Project Managers at the TestAmerica Buffalo facility also maintains copies of these documents.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM and the Laboratory Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal a PM is assigned to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements. Specific information related to project planning may be found in SOP BF-PM-001, Project Information Requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the management staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during production meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager.

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 SPECIAL SERVICES

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 CLIENT COMMUNICATION

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Managers/Designees are available to discuss any technical questions or concerns that the client may have.

7.6 REPORTING

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service.

TestAmerica’s Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase “work sharing” refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica’s Corporate SOP’s on Subcontracting Procedures (CW-L-S-004) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client’s Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client’s analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Client Service Managers (CSM), or Account Executives (AE) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies, such as the Department of Energy and the USDA, may require notification prior to placing such work**.**

Approval may be documented through reference in a quote / contract or e-mail correspondence.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM, Account Executive (AE) or Client Service Manager (CSM) becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be
- as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica. A listing of all approved subcontracting laboratories is available on the TestAmerica intranet site. Supporting documentation is maintained by corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable (e.g. on the subcontractors TNI, A2LA accreditation or State certification.
- Firms identified in accordance with the company’s Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- TNI or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work-sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager/Designee begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures.

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. Once all documents are reviewed for completeness, the Corporate QIM will forward the documents to the Purchasing Manager for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Corporate Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and
- Corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report (Form No. CW-F-WI-009)**.**
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. The CSO personnel will notify all TestAmerica laboratories and Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all CSO Personnel, Laboratory Directors/Managers, QA Managers and Sales Personnel.

8.3 OVERSIGHT AND REPORTING

The PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Corporate Counsel can tailor the document or assist with negotiations, if needed. The PM (or AE or CSM, etc.) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented within the project records. For TestAmerica laboratories, certifications can be viewed on the company TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilities successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor’s report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data are incorporated into the laboratories EDD (i.e. imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs; however, this decision & justification must be documented in the project files, and the ‘Purchase Order Terms And Conditions For Subcontracted Laboratory Services’ must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. . The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

SECTION 9

PURCHASING SERVICES AND SUPPLIES

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Company-Wide Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 REAGENTS, STANDARDS & SUPPLIES

Purchasing guidelines for equipment, consumables and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001 and TestAmerica Buffalo SOP on Solvent Purity, SOP BF-OP-013. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica Sharepoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location. [

9.3.1 Purchasing

Chemical reagents, solvents, glassware and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. Purchase requisitions are placed into the J.D. Edwards system by designated departmental personnel. The listing of items available in the J.D. Edwards system has been approved for use by the corporate purchasing staff. Each purchase requisition receives final approval by the laboratory Operations Manager or purchasing coordinator before the order is submitted.

The analyst may also check the item out of the on-site consignment system that contains items approved for laboratory use.

9.3.2 Receiving

It is the responsibility of the purchasing manager/designee to receive the shipment. It is the responsibility of the department that ordered the materials to document the date the materials were received. Once the ordered reagents or materials are received, the department that submitted the order compares the information on the label or packaging to the original order to ensure that the purchase meets quality level specified. This is documented through the addition of the received date and initials to the information present on the daily order log.

The purchasing manager/designee verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared “public” folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online through the Company’s intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer’s expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOP expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date cannot not be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.

- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained along with the calibration raw data for which the reagent was used.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- umho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25^{o}C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Department Managers/Supervisors must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer’s certification and traceability statements are maintained in the LIMS system, files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. DOC No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Manager and/or the Laboratory Director. If they agree with the request the procedures outlined in TestAmerica’s Corporate Policy No. CA-T-P-001, Qualified Products List, is followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer’s operation manual is retained at the bench.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers, Operations Manager and/or Technical Manager.

Analytical balances are serviced and calibrated annually in accordance with SOP BF-GP-002,. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as NIST thermometers, weight sets, etc, are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor’s services, the vendor’s accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurements & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers /vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form (available on the intranet site).

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technical Manager are consulted with vendor and product selection that have an impact on quality.

SECTION 10

COMPLAINTS

10.1 OVERVIEW

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services, e.g., communications, responsiveness, data, reports, invoicing and other functions expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing with both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented in the laboratory SOP related Corrective Action (BF-QA-005).

10.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to BF-QA-005.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likely hood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 13. In addition, Corporate Management, Sales and Marketing and Information Technology (IT) may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the laboratory and Quality Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16)

SECTION 11

CONTROL OF NON-CONFORMING WORK

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory standard procedures, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the department manager for resolution. The department manager may elect to discuss it with the Technical Manager, QA Manager or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratory's non-conformance and corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Laboratory Director, Technical Manager, Operations Manager or QA Manager, documented and included in the project folder. Deviations must also be noted on the final report with a statement that the compound is not reported in compliance with the analytical method requirements and the reason.

11.2 RESPONSIBILITIES AND AUTHORITIES

Under certain circumstances the Laboratory Director, the Technical Manager, the Operations Manager or a member of the QA team may exceptionally authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's non-conformance and corrective action procedures described in Section 12. This information may also need to be documented in logbooks and/or data review checklists as appropriate**.** Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility senior laboratory management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, Technical Manager, and QA Manager. Suspected misrepresentation issues may also be reported to any member of the corporate staff as identified in Ethics Policy, CW-L-P-004. The data integrity hotline (1-800-736-9407) may also be used. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), (e.g., the VP-QA/EHS)and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, Corporate Quality, Executive VP of Operations and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

Corporate SOP entitled Data Recalls (CW-Q-S-005) is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

Corporate SOP entitled Internal Investigations (CW-L-S-002) is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-Q-S-005.

11.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically as defined by the laboratory's preventive action schedule, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate VP of Operations and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (i.e., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Manager, Operations Manager, QA Manager, Department Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION

12.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memo (NCM) and Corrective Action Reports (CAR) (refer to Figure 12-1).

12.2 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution

12.2.1 **Non-Conformance Memo (NCM)** - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non matrix related)
- Isolated reporting / calculation errors
- Client complaints
- Project Management concerns regarding specific analytical results
- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 **Corrective Action Report (CAR)** - is used to document the following types of corrective actions:

- Questionable trends that are found in the monthly review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and External Audit Findings

- Failed or Unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic Reporting / Calculation Errors
- Client complaints
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

12.3 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. A NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Department Manager, Operations Manager, Technical Manager, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Department Manager, Operations Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Department Managers and the Operations Manager are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM is entered into the Laboratory Information Management System (LIMS) and each CAR is entered into the Incident and Corrective Action Tracker (iCAT) database for tracking and trending purposes for review to aid in ensuring that the corrective actions have taken effect.
- TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, a local spreadsheet database served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.

- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.
- Also refer to Section 15.1.4, Special Audits)

12.4 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of a NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, work instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly at a minimum by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.

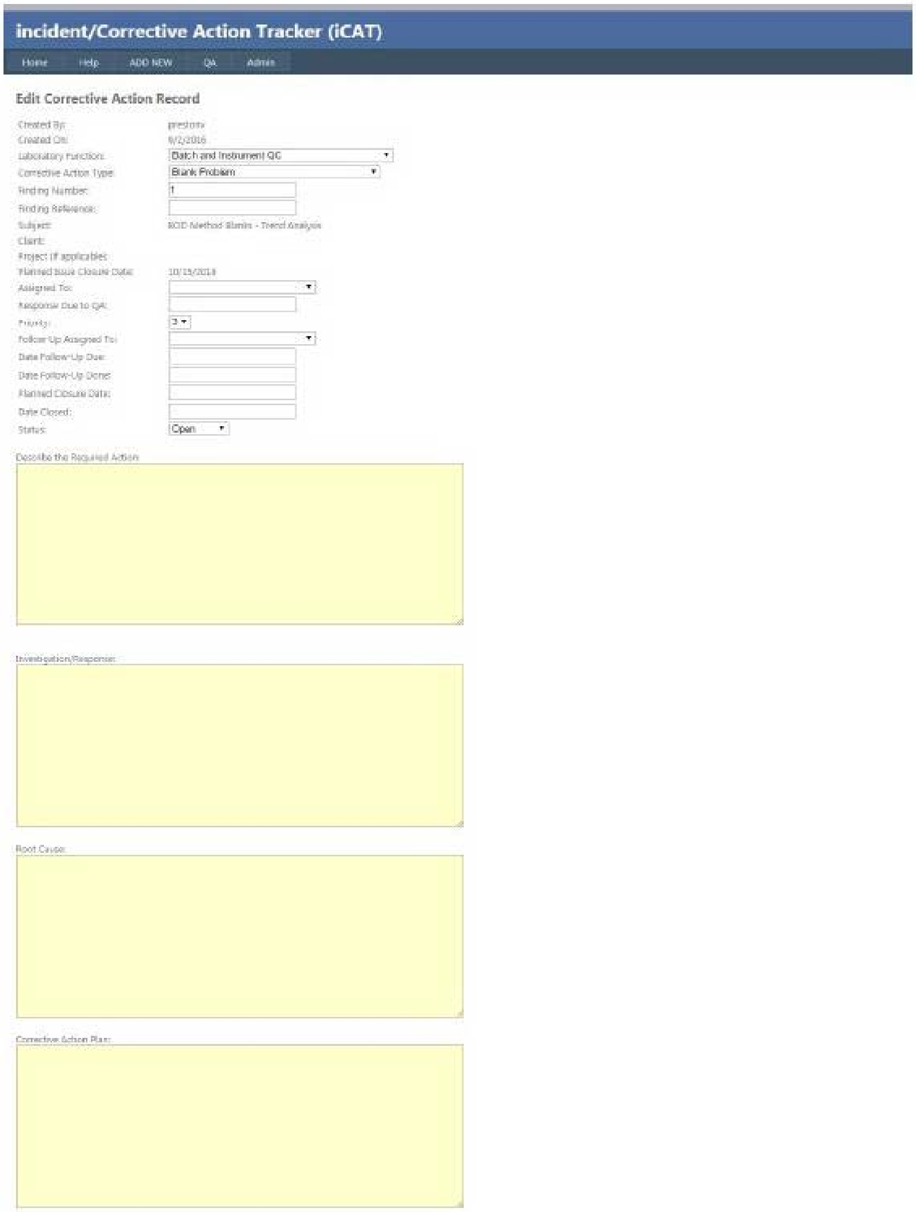
12.5 BASIC CORRECTIONS

When mistakes occur in records, each mistake shall be crossed-out, not obliterated (e.g. no white-out), and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example – iCAT Corrective Action Notice



Edit Corrective Action Record

Created By: prestonv
Created On: 6/2/2016
Laboratory Function: Batch and Instrument QC
Corrective Action Type: Blank Problem
Finding Number: 1
Finding Reference:
Subject: BOD Method Blanks - Trend Analysis
Client:
Project (if applicable):
Planned Issue Closure Date: 10/15/2018
Assigned To:
Response Due to QA:
Priority: 3
Follow-Up Assigned To:
Date Follow-Up Due:
Date Follow-Up Done:
Planned Closure Date:
Date Closed:
Status: Open

Describe the Required Action

Investigation/Response:

Root Cause:

Corrective Action Plan:

Table 12-1.

Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Department Manager)*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Department Manager)*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in LIMs.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. -For matrix spike or duplicate results outside criteria the data for the data for that sample shall be reported with qualifiers.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in LIMs.	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) When the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Department Manager)*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Internal / External Audits *(QA Manager, Department Manager, Operations Manager, Technical Manager, Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc.	- Non-conformances must be investigated through CAR system and necessary corrections must be made.
Reporting / Calculation Errors *(Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager, QA Manager, Corporate QA, Corporate Management)*	- SOP CW-Q-S-005, Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-Q-S-005 or lab SOP BF-QA-005
Client Complaints *(Project Managers, Lab Director, Sales and Marketing, QA Manager)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 17 for an example) *(QA Manager, Lab Director, Operations Manager Department Managers)*	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation *(EH&S Coordinator, Lab Director, Operations Manager, Department Manager)*	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through EH&S office.

Note: 1. Except as noted below for certain compounds, the method blank should be below the reporting limit. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, acetone, 2-butanone and phthalates provided they appear in similar levels in the reagent blank and samples. This allowance presumes that the reporting limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and the other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

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SECTION 13.0

PREVENTIVE ACTION / IMPROVEMENT

13.1 OVERVIEW

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations.

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly be the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

The laboratory's Corrective Action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system/process improvement system:

- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvment.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/Process Improvement is incorporated into the monthly QA reports, corrective action process and management review

13.1.2 Any Preventive Actions/Process Improvements undertaken or attempted shall be taken into account during the Annual Management Systems Review (Section 17). A highly detailed report is not required; however a summary of success and failure within the preventive action program is sufficient to provide management with a measurement for evaluation.

13.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division’s Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes.

SECTION 14.0

CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Exceptions for programs with longer retention requirements are discussed in Section 14.1.2. TestAmerica Buffalo SOP BF-GP-015, Record Storage and Retention, specifies additional storage, archiving and retention procedures.

14.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA department in a database which is backed up as past of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Hardcopy technical records are maintained by the Laboratory Director and the QA Department while electronic technical records are maintained by the IT Administrator.

Table 14-1. Record Index[1]

	Record Types [1]**:**	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - Policy Memorandums - SOPs - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)

	Record Types [1]:	**Retention Time:**
Project Records	- Sample Receipt & COC Documents - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	All HR docs have different retention times: Refer to HR Manual
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.

[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).

* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained according to BF-GP-015 and in such a way that they are secure and readily retrievable at the laboratory facility that provides a suitable environment to prevent damage or deterioration and to prevent loss. Records are maintained for a minimum of five years unless other wise specified by a client or regulatory requirement. All records shall be protected against fire, theft, loss, environmental deterioration and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to the data is limited to laboratory and company employees and shall be documented with an access log.

If records are archived off-site they are to be stored in a secure location where a record is maintained of any entry into the storage facility.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data. Specific Information related to archival of data for greater than 5 years may be found in TestAmerica Buffalo SOP BF-GP-015.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	5 years (project records) 10 years-Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	5 years
NY Potable Water NYCRR Part 55-2	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements are noted with the archive documents or addressed in TestAmerica Buffalo facility-specific records retention procedure BF-GP-015.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. TestAmerica Buffalo SOP BF-GP-015 also contains specific information for archival of scanned data.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (any records stored off site should be accessible within 2 business days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the chain of custody is stored with the project file and the Job Number in TALS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set). Instrument data is stored sequentially by instrument. Calibration data for a given sequence are maintained in the order of the analysis. Sample data are stored on a job number basis in the project file or as part of the daily batch or sequence. Run logs are maintained for each instrument or method; a copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks, bench sheets or excel spreadsheets are used to record and file data. Standard and reagent information is recorded in logbooks or on the raw data for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in TestAmerica SOP BF-GP-015.

- Also refer to Section 19.14.1 'Computer and Electronic Data Related Requirements'**.**

14.2 TECHNICAL AND ANALYTICAL RECORDS

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to

enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing of results.

14.2.2 Observations, data and calculations are recorded real-time.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails.
The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code;
- Date of analysis; time of analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a bench sheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in the method specific SOPs, in the instrument method detail records or the instrument maintenance logs where available.
- analysis type;
- all manual calculations and manual integrations;
- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods, ID codes, volumes, weights, instrument printouts, meter readings, temperatures, calculations, reagents;
- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries.
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- Procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

14.5.4 The laboratory has a record management system (also known as document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per instrument or analysis basis, and are numbered sequentially as they are issued. No instrument or analysis has more than one active notebook at a time, so all data are recorded sequentially within a series of sequential notebooks. Bench sheets and raw data sequence files are filed sequentially by date. Standard and reagent information is maintained in LIMS and logbooks which are maintained on a departmental basis and are numbered sequentially as they are issued or as they are archived by QA.

14.5.5 Records are considered archived when noted as such in the records management system (also known as document control). Access to archived hard-copy information is documented with an access log and in/out records is used to note data that is removed and returned.

14.5.6 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.7 Records Disposal

14.5.7.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

14.5.7.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records Management Company is hired to dispose of records, a "Certificate of Destruction" is required**.**

SECTION 15

AUDITS

15.1 INTERNAL AUDITS

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee or Corporate QA	All areas of the laboratory annually
Method Audits QA Technical Data Audits SOP Compliance Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	QA Methods Audits Frequency: All methods are reviewed annually 50% of methods receive a QA Technical Audit 50% of methods receive a SOP Method Compliance Audit
Special	QA Department or Designee	Surveillance or spot checks performed as needed to monitor specific issues
Performance Testing	Coordinated by Corporate QA	Two successful per year for each TNI -NELAP field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, Chrom AuditMiner is used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period. All analysts should be reviewed over the course of a two year period through at least one QA Technical Audit

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years. It is also recommended that the work of each newly hired analyst assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Non-potable Water, Soil, and Air.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 AUDIT FINDINGS

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. . When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16

MANAGEMENT REVIEWS

16.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Managers, their Quality Director as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Director prepares a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and VPs of Operations.

16.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Manager, Operations Manager, and QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel may be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP No. CW-Q-S-004 & Work Instruction No. CW-Q-WI-003) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective; therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.

- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
  - Adequacy of staff, equipment and facility resources.
  - Adequacy of policies and procedures.
  - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate VP of Operations and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes.

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. The TestAmerica Corporate Internal InvestigationsSOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's President and CEO, COO, Technical & Operations Support, VP of Client and Technical Services, VPs of Operations and Quality Directors receive a monthly report from the VP QA/EHS summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL

17.1 OVERVIEW

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

The laboratory makes every effort to hire analytical staff that possesses a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located in the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, pipette, quantitation techniques, etc. are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC)	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Managers/Department Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Department Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 TRAINING

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics - Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 20).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- The Human Resource office maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Further details of the laboratory's training program are described in TestAmerica Buffalo SOP BF-QA-004, Laboratory Personnel Training.

17.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy No. CW-L-P-004 and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 OVERVIEW

TestAmerica Buffalo is a 32,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for field operations, bottle kit preparation, sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis and administrative functions.

18.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory. Key equipment has been provided with back-up power supply in the event of a power outage.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 FLOOR PLAN

A floor plan can be found in Appendix 1.

18.5 BUILDING SECURITY

Building pass cards and alarm codes are distributed to all facility employees.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. [The reason for this is that it is important to know who is in the building in case of a safety emergency. The visitors logbook is used to ensure that everyone got out of the building safely.] In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19.0

TEST METHODS AND METHOD VALIDATION

19.1 OVERVIEW

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 STANDARD OPERATING PROCEDURES (SOPs)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory:

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP CW-Q-S-002, Writing a Standard Operating Procedure (SOP) and Laboratory SOP BF-QA-003, Procedure for Writing, Reviewing and Revising Controlled Quality Documents (QAM, SOP, etc)
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 LABORATORY METHODS MANUAL

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

19.4.1.1 The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999*
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January 1996.*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; May 18, 2012*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*

- *Methods for the Determination of Organic Compounds in Drinking Water*, *EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*
- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th / 21st/ 22nd/on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008; Final Update V, August 2015.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)* ***(DW labs only)***
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *New York State DEC Analytical Services Protocol, 2005*
- *New York State DOH Methods Manual*
- *Massachusetts Contingency Plan 310 CMR 40, April 25, 2014*
- *Connecticut Reasonable Confidence Protocol, July 2006*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (BF-QA-004) is performed whenever there is a significant change in instrument type (e.g., new instrumentation), method or personnel.

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Operations Manager/Designee and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct a method detection limit study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).

- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

Procedures for generation of IDOCs are detailed below and in laboratory SOP BF-QA-004, Laboratory Personnel Training.

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (see Figure 19-1) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst’s training folder.

19.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value can be differentiated from blanks. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements (refer to 19.7.10). Generally the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used.

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP No. BF-QA-001 for details on the laboratory's MDL process.

19.8 INSTRUMENT DETECTION LIMITS (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation. (For CLP procedures, the IDL is determined using the standard deviation of 7 replicate spike analyses on each of 3 non-consecutive days.)

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL.

19.9 VERIFICATION OF DETECTION AND REPORTING LIMITS

19.9.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, CVAA, etc.) and no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified or see section 20.7.9 for other options. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

19.9.2 When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 the reporting limit and annually thereafter. The annual requirement is waved for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirement.

19.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory's SOPs.

19.11 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, and specific electrode response factors.

19.12 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 ±0.5 mg/L.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g. 524.2, 525, etc) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 SAMPLE REANALYSIS GUIDELINES

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as "reanalysis") may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within ± 1 reporting limit for samples ≤ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Department Supervisor or Laboratory Director/Manager if unsure.

19.14 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. The laboratory is currently running the 'TALS Data System' which is a LIMs system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes a SQL server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity

Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, and data change requirements, as well as an internal LIMS permissions procedure.

  - LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 Ensure Information Availability

Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 Maintain Confidentiality

Ensure data confidentiality through physical access controls such as password protection or website access approval, when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The data review sheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP CA-Q-S-002, *Acceptable Manual Integration Practices*.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the project job folder, computer file, and/or run log. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1%. Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, final inorganic results are reported to 2 significant figures for values less than 10 and 3 significant figures for values greater than 10 on the final report. Organic results are generally reported to 1 significant figure for values less than 10 and 2 significant figures for values greater than 10 on the final report. The number of significant figures may be adjusted based on client or project requirements.

19.14.2.4 For those methods that do not have an instrument printout, an instrumental output or a calculation spreadsheet upload compatible with the LIMS System, the final results and dilution factors are entered directly into LIMS by the analyst, and the software formats the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is automatically transferred to the network server and, eventually, to a back-up tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be “Z”’d out, signed and dated.
- Worksheets are created with the approval of the Technical Manager/QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are out lined in several laboratory SOPs (e.g. BF-SR-002, “Receipt of Analytical Samples”, BF-GP-012, “Technical Data Review”, and BF-PM-001, “Project Information Requirements”) to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data (BF-GP-013, Manual Integration). The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review –The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day’s analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day’s analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships.

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report and creates the invoice. When complete, the report is issued to the client.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using SOP CA-Q-S-002 as the guidelines.

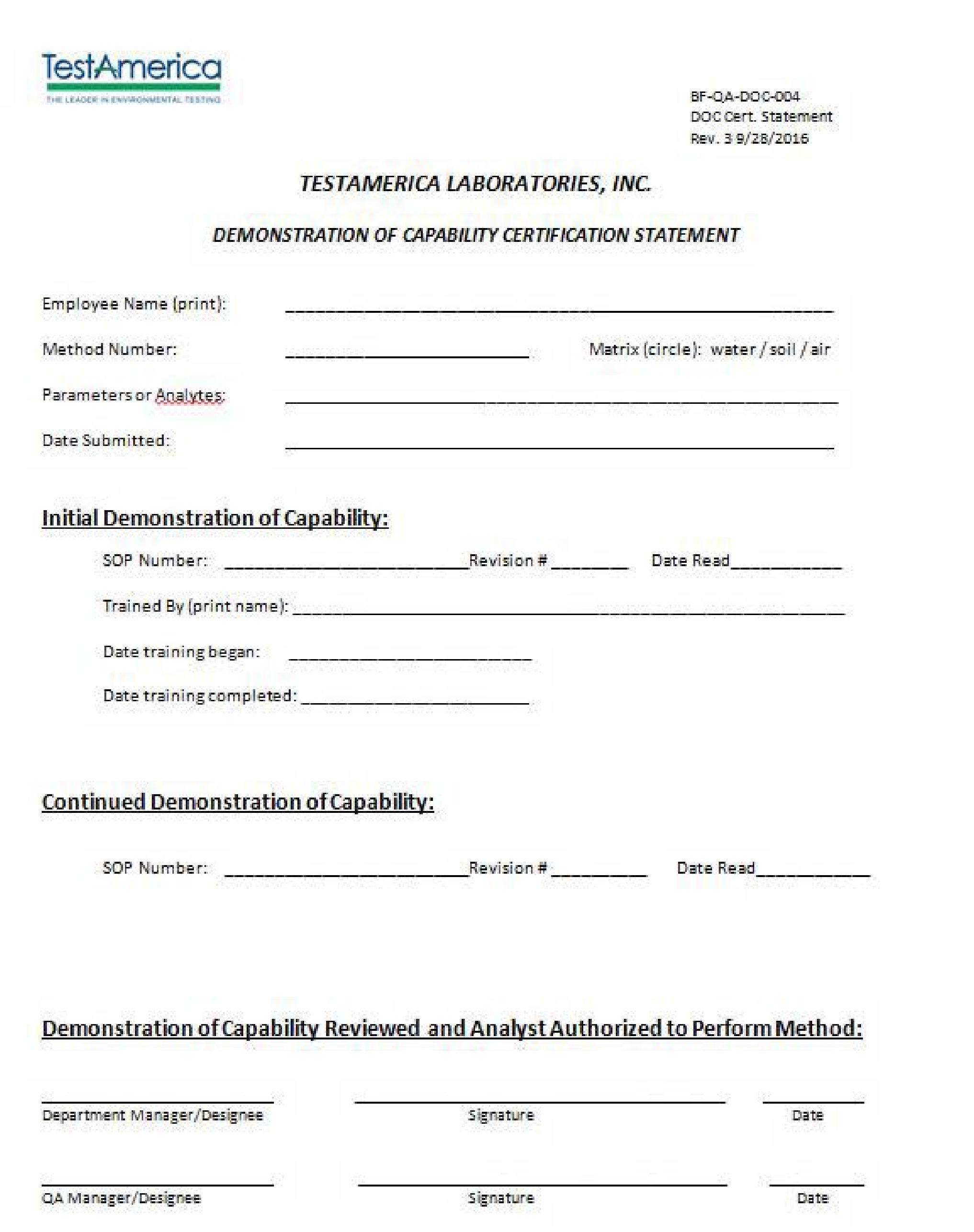
19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

BF-QA-DOC-004
DOC Cert. Statement
Rev. 3 9/28/2016

TESTAMERICA LABORATORIES, INC.

DEMONSTRATION OF CAPABILITY CERTIFICATION STATEMENT

Employee Name (print): ______________________________

Method Number: ______________ Matrix (circle): water / soil / air

Parameters or Analytes: ______________________________

Date Submitted: ______________________________

Initial Demonstration of Capability:

SOP Number: ______________Revision # ______ Date Read__________

Trained By (print name): ______________________________

Date training began: ______________

Date training completed: ______________

Continued Demonstration of Capability:

SOP Number: ______________Revision # ______ Date Read__________

Demonstration of Capability Reviewed and Analyst Authorized to Perform Method:

______________ ______________ ______
Department Manager/Designee Signature Date

______________ ______________ ______
QA Manager/Designee Signature Date

SECTION 20

EQUIPMENT (AND CALIBRATIONS)

20.1 OVERVIEW

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory equipment and instrumentation is presented in Table 20-1*.*

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 PREVENTIVE MAINTENANCE

20.2.1 The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as lubrication, cleaning, and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may also be outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrumentation records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses

20.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance. Laboratory SOPs BF-GP-001,"Calibration of Autopipettes and Repipetters" and BF-GP-002, "Support Equipment: Maintenance, Record Keeping and Corrective Actions of Analytical Balances, Temperature Control Devises and Reagent Water" provide additional detail on the monitoring and record keeping for support equipment.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All reusable thermometers are calibrated on an annual basis with a NIST-traceable thermometer.

- If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

Disposable thermometers are discarded upon expiration and replaced with newly purchased thermometers. IR thermometers should be calibrated over the full range of use, including ambient, iced (4 degrees) and frozen (0 to -5 degrees), per the Drinking Water Manual. The IR thermometers are verified daily and calibrated quarterly. Digital probes and thermocouples are calibrated quarterly.

The NIST Mercury thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST digital thermometer is recalibrated every one year (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories) and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the laboratory SOP BF-GP-020, “Thermometer Calibration”.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically at a minimum on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label is applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.3.6 Field Sampling Devices (Isco Auto Samplers)

Each Auto Sampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

The Auto Sampler is calibrated monthly (or if not utilized monthly, immediately prior to its usage) by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The Auto Sampler is programmed to run three (3) cycles and each of the three cycles is measured into a graduated cylinder to verify 100ml are received.

If the RSD (Relative Standard Deviation) between the 3 cycles is greater than 10%, the procedure is repeated and if the result is still greater than 10%, then the Auto Sampler is taken out of service until it is repaired and calibration verification criteria can be met. The results of this check are kept in a logbook/binder.

Additional calibration and use information is detailed in laboratory SOP BF-FS-006, “Calibration of Field Meter”.

20.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points will be used.

20.4.1.1 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

20.4.1.2 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

20.4.1.3 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these rules is ICP and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

20.4.1.4 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.2 Calibration Verification

The calibration relationship established during the initial calibration must be verified at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and 2009 TNI Std. EL-V1M4, section 1.7.1. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met i.e., RPD, per NELAC (2003) Standard, Section 5.5.5.10 and 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used then bracketing calibration verification standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions:

a).when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b).when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.2.1 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. See laboratory SOP's BF-MB-005 and BF-MV-007 for guidelines for making tentative identifications

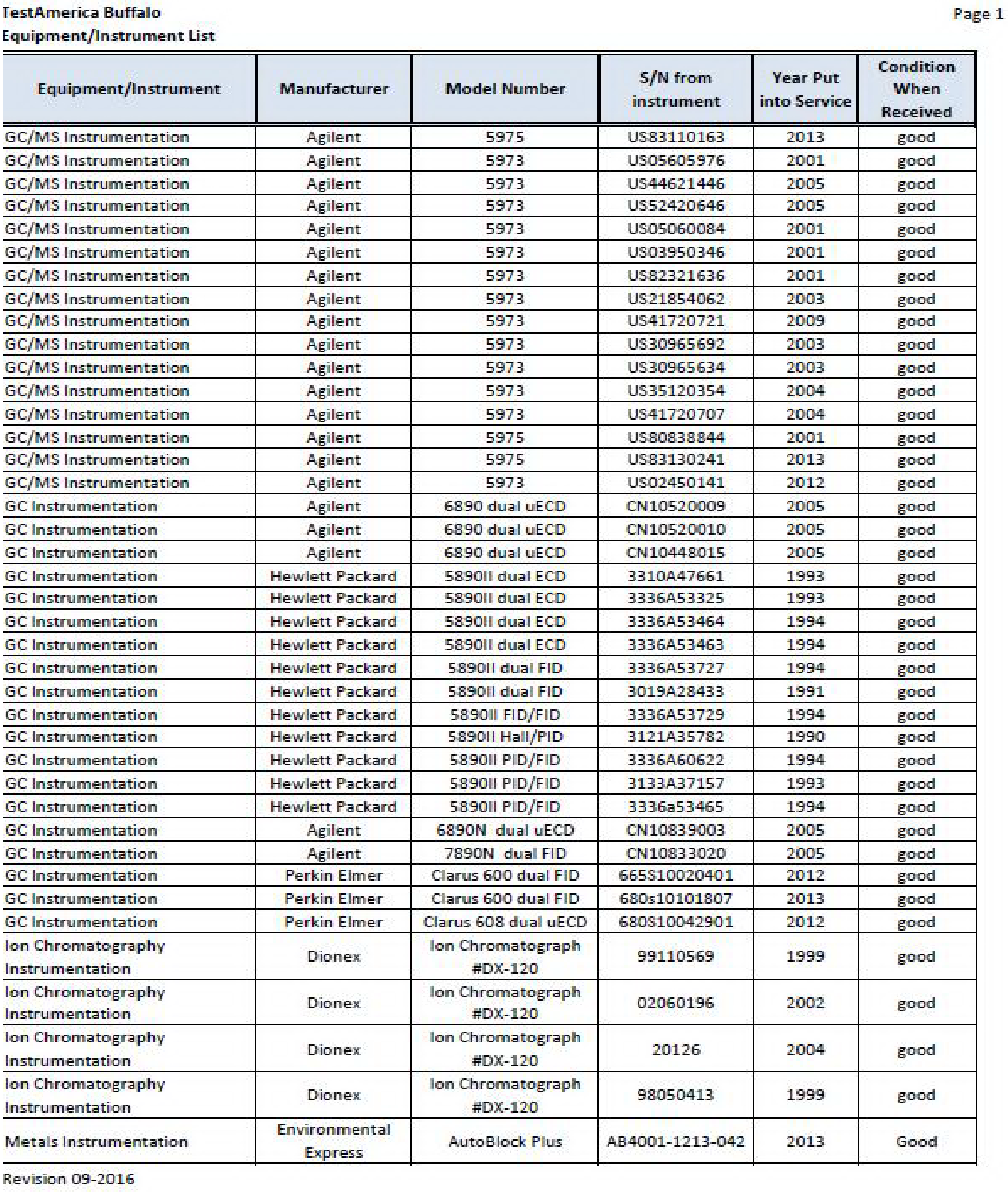
Note:
For general reporting if TICs are requested, the ten (10), largest non-target analyte peaks whose area count exceeds 10% of the nearest internal standard will be termed "Tentatively Identified Compounds" (TICs). More or fewer TICs may be identified based on client requirements.

20.6 <u>GC/MS TUNING</u>

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Laboratory Equipment and Instrumentation – TestAmerica Buffalo



TestAmerica Buffalo
Equipment/Instrument List

Page 1

Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
GC/MS Instrumentation	Agilent	5975	US83110163	2013	good
GC/MS Instrumentation	Agilent	5973	US05605976	2001	good
GC/MS Instrumentation	Agilent	5973	US44621446	2005	good
GC/MS Instrumentation	Agilent	5973	US52420646	2005	good
GC/MS Instrumentation	Agilent	5973	US05060084	2001	good
GC/MS Instrumentation	Agilent	5973	US03950346	2001	good
GC/MS Instrumentation	Agilent	5973	US82321636	2001	good
GC/MS Instrumentation	Agilent	5973	US21854062	2003	good
GC/MS Instrumentation	Agilent	5973	US41720721	2009	good
GC/MS Instrumentation	Agilent	5973	US30965692	2003	good
GC/MS Instrumentation	Agilent	5973	US30965634	2003	good
GC/MS Instrumentation	Agilent	5973	US35120354	2004	good
GC/MS Instrumentation	Agilent	5973	US41720707	2004	good
GC/MS Instrumentation	Agilent	5975	US80838844	2001	good
GC/MS Instrumentation	Agilent	5975	US83130241	2013	good
GC/MS Instrumentation	Agilent	5973	US02450141	2012	good
GC Instrumentation	Agilent	6890 dual uECD	CN10520009	2005	good
GC Instrumentation	Agilent	6890 dual uECD	CN10520010	2005	good
GC Instrumentation	Agilent	6890 dual uECD	CN10448015	2005	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3310A47661	1993	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53325	1993	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53464	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53463	1994	good
GC Instrumentation	Hewlett Packard	5890II dual FID	3336A53727	1994	good
GC Instrumentation	Hewlett Packard	5890II dual FID	3019A28433	1991	good
GC Instrumentation	Hewlett Packard	5890II FID/FID	3336A53729	1994	good
GC Instrumentation	Hewlett Packard	5890II Hall/PID	3121A35782	1990	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3336A60622	1994	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3133A37157	1993	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3336a53465	1994	good
GC Instrumentation	Agilent	6890N dual uECD	CN10839003	2005	good
GC Instrumentation	Agilent	7890N dual FID	CN10833020	2005	good
GC Instrumentation	Perkin Elmer	Clarus 600 dual FID	665S10020401	2012	good
GC Instrumentation	Perkin Elmer	Clarus 600 dual FID	680s10101807	2013	good
GC Instrumentation	Perkin Elmer	Clarus 608 dual uECD	680S10042901	2012	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	99110569	1999	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	02060196	2002	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	20126	2004	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	98050413	1999	good
Metals Instrumentation	Environmental Express	AutoBlock Plus	AB4001-1213-042	2013	Good

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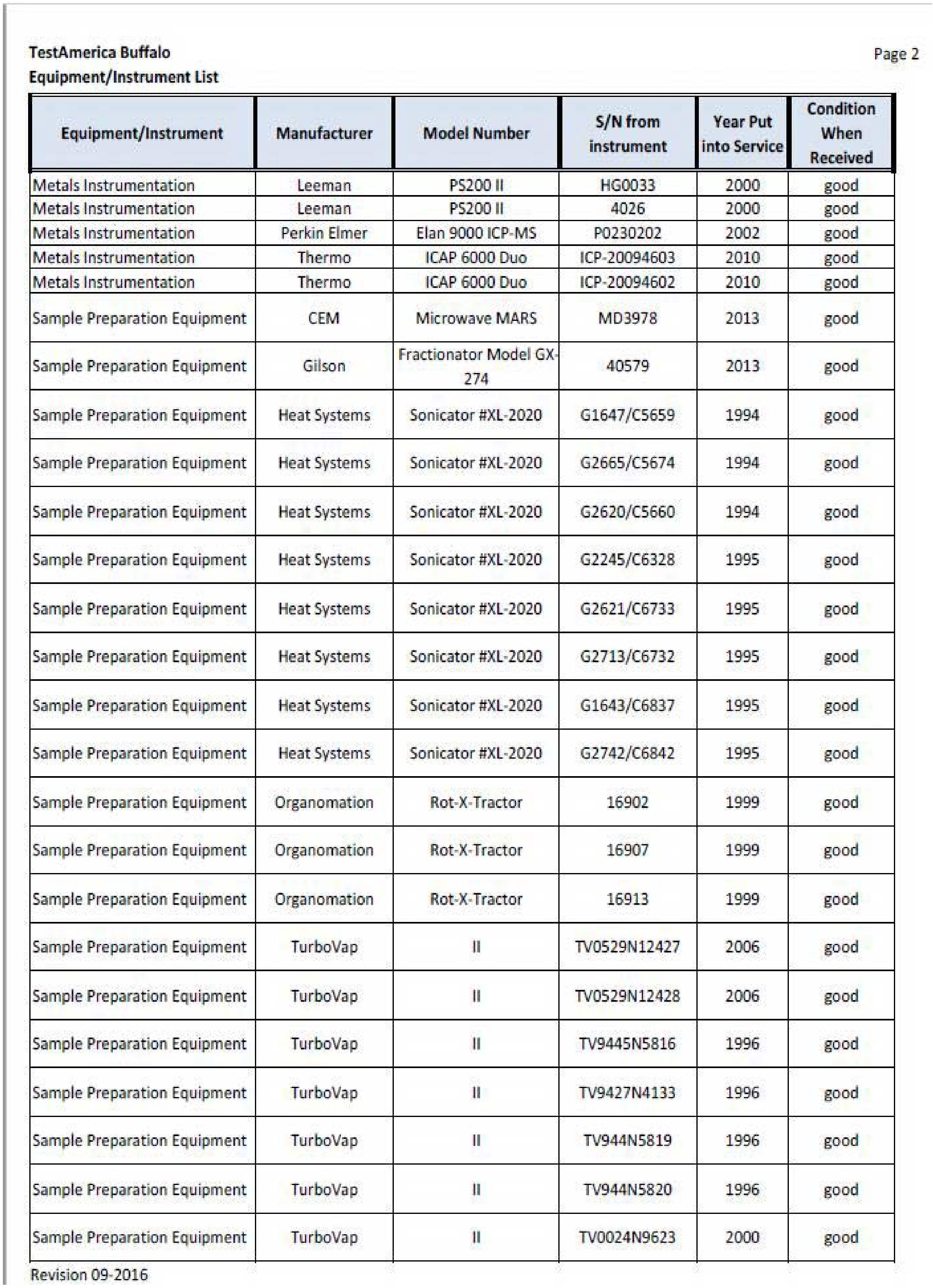

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Equipment/Instrument List

Page 2

Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
Metals Instrumentation	Leeman	PS200 II	HG0033	2000	good
Metals Instrumentation	Leeman	PS200 II	4026	2000	good
Metals Instrumentation	Perkin Elmer	Elan 9000 ICP-MS	P0230202	2002	good
Metals Instrumentation	Thermo	ICAP 6000 Duo	ICP-20094603	2010	good
Metals Instrumentation	Thermo	ICAP 6000 Duo	ICP-20094602	2010	good
Sample Preparation Equipment	CEM	Microwave MARS	MD3978	2013	good
Sample Preparation Equipment	Gilson	Fractionator Model GX-274	40579	2013	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G1647/C5659	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2665/C5674	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2620/C5660	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2245/C6328	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2621/C6733	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2713/C6732	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G1643/C6837	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2742/C6842	1995	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16902	1999	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16907	1999	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16913	1999	good
Sample Preparation Equipment	TurboVap	II	TV0529N12427	2006	good
Sample Preparation Equipment	TurboVap	II	TV0529N12428	2006	good
Sample Preparation Equipment	TurboVap	II	TV9445N5816	1996	good
Sample Preparation Equipment	TurboVap	II	TV9427N4133	1996	good
Sample Preparation Equipment	TurboVap	II	TV944N5819	1996	good
Sample Preparation Equipment	TurboVap	II	TV944N5820	1996	good
Sample Preparation Equipment	TurboVap	II	TV0024N9623	2000	good

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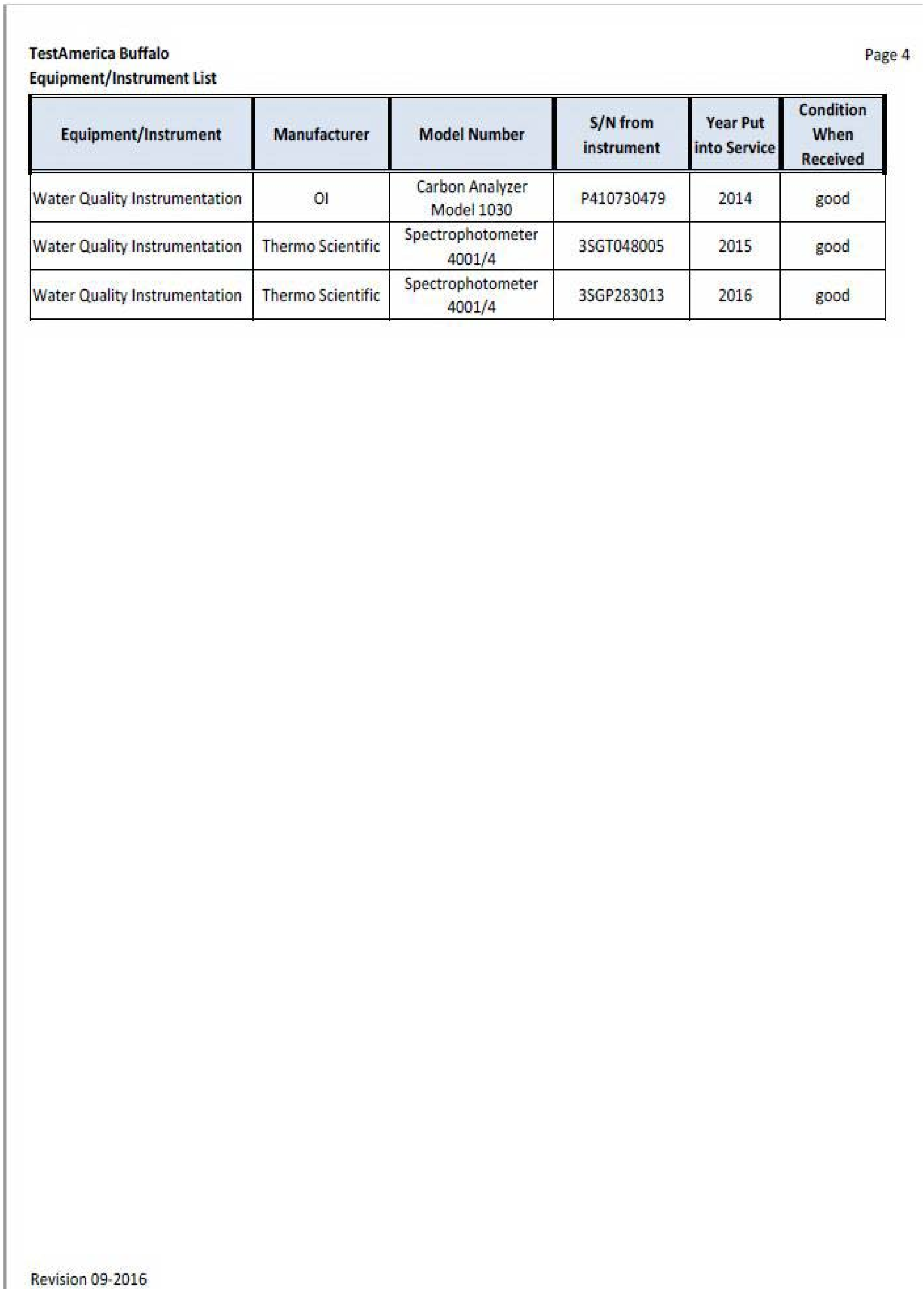
Equipment/Instrument List

Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
Sample Preparation Equipment	TurboVap	II	TV0022N9604	2000	good
Sample Preparation Equipment	TurboVap	II	TV0312N11592	2003	good
Sample Preparation Equipment	TurboVap	II	TV0312N11591	2003	good
Water Quality Instrumentation	Flash Point Analyzer	HFP 339	73390092	2007	good
Water Quality Instrumentation	Flash Point Analyzer	Optiflash 104002	Herzog PAC 000334	2015	good
Water Quality Instrumentation	Glastron	CN Midi-distillation	2502	2003	good
Water Quality Instrumentation	Glastron	Phenol Midi-distillation	2069	2003	good
Water Quality Instrumentation	Glastron	Phenol Midi-distillation	2053	2003	good
Water Quality Instrumentation	Horizon	Speed Vap	03-0415	2005	good
Water Quality Instrumentation	Konelab	20	S5019455	2004	good
Water Quality Instrumentation	Konelab	20XT	E3719731	2005	good
Water Quality Instrumentation	Konelab	Aqua20	SEA032	2009	good
Water Quality Instrumentation	Lachat	Quickchem 8000 Autoanalyzer	A83000-1527	2000	good
Water Quality Instrumentation	Lachat	Quickchem 8500 Autoanalyzer	40300001665	2014	good
Water Quality Instrumentation	Lachat	Quickchem 8500 Autoanalyzer	1106 0000 1336	2013	good
Water Quality Instrumentation	Mantech	BOD Analyzer	MT-0B4-215	2015	good
Water Quality Instrumentation	Mantech	BOD Autoanalyzer	MS-1LO-157	2014	good
Water Quality Instrumentation	ManTech	PC Titrator	MS-OK2-607	2003	good
water Quality Instrumentation	Mantech	PC Titrator	MT-1H5-971	2016	good
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	A547730578	2005	good
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	E616730030	2006	good



Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	P410730479	2014	good
Water Quality Instrumentation	Thermo Scientific	Spectrophotometer 4001/4	3SGT048005	2015	good
Water Quality Instrumentation	Thermo Scientific	Spectrophotometer 4001/4	3SGP283013	2016	good

Note: The Equipment List is current at the date of publication of this manual. An updated list may be obtained by contacting the TestAmerica Buffalo Quality Department.

Table 20-2.

Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear Fill rinse tank with 10% HCl Change dryer tube Fill reductant bottle with 10% Stannous Chloride	Daily Daily As Needed Daily
ICP & ICP/MS	Check pump tubing Check liquid argon supply Check fluid level in waste container Check re-circulator levels Clean or replace filters Check torch Check sample spray chamber for debris Clean and align nebulizer Change pump oil Change Cones Change printer cartridge Replace pump tubing	Daily Daily Daily Monthly As required Daily Monthly Monthly Monthly As required As required As required
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Annually
Auto Analyzers	Clean sampler Check all tubing Clean inside of colorimeter Clean pump well and pump rollers Clean wash fluid receptacle Oil rollers/chains/side rails Clean optics and cells	Daily Daily Daily Quarterly Weekly Weekly Quarterly

Instrument	Procedure	Frequency
Agilent GC/MS	Pump oil-level check	Monthly
	Pump oil changing	Annually
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	As required
	COMPUTER SYSTEM AND PRINTER:	
	Air filter cleaning	As required
	Change data system air filter	As required
	Printer head carriage lubrication	As required
	Paper sprocket cleaning	As required
	Drive belt lubrication	As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration	Daily
	Check carrier gas flow rate in column	Daily via use of known compound retention
	Check temp. of detector, inlet, column oven	Daily
	Septum replacement	As required
	Glass wool replacement	As required
	Check system for gas leaks with SNOOP	W/cylinder change as required
	Check for loose/frayed power wires and	As Required
	insulation	As Required
	Bake injector/column	As Required
	Change/remove sections of guard column	As Required
	Replace connectors/liners	As Required
	Change/replace column(s)	
Electron Capture Detector (ECD)	Detector wipe test (Ni-63)	Semi-annually
	Detector cleaning	As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Photoionization Detector (PID)	Change O-rings	As required
	Clean lamp window	As required
HPLC	Change guard columns	As required
	Change lamps	As required
	Change pump seals	Semi-annually or as required
	Replace tubing	As required
	Change fuses in power supply	As required
	Filter all samples and solvents	Daily
	Change autosampler rotor/stator	As required

Instrument	**Procedure**	**Frequency**
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
Centrifuge	Check brushes and bearings	Every 6 months or as needed

Table 20-3.

Periodic Calibration

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using "S" NIST traceable weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily, when used Annual	± 0.2%	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Top Loading Balance	Accuracy determined using "S" NIST traceable. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily, when used Annual	± 0.5%	Clean. Replace.
NIST Certified Weights	Accuracy determined by accredited weights and measurement laboratory.	1 year	As per certificate.	Replace.
NIST-Traceable Thermometer-Mercury	Accuracy determined by accredited measurement laboratory.	3 years	As per certificate.	Replace.
NIST-Traceable Thermometer-Digital	Accuracy determined by accredited measurement laboratory.	1 year	As per certificate	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 2.0°C	Replace
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 2.0°C	Replace

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
InfraRed Temperature Guns	Against NIST-traceable thermometer Accuracy determined by accredited measurement laboratory.	Daily at appropriate temperature range for intended use. Annual	± 2.0°C	Repair/replace
Dial-type Thermometers	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 2.0°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer.	Daily. If out of range, check again in two hours.	0-6°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10)-(-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water or solvent of use, dispense into tared vessel. Record weight with device ID number. Calibrate using 4 replicate gravimetric measurements	Each day of use Quarterly	± 2% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.

Instrument	**Type of Calibration/ Number of Standards**	**Frequency**	**Acceptance Limits**	**Corrective Action**
Glass Microliter Syringes	None	Accuracy must be initially demonstrated if syringe was not received with a certificate attesting to established accuracy.	± 1%	Not applicable.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Inorganics Department.	Daily	<1.0 µmho at 25°C	Record on log. Report discrepancies to QA Manager, Operations Manager or Technical Manager.

SECTION 21

MEASUREMENT TRACEABILITY

21.1 OVERVIEW

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. For certain programs Microsyringes are verified semi-annually or disposed of after 6 months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g. bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory accreditation Cooperation) or APLAC (Asia – Pacific Laboratory Accreditation Cooperation)..A certificate and scope of accreditation is kept on file at the laboratory.

The calibration report or certificate submitted to ***TestAmerica Buffalo*** contains, in a well designed format, a traceability statement, the conditions under which the calibrations were made in the context of any potential influence, a compliance statement with an identified metrological specification and the pertinent clauses, a clearly identified record of the quantities and functional test results before and after re-calibration, and no recommendation on the calibration interval. Opinions and interpretations of results are presented along with the basis upon which they were made and identified as such. The report may be submitted by facsimile or other electronic means as long as the requirements of the International Standard are achieved. If significant amendments are made to a calibration certificate, a supplemental certificate for the serial-number-specified piece of equipment is so identified. When a new certificate is offered, it uniquely identifies and references the one it replaces. All calibration reports are filed in the QA Office.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. Method specific information may also be found in the laboratory method SOPs in the "Standards and Reagents" sections. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. Refer to SOP No. CA-Q-S-001, Solvent and Acid Lot Testing and Approval.

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained by each department in bound or electronic folders. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer laboratory SOP BF-GP-019, “Standard Traceability and Preparation” and also to the method specific SOPs.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material. Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory department’s chemical history log and are assigned a unique identification number. Preparation of working standards or reagents prepared from the stock is documented in the laboratory Department’s Standard Preparation Log. The following information is typically recorded:

- Standard ID
- Description of Standard
- Department
- Preparer’s name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date

- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment section

Records are maintained for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date
- Standard ID from LIMS.
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in the LIMS system.

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOPs.

SECTION 22.0

SAMPLING

22.1 OVERVIEW

The laboratory provides sampling services. Sampling procedures are described in the following SOPs:

BF-FS-001	Chain of Custody Documentation
BF-FS-003	Groundwater Sampling Field Data Collection
BF-FS-004	Equipment Decontamination
BF-FS-005	Groundwater/Surface Water Sampling
BF-FS-006	Calibration of Field Meter
BF-FS-007	Low Flow Sampling Procedures
BF-FS-008	Surface and Subsurface Soil/Sediment Sampling

22.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory online.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the chain-of-custody (COC) form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g. 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g. 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis include any necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is. These programs will be addressed on a case-by-case basis.

22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times, this info is in the SOP or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

The following information provides general guidance for homogenization and subsampling. For laboratory specific procedures refer to SOP BF-GP-005, "Sample Homogenization and Subsampling".

SECTION 23

HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The shipping documents are retained with the project files.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC or in the project notes, sample management will initiate Strict Chain of Custody procedures as defined in SOP BF-GP-018, "Strict Internal Chain-of-Custody".

23.2 SAMPLE RECEIPT

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on the Sample Login Form – and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 480 - 9608 - A - 1

Location ID (480) → 480
Login ID → 9608
Container Occurrence → A
Sample Number → 1

The above example states that TestAmerica Buffalo Laboratory (Location 480). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: XXX - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 220-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 SAMPLE ACCEPTANCE POLICY

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);

- sample holding times must be adhered to (Sampling Guide);
- every sample cooler is given a radiation screen with a standardized Radiation Monitor (Monitor 4 model). This screen has no analytical repercussions; it is just a gross screen for employee safety purposes. Contact TestAmerica Buffalo's Technical Manager, Environmental Health and Safety Coordinator or Sample Control Manager immediately if screening indicates radioactivity in excess of 0.02 mR/hr.;
- The project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks described in Section 23.1.1.1 that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP No. BF-SR-002.

23.4 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix. Aqueous samples designated for metals analysis are stored at ambient temperature. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed at a minimum of every two weeks.

Analysts and technicians provide a request form to the cooler custodian who then retrieves the requested samples. In the absence of the cooler custodian, the analysts may personally retrieve the sample containers allocated to their analysis from the designated refrigerator. The samples are placed on carts, transported the analytical area and analyzed. Following analysis the remaining sample is returned to the refrigerator from which it originally came. All unused portions of samples are returned to the secure sample control area. All samples are kept in the refrigerators for two to four weeks after analysis, which meets or exceeds most sample holding times. After two to four weeks the samples are moved to dry room temperature, sample archive area where they are retained a minimum of 2 weeks after the final report has been issued to the client at which time disposal occurs. Special arrangements may be made to store samples for longer periods of time. Extended archival periods allow additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, samples which are known or suspected to be hazardous are segregated and a notification is issued to all laboratory personnel.

All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm. All soil samples, including foreign soil samples are heat treated or incinerated in accordance with USDA permit requirements and are transported / disposed by USEPA approved facilities.

Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

23.6 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). For sample shipments which include water/solid volatile organic analyses (see Note), a trip blank is enclosed when required by method specifications or state or regulatory programs. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will analyze the trip blanks that were supplied.

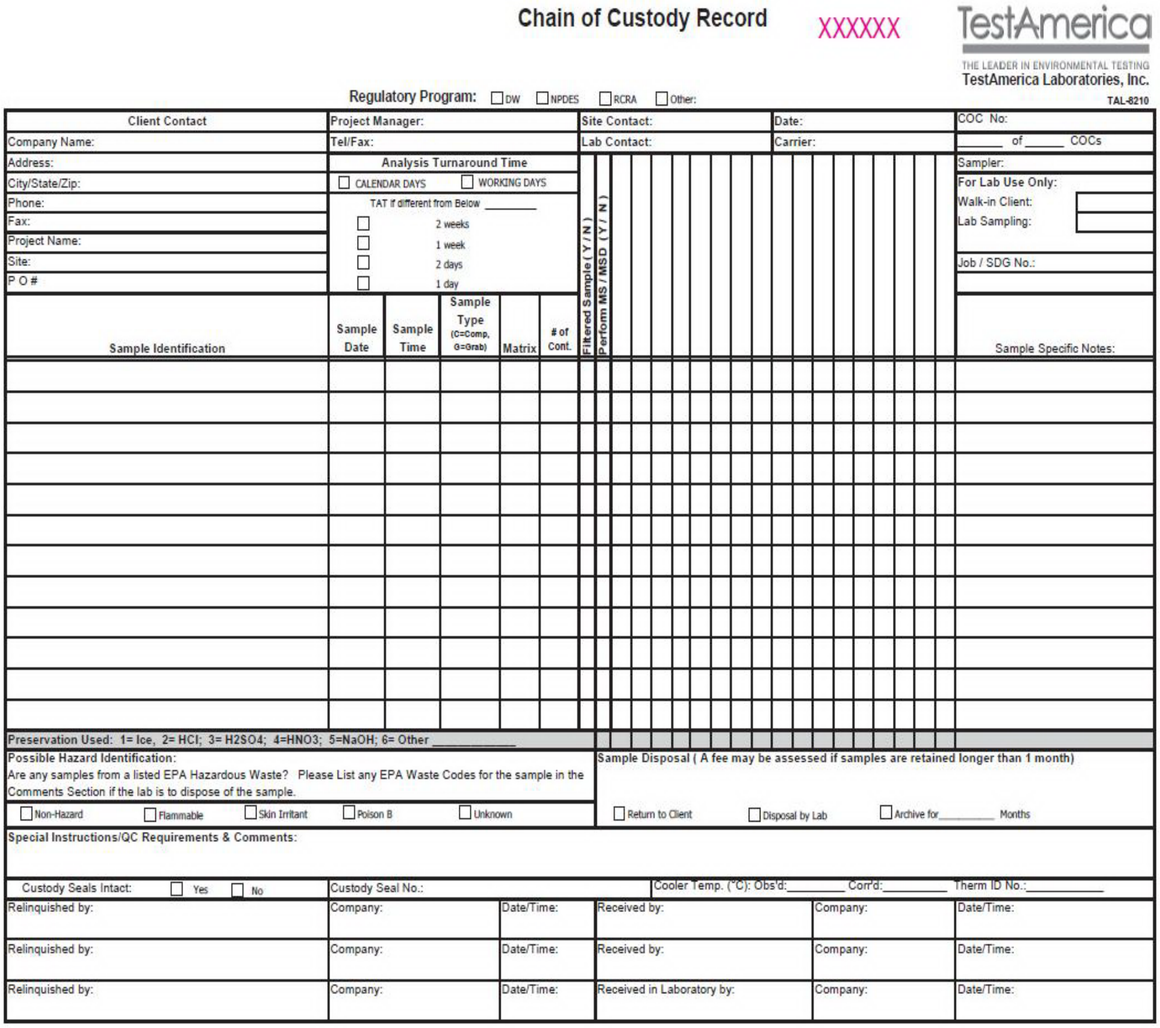
23.7 SAMPLE DISPOSAL

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP: BF-WM-001, "Waste Management".) All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than six weeks from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample may request to participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal and nature of disposal (such as sample depletion, hazardous waste facility disposal, and return to client). All disposal of sample containers is accomplished through incineration. A Waste Disposal Record should be completed.

Figure 23-1.

Example: Chain of Custody (COC)



Chain of Custody Record XXXXXX

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.
TAL-8210

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Company Name:	Tel/Fax:	Lab Contact:	Carrier:	_______ of ______ COCs
Address:	Analysis Turnaround Time			Sampler:
City/State/Zip:	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone:	TAT if different from Below _________			Walk-in Client:
Fax:	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____________

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for_________ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No
Custody Seal No.:
Cooler Temp. (°C): Obs'd:_________ Corr'd:_________ Therm ID No.:___________

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Figure 23-2.

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
    - ➢ *Client name, address, phone number and fax number (if available)*
    - ➢ *Project name and/or number*
    - ➢ *The sample identification*
    - ➢ *Date, time and location of sampling*
    - ➢ *The collectors name*
    - ➢ *The matrix description*
    - ➢ *The container description*
    - ➢ *The total number of each type of container*
    - ➢ *Preservatives used*
    - ➢ *Analysis requested*
    - ➢ *Requested turnaround time (TAT)*
    - ➢ *Any special instructions*
    - ➢ *Purchase Order number or billing information (e.g. quote number) if available*
    - ➢ *The date and time that each person received or relinquished the sample(s), including their signed name.*
    - ➢ ***The date and time of receipt must be recorded between the last person to relinquish the samples and the person who receives the samples in the lab, and they must be exactly the same.***
    - ➢ **Information must be legible**

2) Every sample cooler is given a radiation screen with a standardized Radiation Monitor (Monitor 4 model). This screen has no analytical repercussions; it is just a gross screen for employee safety purposes. Contact TestAmerica Buffalo's Technical Manager, Environmental Health and Safety Coordinator or Sample Control Manager immediately if screening indicates radioactivity in excess of 0.02 mR/hr.

3) Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any TestAmerica facility or

courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

4) Samples must be properly labeled.
    - Use durable labels (labels provided by TestAmerica are preferred)
    - Include a unique identification number
    - Include sampling date and time & sampler ID
    - Include preservative used.
    - Use indelible ink
    - **Information must be legible**

5) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested.

6) Samples must be preserved according to the requirements of the requested analytical method. See lab Sampling Guide.
   Note: Samples that are hand delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

    - Chemical preservation (pH) will be verified prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

    - For Volatile Organic analyses in drinking water (Method 524.2). Residual chlorine must be neutralized prior to preservation. If there is prior knowledge that the samples are not chlorinated, state it on the COC and use the VOA vials pre-preserved with HCl. The following are other options for a sampler and laboratory where the presence of chlorine is not known:
        - 1. Test for residual chlorine in the field prior to sampling.
            - If no chlorine is present, the samples are to be preserved using HCl as usual.
            - If chlorine is present, add either ascorbic acid or sodium thiosulfate prior to adding HCl.
        - 2. Use VOA vials pre-preserved with sodium thiosulfate or ascorbic acid and add HCl after filling the VOA vial with the sample.
    - **FOR WATER SAMPLES TESTED FOR CYANIDE – for NPDES samples by Standard Methods or EPA 335**
        - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample must be treated with Cadmium Chloride and filtered prior to the addition of NaOH.

            - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.

- It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.

- The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

7) Sample Holding Times

- TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (2 working days) remaining on the holding time to ensure analysis.

- Analyses that are designated as “field” analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for “field” analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis.

8) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply this blank with the bottle order.

9) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

10) Recommendations for packing samples for shipment.

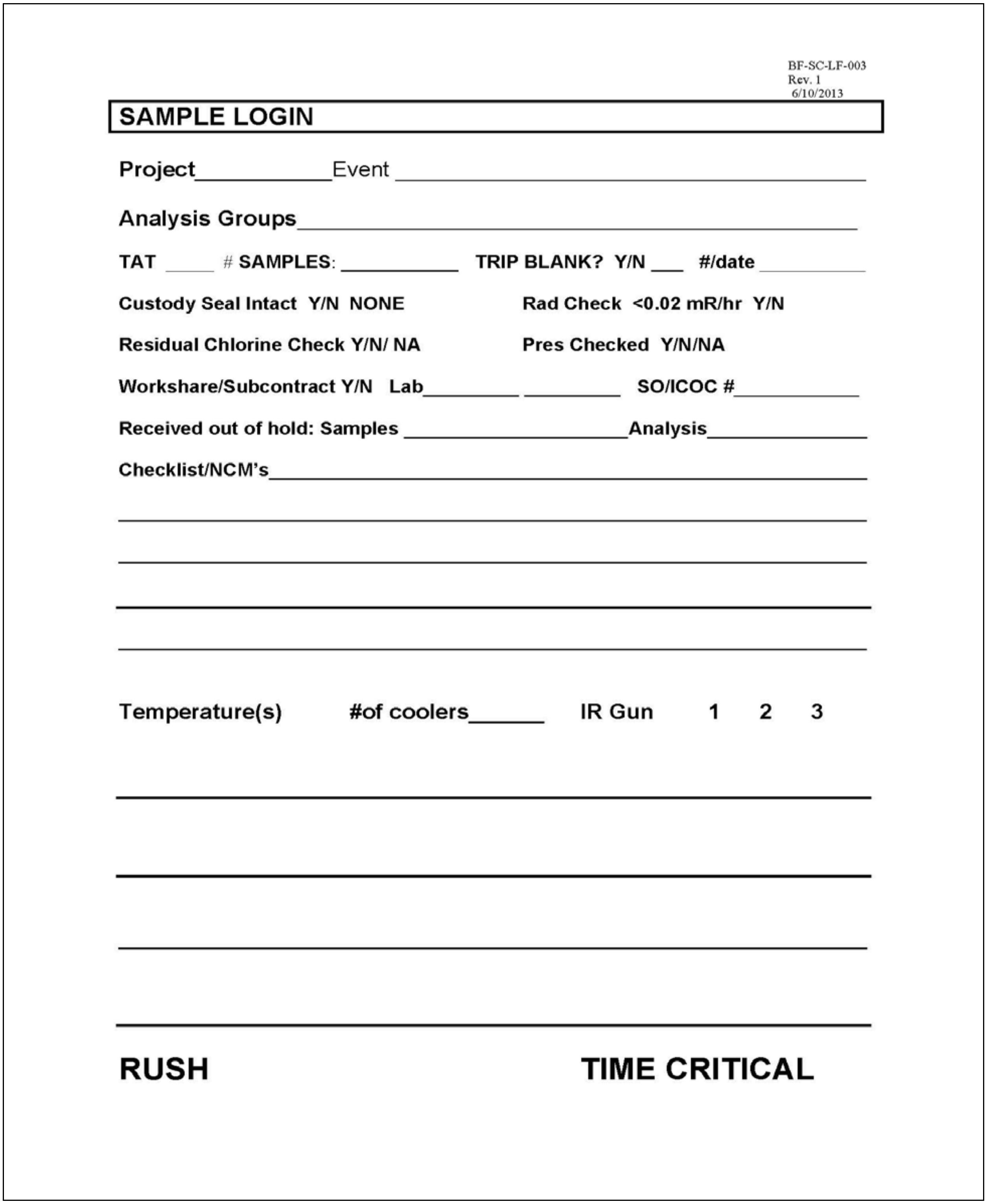
    - Pack samples in Ice rather than “Blue” ice packs.

    - Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.

    - Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.

    - Fill extra cooler space with bubble wrap.

Figure 23-3.
Example: Cooler Receipt Form (Optional)



BF-SC-LF-003
Rev. 1
6/10/2013

SAMPLE LOGIN

Project____________**Event** ____

Analysis Groups____

TAT _____ # **SAMPLES**: ___________ **TRIP BLANK? Y/N** ___ **#/date** __________

Custody Seal Intact Y/N NONE **Rad Check <0.02 mR/hr Y/N**

Residual Chlorine Check Y/N/ NA **Pres Checked Y/N/NA**

Workshare/Subcontract Y/N Lab_________ _________ **SO/ICOC #**___________

Received out of hold: Samples ____________________**Analysis**______________

Checklist/NCM's____

Temperature(s) **#of coolers**______ **IR Gun** **1** **2** **3**

RUSH **TIME CRITICAL**

Section 24.0

ASSURING THE QUALITY OF TEST RESULTS

24.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 NEGATIVE CONTROLS

Table 24-1.

Control Type	Details
Method Blank (MB)	Are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	Are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

Table 24-1.

Control Type	Details
Instrument Blanks	Are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.
Trip Blank [1]	Are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan) Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	Are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	Are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard may be reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

24.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

24.4.1.4 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.5 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). In order to meet this requirement, TestAmerica Buffalo spikes with the Corporate Standard Standards primary mix for each analysis. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

24.4.1.5.1 For methods that have 1-10 target analytes, spike all components.

24.4.1.5.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

24.4.1.5.3 For methods with more than 20 target analytes, spike at least 16 components.

24.4.1.5.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

24.4.1.5.5 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 SAMPLE MATRIX CONTROLS

Table 24-5. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	Used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	Essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

24.6.1 As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable.

24.6.3.4 The maximum acceptable recovery limit will be 150%.

24.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

24.6.3.6 If either the high or low end of the control limit changes by ≤ 5% from previous, the data points are inspected and, using professional judgment, the limits may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. This process is outline in BF-QA-002.

24.6.4.1 The control limits are maintained in the laboratory LIMs system. The limits for each analyte/method/matrix combination are assigned effective and expiration dates. The QA department is able to query the LIMs system and print an active list of control limits based on this database. The most current laboratory limits (based on the effective/expiration dates) are reflected on the laboratory worksheets and final reports unless superseded by project specific limits.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 13) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples.

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 22.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 19.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25.0

REPORTING RESULTS

25.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. A variety of report formats are available to meet specific needs. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

The laboratory complies with any state reporting requirements. An example is located in BF-PM-008 – Massachusetts DEP Notification Procedures.

Review of reported data is included in Section 19.

25.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report) with a "sample results" column header.

25.2.2 Each report cover page is printed on company letterhead which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. job number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as # / ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Practical quantitation limits or client reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits (if requested).

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda). Sample temperatures are recorded in the report case narrative and on the COC. Deviations from normal conditions (e.g., preservation, breakage) are recorded in the report case narrative.

25.2.17 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.19 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.20 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are qualified Project Managers appointed by the Manager of Project Managers.

25.2.21 When NELAP accreditation is required, the lab shall certify that the test results meet all requirements of NELAP or provide reasons and/or justification if they do not.

25.2.22 The laboratory includes a cover letter.

25.2.23 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.24 When Soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.25 Appropriate laboratory certification number for the state of origin of the sample if applicable.

25.2.26 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g, partial report). A complete report must be sent once all of the work has been completed.

25.2.27 Any non-TestAmerica subcontracted analysis results are provided as an addendum to the report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.28 Certification Summary report, where required, will document that unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

25.3 REPORTING LEVEL OR REPORT TYPE

TestAmerica Buffalo offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level 1 is a report with all of the elements outlined in Section 25.2 above, excluding 25.2.15 (QC data)
- Level II is a Level I report plus summary information, including results for the method blank, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. Procedures used to ensure client confidentiality are outlined in Section 26.7.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services in addition to the test report as described in section 25.2. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD . TestAmerica Buffalo offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report

25.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

25.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in Section 8.

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.6 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. It is our policy that facsimiles are *intended for and should be used for business purposes only. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify the sender.*

25.7 FORMAT OF REPORTS

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "R". The revised report will have the word "revised" appended to the cover letter.

When the report is re-issued, a notation of "revised" is placed on the cover/signature page of the report. A brief explanation of reason for the re-issue is included in the report case narrative.

25.9 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

25.9.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

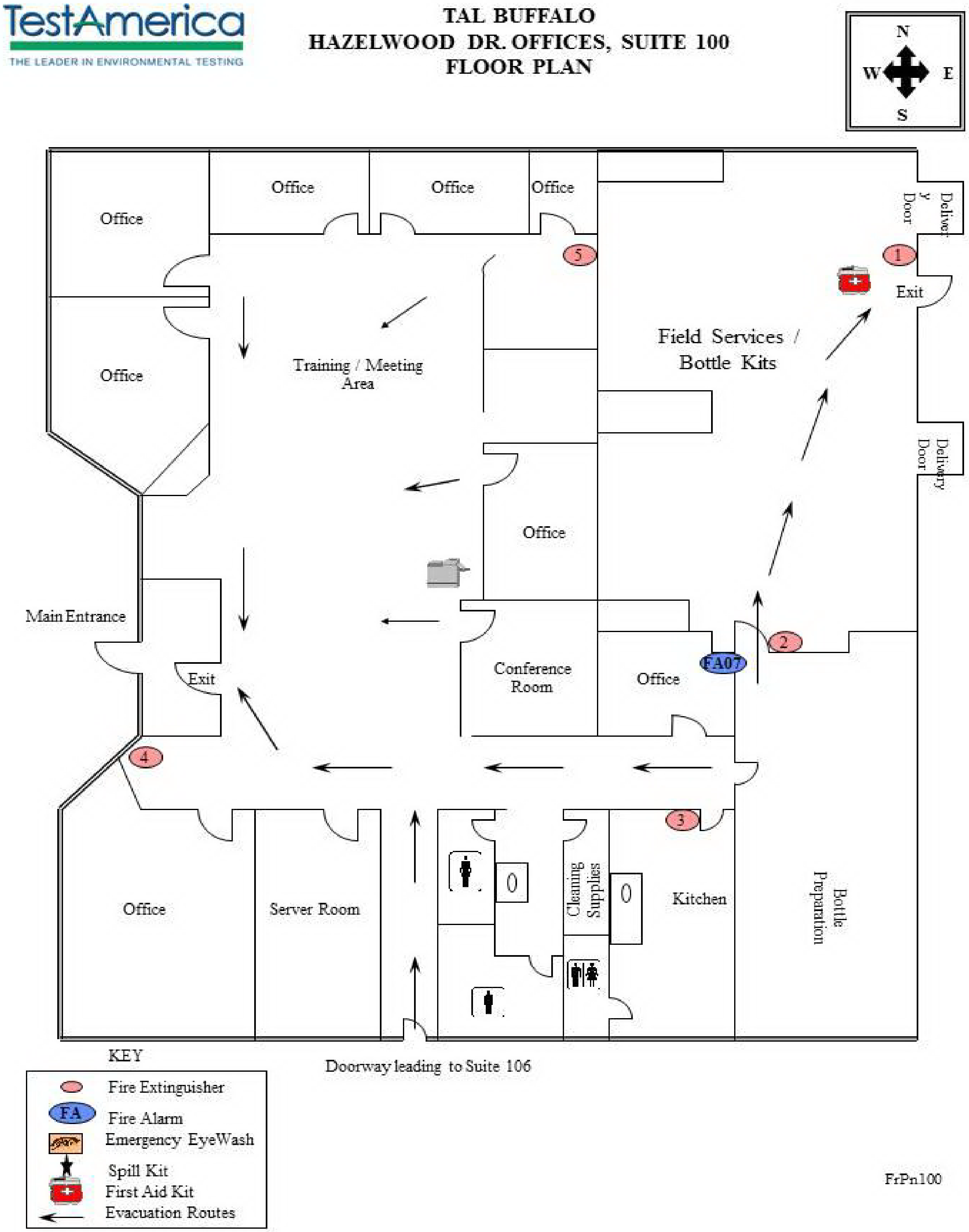
- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

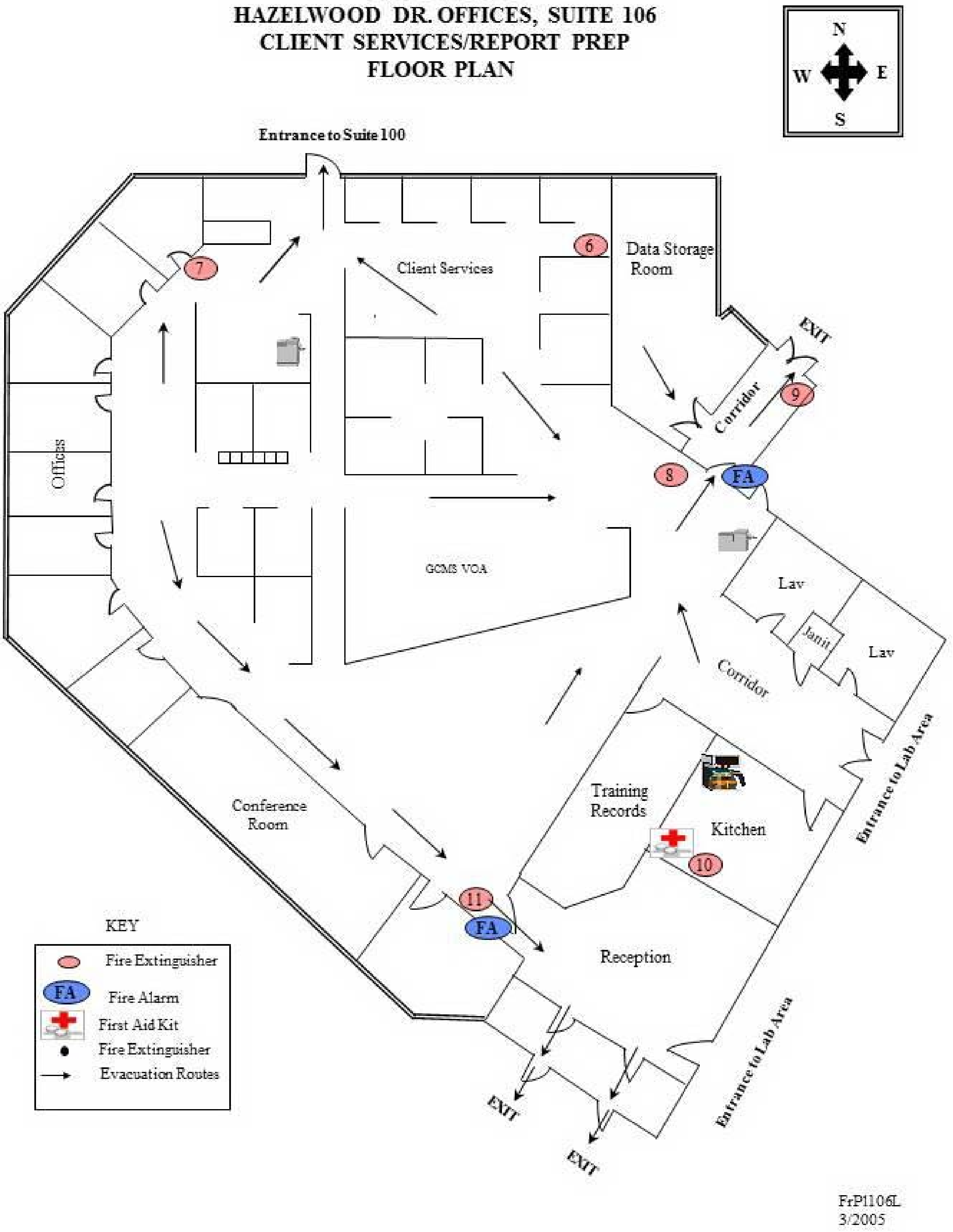
TestAmerica does not issue multiple reports for the same workorder where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.

TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 100
FLOOR PLAN



TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 106
CLIENT SERVICES/REPORT PREP
FLOOR PLAN

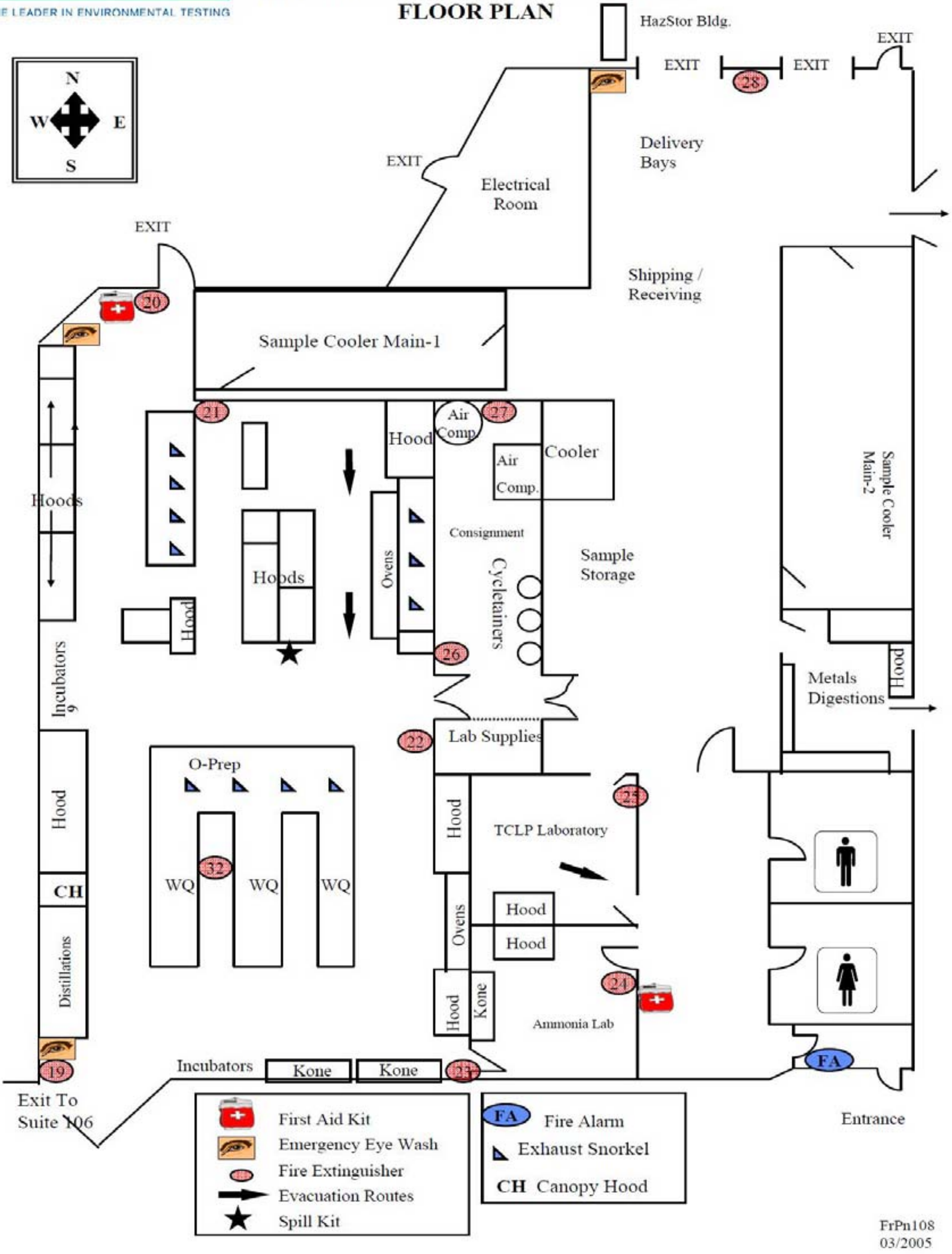


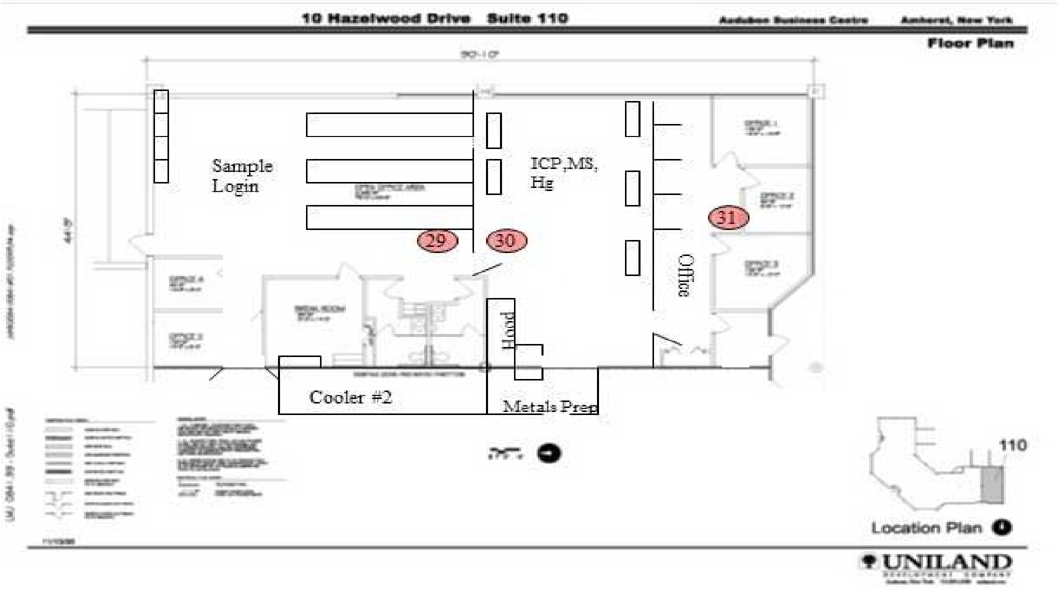
TAL BUFFALO
HAZELWOOD DR. NY OFFICES, SUITE 106
LABORATORY AREA
FLOOR PLAN

FrPn106r
03/2005

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 108
FLOOR PLAN




10 Hazelwood Drive Suite 110
Audubon Business Centre
Amherst, New York
Floor Plan
Sample Login
ICP,MS, Hg
29
30
31
Office
Hood
Cooler #2
Metals Prep
110
Location Plan
UNILAND

Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (TNI)

Accrediting Authority: The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (TNI)

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (TNI)

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory’s control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

> 1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).
>
> 2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material, accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI).

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (TNI)

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Derivitization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures

(TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (TNI)

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item (ASQC), whether in the laboratory's control or not.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for Inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with <15% Settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% Settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air & Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (TNI)

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (TNI)

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (TNI)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (TNI)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI) [2.1]

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: Material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or and which is accepted as the method for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS-ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection

LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SDS - Safety Data Sheet
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
TNI – The NELAC Institute
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3. Laboratory Certifications, Accreditations, Validations

TestAmerica Buffalo maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Certifications

Laboratory	Program	Authority	Identification	Expiration Date
TestAmerica Buffalo	Federal	USDA	P330-11-00386	11/26/2017
TestAmerica Buffalo	NELAP	Florida	E87672	06/30/2017
TestAmerica Buffalo	NELAP	Illinois	200003	09/30/2016
TestAmerica Buffalo	NELAP	Kansas	E-10187	10/31/2016
TestAmerica Buffalo	NELAP	Louisiana	02031	06/30/2017
TestAmerica Buffalo	NELAP	Minnesota	036-999-337	12/31/2016
TestAmerica Buffalo	NELAP	New Jersey	NY455	06/30/2017
TestAmerica Buffalo	NELAP	New York	10026	03/31/2017
TestAmerica Buffalo	NELAP	Oregon	NY200003	06/09/2017
TestAmerica Buffalo	NELAP	Pennsylvania	68-00281	07/31/2017
TestAmerica Buffalo	NELAP	Texas	T104704412-15-6	07/31/2017
TestAmerica Buffalo	NELAP	Virginia	460185	09/14/2017
TestAmerica Buffalo	NELAP Primary AB	New Hampshire	2973	09/11/2017
TestAmerica Buffalo	NELAP Secondary AB	New Hampshire	2337	11/17/2016
TestAmerica Buffalo	State Program	Arkansas DEQ	88-0686	07/06/2017
TestAmerica Buffalo	State Program	California	1169CA	09/30/2017
TestAmerica Buffalo	State Program	Connecticut	PH-0568	09/30/2016
TestAmerica Buffalo	State Program	Georgia	956	03/31/2017
TestAmerica Buffalo	State Program	Georgia	N/A	03/31/2017
TestAmerica Buffalo	State Program	Iowa	374	03/01/2017
TestAmerica Buffalo	State Program	Kentucky (DW)	90029	12/31/2016
TestAmerica Buffalo	State Program	Kentucky (UST)	30	03/31/2017
TestAmerica Buffalo	State Program	Kentucky (WW)	90029	12/31/2016
TestAmerica Buffalo	State Program	Maine	NY00044	12/04/2016
TestAmerica Buffalo	State Program	Maryland	294	03/31/2017
TestAmerica Buffalo	State Program	Massachusetts	M-NY044	06/30/2017
TestAmerica Buffalo	State Program	Michigan	9937	03/31/2016 *
TestAmerica Buffalo	State Program	North Dakota	R-176	03/31/2017
TestAmerica Buffalo	State Program	Oklahoma	9421	08/31/2017
TestAmerica Buffalo	State Program	Rhode Island	LAO00328	12/30/2016
TestAmerica Buffalo	State Program	Tennessee	TN02970	03/31/2017
TestAmerica Buffalo	State Program	Washington	C784	02/10/2017
TestAmerica Buffalo	State Program	West Virginia DEP	252	09/30/2016
TestAmerica Buffalo	State Program	Wisconsin	998310390	08/31/2017

Page 1 of 1

* Certification Valid - Laboratory is Pending Renewal with the Program Authority

For more information, or to contact a local TestAmerica representative nearest you, please visit our website at www.testamericainc.com

The certificates and accredited parameter lists are available for each State/Program at www.testamericainc.com under Analytical Services Search – Certifications.

APPENDIX G. FIELD SAMPLING PLAN

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

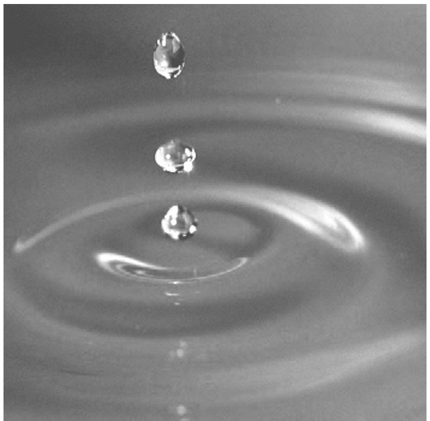
Field Sampling Plan
Former Sag Harbor MGP Site

Sag Harbor, New York
AOC Index No.: D1-0002-98-11
Site No. 1-52-159

Submitted to:
National Grid
175 East Old Country Road
Hicksville, NY 11801

Submitted by:
GEI Consultants, Inc., P.C.
110 Walt Whitman Road
Huntington Station, NY 11746

September 2019
Project 1702897



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Section 2 - Pre-Mobilization Activities (PM)

Section 3 – Field Documentation (FD)

Section 4 – Drilling Methods (DM)

Section 5 – Sample Collection and Field Screening (SC)

Section 6 – Solid Matrix Sampling (SM)

National Grid Color Descriptions of Samples at Urban Impacted Sites (April 8, 2016)

Section 7 – Groundwater (GW)

GW-001 Water Level and Non-Aqueous Phase Liquid (NAPL) Measurement (Rev. 3, September 2012)
GW-002 Non-Aqueous Phase Liquid (NAPL) Recovery (Rev. 3, September 2012)
GW-003 Low Flow (Low Stress) Groundwater Sampling (Rev. 2, June 2011)
GW-004 pH and Temperature Measurement (Rev. 2, June 2011)
GW-005 Turbidity Measurement (Rev. 2, June 2011)
GW-006 Specific Conductance Measurement (Rev. 2, June 2011)
GW-007 Dissolved Oxygen Measurement (Rev. 2, June 2011)
GW-008 Temporary Groundwater Sampling Points (Rev. 2, June 2011)
GW-009 Potable Well Sampling (Rev. 2, June 2011)
GW-010 Slug Test (Rev. 2, June 2011)
GW-011 Constant Head Permeability Test (Rev. 1, June 2011)
GW-012 Open Standpipe Piezometer (Rev. 1, June 2011)
GW-013 Vibrating Wire Piezometer Construction and Installation (Rev. 1, June 2011)
GW-014 Dense Non-Aqueous Phase Liquid (DNAPL) Measurement and Recovery (Rev. 1, June 2011)

Section 8 – Surface Water Sampling (SW)

SW-001 Surface Water Sampling (Rev. 2, June 2011)

Section 9 – Sediment Sampling (SS)

SS-001 Sediment Sampling Using a Ponar or Shipek Grab Sampler (Rev. 2, June 2011)
SS-002 Sediment Sampling Using Vibracore Equipment (Rev. 2, June 2011)
SS-003 Sediment Sampling Using a Remote Sampler (Rev. 2, June 2011)

Section 10 – Air Sampling and Monitoring (AR)

AR-001 General Guidance on Work Zone Monitoring Methods (Rev. 3, June 2013)
AR-002 Air Sampling for Dust (Particulate Matter) using the MIE DataRAM™ Real-Time Aerosol Monitor DataRam™ Real-time Aerosol Monitor (Portable) (Rev. 2, June 2011)
AR-003 Ambient Air Monitoring Method PM10 (Rev. 2, June 2011)
AR-004 PAHs in Ambient Air TO-13A (Rev. 2, June 2011)
AR-005 Hydrogen Cyanide Work Zone Air Monitoring Procedures
AR-006 VOCs in Ambient Air In Summa Canisters (Rev. 1, June 2013)

Section 11 – Soil Gas Sampling (SG)

SG-001 General Guidance on Soil Vapor Intrusion Evaluations (Rev. 2, June 2011)
SG-002 Soil Vapor Sample Collection (Rev. 2, June 2011)

Section 12 – Quality Control – Quality Assurance (QA)

Section 13 – Technical Report Production (RP)

Section 14 – Biosolve

MJF/amm
H:\TECH\project\National Grid\Skillman Street Holder\SMP\Draft ISMP Rev 01 Mar 2018\Appendices\Appendix J - FSP\FSP Cover and TOC.docx

Section 1

Introduction

STANDARD OPERATING PROCEDURE

1. Introduction

This document presents the Standard Operating Procedures (SOPs) for the Atlantic and New England Regions of GEI Consultants, Inc. (GEI). The primary intent of the document is to promote consistency in application of Standard Operating Procedures (SOPs) for environmental field and some office operations. Application and use of SOPs will be considered and may be discussed in annual staff reviews.

This SOP document encompasses a broad range of activities to improve the planning, implementation, and documentation of most environmental field and some office operations. The methodologies presented in this manual may not be applicable to site-specific situations. If you are uncertain about a procedure, confirm its adequacy with the project manager, client, and/or regulatory bodies to confirm that procedures are consistent with their expectations.

The document is organized according to the chronological sequence of typical work flow proceeding from project setup to field activities, data collection, and report preparation tasks.

Two types of documents are contained herein:

- General Guidance Procedures – Documents intended to be informative and not prescriptive. These documents are designed to provide necessary background information to adequately understand the process.
- Standard Operating Procedures – Documents intended to describe standard procedures and limitations.

2. SOP Layout Design

2.1. Header Information

- Each SOP contains within its name a two letter abbreviation of the general category in which it belongs (i.e. RE-001 means it is in Site Reconnaissance). The table of contents provides the definition for each abbreviation. The SOP name and number is provided in the header and footer of the document. The revision number is provided in the header of each SOP.
- The effective date is provided in the header of each SOP. The effective date provides the date when the revisions to the SOP are in effect and provides information as to the last time the SOP was updated. Each SOP should contain the most up-to-date version and effective date.

2.2. Footer Information

- Each footer contains the page number and total page numbers as well as a second reference to the SOP name. This should help organize and collate pages.

2.3. Body of Text

- Limitations are provided to describe precautions or common issues associated with the performance of the procedure.
- References provide sources consulted for development of the SOP.
- Attachments provide reference to external documentation that should be reviewed in conjunction with the SOP.
- At least one contact person is provided at the bottom of each SOP. These people should be contacted with any questions or comments on the particular SOP. The contact can clarify the SOP or edit as necessary.

2.4. Process for editing/updating SOPs

Should you need to make a global change to an existing SOP, the current .pdf version can be found on the Intranet.

In order to make your changes, you will need to request a WORD copy of the SOP from Andrea Hippler, Jerry Zak or Ryan Hoffman. Once you have made your changes, the SOP should be e-mailed to Jerry Zak, Andrea Hippler and Ryan Hoffman with a note as to what changed.

This document has been provided to all staff performing environmental field tasks for GEI's Atlantic and New England Regions.

3. Attachment

Attachment A – Acronym List

STANDARD OPERATING PROCEDURE

Abbreviations and Acronyms

AOC	Area of Concern
ASTM	American Society for Testing and Materials
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethyl Benzene, Xylenes
CAMP	Community Air Monitoring Plan
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CFR	Code of Federal Regulations
COC	Chain of Custody
DL	Detection Limit
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DQO	Data Quality Objectives
EC	Engineering Controls
EIS	Environmental Impact Study
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FS	Feasiblity Study
FWRIA	Fish and Wildlife Resources Impact Analysis
GAC	Granular Activated Carbon
GC/MS	Gas Chromatograph/Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption Spectrometry
GIS	Geographic Information Systems
GPR	Ground-penetrating Radar
HASP	Health and Safety Plan
HOC	Halogenated Organic Compound
HDPE	High Density Polyethylene
HPLC	High Pressure Liquid Chromatography
HSO	Health and Safety Officer
IC	Institutional Controls
ICP	Inductively Coupled Plasma Atomic Emission Spectrometry
IDW	Investigation Derived Waste
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level (for EPA Drinking Water Standards)
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MSDS	Material Safety Data Sheet
NAPL	Non-aqueous Phase Liquids

NCP	National Contingency Plan
NPL	National Priority List
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
QHHEA	Qualitative Health and Human Exposure Assessment
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RCRA	Resource Conservation Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RFP	Request For Proposal
RP	Responsible Party
SARA	Superfund Amendments and Reauthorization Act
SCGs	Standards, Criteria, and Guidance
SMP	Site Management Plan
SOP	Standard Operating Procedure
SOW	Scope of Work or Statement of Work
SPLP	Synthetic Precipitate Leaching Procedure
STEL	Short-Term Exposure Limit
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Indentified Compound from Mass Spectrometry
TOC	Total Organic Carbon
TOSCA	Toxic Substance Control Act
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
USGS	United States Geologic Survey
VOC	Volatile Organic Compounds
WP	Work Plan
XRF	X-Ray Fluorescence

MEASUREMENTS

ppm	Parts per million
ppb	Parts per billion

ppbv	Parts per billion by volume
ppmv	Parts per million by volume
bgs	Below Ground Surface
msl	Mean Sea Level
ppbv	Parts per billion by volume
µg/L	Microgram per liter
µg/Kg	Microgram per kilogram
µg/m3	Microgram per cubic meter
mg/L	Milligram per liter
mg/kg	Milligram per kilogram
Mf/L	Million fibers per liter

Section 2

Pre-Mobilization Activities (PM)

STANDARD OPERATING PROCEDURE

PM-001 Utility Markout and Clearance

---

1. Objective

Describe typical utility markout/clearance procedures prior to and during excavation. All markout procedures should be performed in accordance with local and state regulations.

Many states, by law, require that utility companies are notified before excavation begins. Actual procedures and requirements differ by state. City/state government may have additional requirements for utility markout procedures. Check the requirements in the locality before beginning. Also check with the GEI project manager to determine whether it is most appropriate for GEI or the drilling/excavation subcontractor to handle mark out and clearance.

2. Execution

Public Utility Markouts

- The drilling/excavation locations should be marked with white paint, stakes, or flags.
- The contractor should call the appropriate one call communication network for the state the work is being conducted in. Refer to the Reference section in this SOP for contact information. Contractors shall provide all necessary information to the one call system. Sample location maps may be provided to clarify sampling locations. The contractor shall provide GEI with the utility clearance ticket number.
- If necessary, contact the municipalities or other utility owners to mark their water, sewer, or other lines if they do not belong to the one call system. The contractor should keep a record of these calls.
- Utility plans, if available, should be obtained from the property owner or municipal offices.
- Prior to excavation, a visual check should be made that all utilities companies and municipalities have marked their locations. This includes looking for signs that a utility exists, and verifying that the markings agree with a visual check. If they do not, contact the appropriate utility to remark their locations.
- Utilities will generally only markout and clear utilities in roadways or other public property up to the property boundary. Owners of fiber optic cables, natural gas pipelines, and other high hazard utilities will often markout on private property if requested. The contractor should request this. See section on private utility clearance below.
- Public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation should adopt the American Public Works Association (APWA) Uniform Color Code using ANSI standard Z535.1 Safety Colors for temporary marking and utility identification, as follow:

The APWA Uniform Color Code

1. **White** – Proposed Excavation
2. **Pink** – Temporary Survey Markings
3. **Red** – Electric Power Lines, Cables, Conduit and Lighting Cables
4. **Yellow** – Gas, Oil, Steam, Petroleum & Gaseous Material
5. **Orange** – Communications, Alarm or Signal Lines, Cables or Conduit
6. **Blue** – Potable Water
7. **Purple** – Reclaimed Water, Irrigation and Slurry Lines
8. **Green** – Sewers and Drain Lines

However, not all organization do use these colors. Make sure the color scheme is understood.

- The excavator/contractor and consultant begins work on the scheduled work date and time (if all the facility operators have responded) taking care to find and preserve any markings that have been made.
- If markings may be disturbed during work, establish offset marks to create reference points for the underground utilities. Take photographs of the markings before starting work.
- When digging near a buried utility, the excavator/contractor and consultant should be aware of their proximity to the utility and use caution.
- If there is uncertainty about the accuracy of the markings or there are too many utilities in a given location to excavate or drill safely, consideration should be given to hand-digging the first few feet, vacuum excavation, or use of a utility location company as detailed below in Private Utility Markouts.
- Some clients may require hand or vacuum clearance to a minimum depth. Check with the GEI project manager.
- If exposing a utility, the excavator/contractor should provide proper support and protection for the utility to prevent damage. Contact the utility operator for support, guidance, or assistance.
- When the excavation is complete, the excavator/contractor should provide proper backfill for any utilities that have been exposed.

Private Utility Markouts

- Utility markouts on private property should follow the steps outlined above in public utility markouts with the additions below.
- If work is conducted on private property where public utilities may not provide markouts and the property owner cannot provide accurate utility plans, it is

recommended to use a company to determine the utility locations using one or more of the following technologies:

i. <u>Electro-Magnetic (EM) device:</u> This technology uses an electro-magnetic field in the subsurface to accurately locate metallic lines or non-metallic lines incorporating a metallic trace wire along their surface. The field is created either by direct contact to the pipe or tracewire, or by an induced current via radio waves.
ii. <u>Sewer Sonde:</u> For non-metallic lines where internal access is possible (such as clean-out ports in a sewer), a beacon or 'sonde' that emits a signal to the surface receiver as it is snaked through the pipe provides the same accuracy as the EM detector. If the internal condition of the pipe is desired, a camera can be deployed instead of a simple sonde.
iii. <u>Ground Penetrating Radar (GPR):</u> This technology involves radar waves reflecting to a surface receiver which provides a visual real-time map of the subsurface by which anomalies (such as pipes or tanks) may be detected. It has limitations in clay or wet soils and requires a skilled operator for interpretation. GPR should be considered for high risk utilities (e.g. PVC natural gas lines without trace wire) where line-of-sight project from site entry point to a kiosk or other building is uncertain.

- Utility markout on private property should include clearance for other types of underground structures such as underground storage tanks, septic systems, utility or access tunnels, and in-ground irrigation systems.

3. Limitations

- Markout notification time usually does not include holidays. Make sure holidays are considered and markout time is scheduled accordingly. Do not conduct excavation or drilling prior to the required wait time. Do not mark excavation locations using spray paint if it is raining or snowing enough so that the paint markings will be washed away. Consider using long stakes instead of paint if snow is predicted. Excavations within the tolerance zone should be performed with non-powered hand tools until the marked utility is exposed. The tolerance zone may be determined by the utilities, law or codes.
- When excavating close to an underground utility, it is good practice for the contractor/excavator to have a spotter assist and guide the machine operator.
- Take care not to damage the conduit or protective coating of a utility. If the excavator/contractor damages this, leave the damaged utility exposed and immediately call the utility owner.
- If contact to a gas utility occurs, notify police, fire, and emergency personnel, and evacuate employees and general public. No attempt should be made to tamper with or correct the damaged utility.

4. References

Connecticut
Name: Call-Before-You-Dig (CBYD)
Telephone: 811 or 1-800-922-4455
Website: www.cbyd.com
Wait time after notification: 2 business days (excluding holidays)
Expiration of markout: 30 days

Massachusetts, Maine, New Hampshire, Rhode Island and Vermont
Name: Dig Safe
Telephone: 811 or 1-888-DIG-SAFE
Website: www.digsafe.com
Wait time after notification:
  MA, ME, NH, and RI: 3 business days (excluding holidays)
  VT: 2 business days (excluding holidays)
Expiration of markout: 30 days

New York State
Name: Dig Safely New York
Telephone: 811 or 1-800-962-7962
Website: www.digsafelynewyork.com
Wait time after notification: 2 business days (excluding holidays)
Expiration of markout: 30 days

New York City/Long Island
Name: New York City One Call Center
Telephone: 811 or 1-800-272-4480
Website: www.nycli1calldsi.com
Wait time after notification: 2 to 10 days (excluding holidays)
Expiration of markout: 30 days

New Jersey
Name: New Jersey One Call
Telephone: 811 or 1-800-272-1000
Website: www.nj1-call.org
Wait time after notification: 2 business days
Expiration of markout: 45 days

5. Attachment

Attachment A – Standard Utility Color Codes

6. Contact

Anne Leifer

SOP PM-001

Attachment A – Standard Utility Color Codes

Color Code	**Utility Description**
Red	Electric
Yellow	Gas-Oil
Orange	Communications
Blue	Water
Green	Sewer
White	Proposed Excavation

Section 3

Field Documentation (FD)

STANDARD OPERATING PROCEDURE

FD-001 Field Notebook

---

1. Objective

Describe methods for documentation of field activities.

Documentation of site activities is a crucial part of the field investigation process. The field notebook serves as the record of field activities performed or observed during the project. It provides a factual basis for preparing field observation reports, if required, and reports to clients and regulatory agencies. Example field notes are provided in Attachment A.

2. Execution

- Use a separate all-weather bound notebook for each site/location/project number. Spiral notebooks should not be used because pages can be easily removed.
- Write neatly using black or blue pen, preferably a waterproof pen. Use of pencil is also acceptable only with approval of the project manager, such as in but not limited to, certain field conditions [e.g., cold or wet weather].
- Write the project name, project number, book number (i.e., 1 of 3), and date on the front cover. On the inside cover, identify the project name, project number, and “Return Book To:” the office address of the project manager.
- Number all of the pages of the field book starting with the first entry.
- Record activities as they occur. Record only facts and observations, regardless of whether they appear to be relevant at that time.
- Identify conditions or events that could affect/impede your ability to observe conditions (e.g. snow-covered ground surface, inability to access areas of interest).
- Neatly cross out mistakes using a single line and initial them. Erasures are not permitted.
    - If an error is made on an entry in the field notebook, the individual who made the entry should make the corrections. The corrections must be initialed and dated by the person making the correction.
- Sign or initial and date the bottom of every page with an entry if the project requires such documentation.
- Place a diagonal line through unused portions of a page.
- Record the following information upon each arrival at the site:
    - Date/time/weather.
    - GEI personnel.
    - Purpose of visit/daily objectives.
    - People (client, contractor, landowners, etc.) present upon GEI arrival.

- Record the following information during the course of the day:
    - Conversations with contractors/subcontractors, clients, visitors, GEI staff, landowners (site or abutters). If possible, record complete names, titles, and affiliations.
    - Time of arrival and departure of individuals.
    - Activities as they occur.

- Additional examples of observations to record may include and are not limited to:
    - Type and quantity of monitoring well construction materials used.
    - Use of field data sheets or electronic logging equipment (e.g. boring logs, monitoring well sampling logs, etc.).
    - Ambient air monitoring data.
    - Field equipment calibration information.
    - Locations and descriptions of sampling points.
    - Contractor/Subcontractor progress.
    - Sample media (soil, sediment, groundwater, etc.).
    - Sample collection method.
    - Number and volume of sample(s) collected and sample bottle preservatives used.
    - Sample identification number (s) and date and time of sample collection.
    - Approximate volume of groundwater removed before sampling.
    - Any field observations made such as pH, temperature, turbidity, conductivity, water level, etc.
    - References for maps and photographs of the sampling site(s).
    - Information pertaining to sample documentation: bottle lot numbers/ dates, method of sample shipments, chain-of custody record numbers, and overnight shipping numbers.
    - Surveying data (including sketches with north arrows).
    - Changes in weather.
    - Rationale for critical field decisions.
    - Recommendations made to the client representative and GEI Project Manager.
    - Site sketch of conditions at the end of the day.
    - Summary of work completed/work remaining.
    - Allow time at the end of the day to complete entries in the notebook.

3. References

New Jersey DEP Field Sampling Procedures Manual, August 2005.

ASFE Daily Field Report for Geotechnical Field Observation, 2nd Edition (2001), ASFE, Inc.

4. Attachments

Attachment A - Example Field Notes

5. Contact

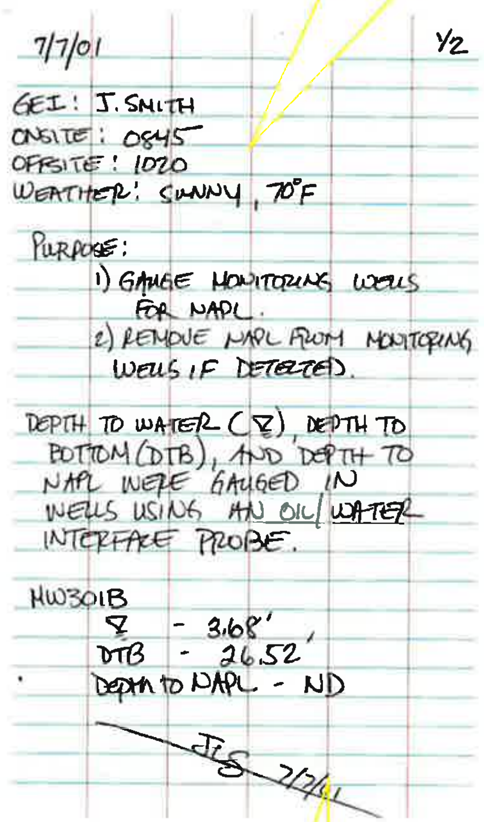
Melissa Felter
Leslie Lombardo

SOP FD-001

Attachment A – Example Field Notes

Start of each day includes:
- •Date
- •Project Number
- •People on site
- •Purpose of Work
- •Weather Conditions

Each page is numbered



7/7/01 1/2

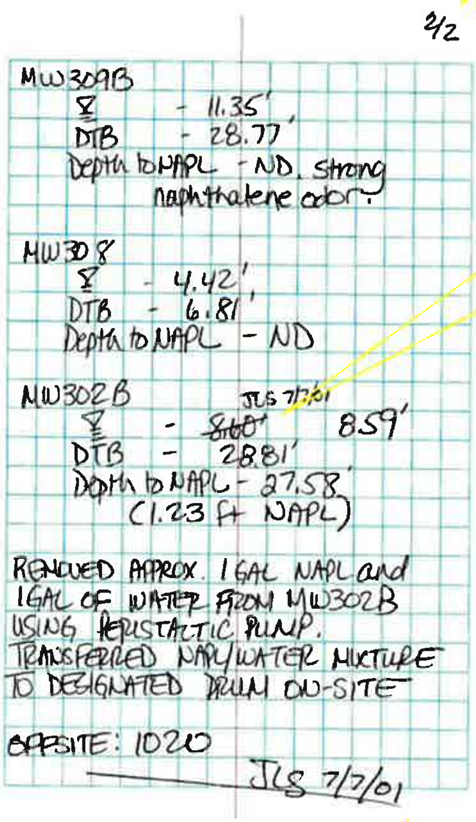
GEI: J. SMITH
ONSITE: 0845
OFFSITE: 1020
WEATHER: SUNNY, 70°F

PURPOSE:
1) GAUGE MONITORING WELLS FOR NAPL.
2) REMOVE NAPL FROM MONITORING WELLS IF DETECTED.

DEPTH TO WATER (∇), DEPTH TO BOTTOM (DTB), AND DEPTH TO NAPL WERE GAUGED IN WELLS USING AN OIL/WATER INTERFACE PROBE.

MW301B
∇ - 3.68',
DTB - 26.52'
Depth to NAPL - ND

JLS 7/7/01



2/2

MW309B
∇ - 11.35',
DTB - 28.77'
Depth to NAPL - ND, Strong naphthalene odor.

MW308
∇ - 4.42',
DTB - 6.81'
Depth to NAPL - ND

MW302B
JLS 7/7/01
∇ - ~~8.60'~~ 8.59'
DTB - 28.81'
Depth to NAPL - 27.58'
(1.23 ft NAPL)

REMOVED APPROX. 1 GAL NAPL and 1 GAL OF WATER FROM MW302B USING PERISTALTIC PUMP. TRANSFERRED NAPL/WATER MIXTURE TO DESIGNATED DRUM ON-SITE

OFFSITE: 1020

JLS 7/7/01

Errors are single line crossed out and initialed

Blank Space crossed out and initialed

Bottom of each page signed and dated

STANDARD OPERATING PROCEDURE

FD-002 Field Observation Report

---

1. Objective

Describe methods to generate a Field Observation Report.

The Field Observation Report is used to record a summary of activities, observations, and decisions made during the day's field work. The daily field observation report serves as a permanent record of the day's activity for the Project Manager (PM), In-House Consultant (IHC), and/or client.

2. Execution

- If required, at the close of the day's field work, a Field Observation Report should be prepared by the individual responsible for the field notebook. This report should be completed before leaving work for the day. Contents of the report should include, at a minimum, the following information:
    - A record of person(s) present at the site, time of arrival, departure times (e.g., GEI, contractor(s), client, etc.).
    - A record of the daily objective(s) and the activities performed (e.g., drilled five borings in the overburden).
    - A summary of deviation(s) from the field plan or objectives.
    - A summary of field decisions made, who made them, and the basis for such decisions.
    - A diagram, sketch, and/or map showing the location and extent of the work or other significant observation(s) made during the day.
    - Recommendations that may result from field observations and actions that may result from implementation of those recommendations.
    - A summary listing and field sketch showing location(s) of field activity.
- Submit a draft report to the PM/IHC for review. Complete any editorial changes, sign, date, and submit the report to PM/IHC for approval/signature. Field Observation Reports should be written neatly. They are not required to be typed unless specifically requested by the PM.

3. Limitations

- The Field Observation Report is not a substitute for the field notebook.
- Not all projects require daily Field Observation Reports.
- The Field Observation Report should be based primarily on factual information. Opinions, if necessary, should be identified as such. Any speculation should be clearly noted in the report as such.

- The Field Observation Report should never be released to anyone other than the PM/IHC prior to review and sign-off unless explicitly authorized by the PM/IHC.

4. References

New Jersey DEP Field Sampling Procedures Manual, August 2005

ASFE Daily Field Report for Geotechnical Field Investigations, 2nd Edition (2001), ASFE, Inc.

5. Attachments

Attachment A - Example Field Observation Report

6. Contact

Melissa Felter
Leslie Lombardo

FIELD OBSERVATION REPORT

Project :	Guard Booth Upgrades	**Date:**	November 8, 2006
Client :	ACME Industries	**Report No.**	1
Contractor:	ABC Contracting	**Page:**	1 of 2
Subcontractor:	NA	**GEI Proj. No.**	99999-0

SOP FD-002 - Attachment A – Example Field Observation Report

Time of Arrival: 0700 **Departure: 1440** **Weather: Overcast, Raining, 55^{0}F**

Persons Contacted, Company	**GEI Representatives**
Jane Doe, ABC Contracting	Bill Smith

Purpose of Site Visit: To observe excavation of soils for new guard booth and sidewalk.

Observations:

1. **Excavation**
    a. Areas for guard booth and sidewalk were laid out by ABC with stakes, string, and spray paint. Locations were between the pavement and wetland area; no excavation occurred in the wetland area.
    b. Staging area for soil stockpile was located to the west of the excavation, along the fenceline; polyethylene sheeting was placed beneath the pile.
    c. HDPE membrane delivered to site; stored in garage area through the inside fence.
    d. ABC crew began hand digging area for sidewalk and guard booth. Sidewalk area measured 22 feet long by 4 feet wide by 4 inches deep. Guard booth area measured 12 feet long by 10 feet wide by 9 inches deep. Utility pole and bollard locations started today.
    e. Rain continued to get worse in the afternoon; ABC covered the entire excavation and soil stockpile with poly sheeting and secured the sheeting with grade stakes.

2. **Subgrade Preparation**
    a. Subgrade preparation for the sidewalk and guard booth areas at the site is complete.

3. **Dewatering**
    a. No dewatering occurred today.

4. **Air Monitoring**
    a. During excavation, I monitored the breathing zone of the workers with an organic vapor meter (OVM). No headspace readings were measured in soil samples S-1 through S-8.

FIELD OBSERVATION REPORT

Project :	Guard Booth Upgrades	**Date:**	November 8, 2006
Client :	ACME Industries	**Report No.**	1
Contractor:	ABC Contracting	**Page:**	2 of 2
Subcontractor:	NA	**GEI Proj. No.**	99999-0

Picture 1: Sidewalk excavation and bollard layout

By: Bill Smith	**Reviewed By:**

GEI CONSULTANTS, INC.
Environmental Standard Operating Procedures
Atlantic and New England Regions

SOP No. FD-003
Revision No. 3
Effective Date: June 2011

STANDARD OPERATING PROCEDURE

FD-003 Sample Management and Chain of Custody

1. Objective

Describe methods to label sample containers, manage the samples, and prepare Chain of Custody documentation for the samples. Sample transport is also addressed.

2. Project Setup

When setting up a sampling event, inform the recipients of the samples (laboratories) and recipients of laboratory results (data group and project managers). Discuss with the laboratory the sampling media, turnaround times, and reporting limits for appropriate regulatory criteria for the site. Include the data group on correspondence so that turnaround times, data validation, and project deliverable schedules can be tracked successfully.

- <u>Laboratory</u> - Number of samples, analyses needed: bottle orders and holding times, turnaround times needed, reporting limits needed for regulatory criteria.
- <u>Data group</u> - Number of samples, analyses requested, turnaround times and reporting limits requested, data validation needed, regulatory criteria to use for tabulating results, deliverables needed, and project name and number.
- <u>Schedule</u> - Inform the laboratory and Data Group of schedule delays, changes to analyses, and expediting.

3. Sampling Execution

- Review the work plan prior to sampling to determine the following:
    - Sample matrix and sampling method.
    - Required analysis and sample volumes.
    - Sample container type and preservative requirements.
    - Required analysis methods and/or report formats.
    - The turnaround time required by the project.
    - If the data will be sent directly from the laboratory to the data validator, Project Manager, or Data Group.
    - Holding time restrictions for sampling media and analytical methods.
    - Sample naming convention used for this project site.
- Sample labels should be filled out using a waterproof or permanent marker or pen. Required information includes:
    - Sample ID.
    - Date and time (military time) of sample collection.
    - Project number.
    - Sample preservatives.
    - Sampler's initials.
    - Laboratory analytical methods.

- Place the label on the jar or bottle, not on the cap. Sample custody begins at this time.
- Record the above information in the field notebook.
- Individually wrap sample jars with packing material, if needed. See SOP SC-002 for guidance on packaging samples for shipment to the laboratory by way of common carrier. Place samples in a cooler with bagged ice or freezer packs (blue ice) immediately after collection. Add sufficient ice or freezer packs to cool samples to approximately 4°C.
- Complete a chain of custody (COC) for the samples as described below. GEI or laboratory COCs may be used as long as they contain fields for all required sample information as described in Section 2.1.

3.1. Chain-of-Custody (COC) Completion

- Fill out COC neatly and in permanent ink. Alternatively, an Excel version of the GEI COC is available and can be filled out electronically.
- Certain analyses (i.e. air analysis by TO-15) require specialized, laboratory issued COCs. Make sure any specialized COCs are available before sample collection.
- Record the project name and number, the sampler's name(s) and the state where the samples were collected.
- For each sample, enter the sample identification number, date and time (military time) collected, the number of sample containers, and any additional information to fulfill project, client or regulatory requirements.
- Record the type of analysis (including laboratory method; e.g. EPA-SW846 Method XX) requested and the preservative (if appropriate) in the vertical boxes.
- Field duplicates should be anonymous to the laboratory, but must be recorded for use by the Data Group. To keep track of this information, link the field duplicate with the proper sample in the field notebook. If required by the Project Manager or Data Group, also document this information on or attach a note to the GEI copy of the COC.
- Trip blanks for large sites should be named similar to the samples they are collected with so that there are not two of the same sample name for the same site. For example, "OU1TB-122509" and "OU3TB-122509" would avoid any mistakes.
- Strike incorrect entries on the COC with a single line, followed by the initials of the person making the correction, the date, and the correct entry.
- When sample custody is ready to be relinquished, complete the bottom of the form with date and time (military time) and signatures of relinquisher and receiver of samples as indicated. The sample collector is always the first signature while the analytical laboratory is the final signature. Theoretically, all individuals handling the samples between collection and laboratory should sign the form; however, if a common carrier (i.e., Federal Express, UPS) is used for shipping, GEI must identify the carrier in the 'Received by' box on the

COC. If the sampler hand delivers the samples to the laboratory, the received box must be signed by the laboratory.

- If the samples are placed in a designated secure area (e.g. GEI sample fridge), note this location in the "Received by" box on the COC.
- GEI uses both single sheet and triplicate COCs. If using the triplicate COCs (white, yellow, and pink copies), the pink copy should be retained by the sampling personnel and provided to the Data Group for proper filing. The white and yellow copies should accompany the samples to the laboratory.
- If you are using the single sheet COC, make a copy of the COC after it has been signed by the lab courier and forward it to the Data Group.
- Prior to sample shipment by common carrier, the COC must be placed inside the cooler in a Ziplock bag or other watertight package.
- If a common carrier such as FedEx is used to transport the samples to the laboratory, include the carrier tracking number and identify the carrier in the "Received by" box on the COC.
- If a courier is used to transport samples to the laboratory (lab courier or GEI personnel), the courier signs the COC in the "Received by" box.
- Place a custody seal on the cooler if shipping via common carrier.
- Transport samples to the laboratory as soon as possible. It is preferable to transport the samples directly to the laboratory from the field. Samples brought back to the office for storage prior to submission to the laboratory must be kept cold (4° C).
- Unused sampling containers/media that are sent back to the lab should be included on a separate COC.
- After the samples are sent to the laboratory, the GEI copy of the COC must be forwarded to the Data Group: datagroup@geiconsultants.com.

4. Limitations

- Keep the number of people involved in handling samples to a minimum.
- Where practical, only allow people associated with the project to handle the samples.
- Always document the transfer of samples from one person to another on the COC.
- The COC should always accompany the samples.
- Give samples positive identification at all times that is legible and written with waterproof or permanent ink.
- When sending samples via a common carrier, use one COC per package.
- Where practical, avoid sending samples from more than one site with separate COCs in a single package.

5. References

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory

6. Attachments

Attachment A - Example Chains of Custody
Attachment B - Shipping Info Pics

7. Contact

Brian Skelly
Leslie Lombardo

Chain of Custody Record

STL-4124 (0901)

STL Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Tel: 203-929-8140

Example ·
COC

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

Client: GEI
Address: 455 Winding Brook Dr
City: Glastonbury
State: CT
Zip Code: 06033
Project Name and Location (State): Carroll Gardens NY
Contract/Purchase Order/Quote No.:
Project Manager: Dave Terry
Telephone Number (Area Code)/Fax Number: 860 368 5300 / 860 368 5307
Site Contact: M. Felter
Lab Contact: Paul Hobart
Carrier/Waybill Number: FedEx 9383 7603 0879
Date: 12-31-07
Lab Number:
Chain of Custody Number: 00452
Page 1 of 1

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Matrix: Aqueous	Matrix: Sed.	Matrix: Soil	Matrix:	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH		Analysis (Attach list if more space is needed): VOC 8260B	SVOC 8270C	TO-15 + NAPHTHALENE										Special Instructions/ Conditions of Receipt
CGSB-01 (0-2)	12-31-07	1130				X		X							X	X											
CGSB-02 (3-4)	12-31-07	1250				X		X							X	X											
CGSB-02 (3-4) MS	12-31-07	1250				X		X							X	X											
CGSB-02 (3-4) MSD	12-31-07	1250				X		X							X	X											
CGSB-XX (5-6)	12-31-07	0800				X		X							X	X											
CGTB-123107	12-31-07	1400					TB				X				X												
CGGW-01	12-31-07	1430		X				X			X				X	X											
CGSG-01	12-31-07	0700-1500	X														X										~~CANISTER~~# 2013 REGULATOR# 779

~~NEW JERSEY: "CLP data package deliverables"~~

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other See Contract

QC Requirements (Specify) NYS Cat B ASP deliverable send to Lorie Mackinnon
Send EDD to datagroup@geiconsultants.com

1. Relinquished By Melissa J Felter	Date 12-31-07	Time 1600	1. Received By FedEx WAYBILL 923117-4432	Date 12-31-07	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments
USED FLOW CONTROLLER FOR AIR SAMPLE INCLUDED

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

EXAMPLE COC

Chain-of-Custody Record

Laboratory: Accutest

Laboratory Job #
(Lab use only)

GEI Consultants
400 Unicorn Park Dr.
Woburn, MA 01801
PH: 781.721.4000
FX: 781.721.4073

Project Information

Project Name: MWRA - Low Service Storage Tank

Project Location: Stoneham, MA

Project Number: 093400

Project Manager: D. Aghjayan

Page _1_ of _1_

Send Report to: rseigener@geiconsultants.com

Send EDD to: labdata@geiconsultants.com

MCP PRESUMPTIVE CERTAINTY REQUIRED – YES NO

If Yes, Are MCP Analytical Methods Required? YES NO NA

If Yes, Are Drinking Water Samples Submitted? YES NO NA

If Yes, Have You Met Minimum Field QC Requirements? YES NO NA

Sample Handling

Samples Field Filtered
YES NO NA

Sampled Shipped With Ice
YES NO

								Preservative								
								None	MeOH	None	None	MeOH	None	None	None	
								Analysis								
Lab Sample Number	GEI Sample ID	Collection Date	Collection Time	Matrix	No. of Bottles	Sampler(s) Initials		PCBs	VPH Fractions Only	EPH Fractions Only	SVOCs	VOCs, % Solids**	Conductivity	RCRA 8 Metals*	TPH by GC/FID DRO	Sample Specific Remarks
	093400-LS6-S5(19'-21')	12/29/2009	9:30	SO	3	JMR			x			x				
	093400-LS6-COMP (FILL)	12/29/2009	9:30	SO	1	JMR		x		x	x		x	x	x	
	093400-LS6-COMP (NATIVE)	12/29/2009	15:00	SO	1	JMR		x		x	x		x	x	x	
	093400-LS8-COMP	12/29/2009	14:00	SO	1	JMR		x		x	x		x	x	x	
	093400-LS9-S4 (8'-8'-5")	12/30/2009	14:30	SO	3	JMR			x			x				
	093400-LS9-COMP	12/30/2009	15:00	SO	1	JMR		x		x	x		x	x	x	

MCP Level Needed: GEI requires the most stringent Method 1 MCP standard be met for all analytes whenever possible.

Relinquished by: (signature)	Date:	Time:	Received by: (signature)
1. Joseph M.	12/30/09	16:30	1. GEI FRIDGE
2. GEI FRIDGE	1/4/10	1310	2. Naomi
3. Naomi	1/4/10	1310	3.
4.			4.

Turnaround Time (Business days):

Normal _X_ Other ____
10-Day ____ 7-Day ____
5-Day ____ 3-Day ____

Before submitting rush turnaround samples, you **must** notify the laboratory to confirm that the TAT can be achieved.

Additional Requirements/Comments/Remarks:

Please use MA Landfill List

* Please run TCLP analysis for RCRA 8 Metals results that exceed the 20 times rule.

** Please use % solids sample for VOC and VPH analysis of 093400-LS6-COMP (FILL), 093400-LS6-COMP (NATIVE), 093400-LS8-COMP, and 093400-LS9-COMP

Chain-of-Custody Record

Laboratory:

Laboratory Job #
(Lab use only)

GEI Consultants

455 Winding Brook Drive, Suite 201
Glastonbury, CT 06033
PH: 860.368.5300
FX: 860.368.5307

Project Information

Project Name/Number:

Project Location:

Project Contact:

Phone Number:

Page __ of __

Send Report to:

Send EDD to: datagroup@geiconsultants.com

Deliverables:

If Yes, Have You Met Minimum Field QC Requirements? YES NO NA

Sample Handling

Samples Field Filtered
YES NO NA

Samples Shipped With Ice
YES NO

							Preservative									
							Analysis									
Lab Sample Number	**GEI Sample ID**	**Collection**		**Matrix**	**No. of Bottles**	**Sampler(s) Initials**										**Sample Specific Remarks**
		Date	**Time**													

Relinquished by sampler: (signature) 1.	Date :	Time:	Received by: (signature) 1.
Relinquished by: (signature) 2.	Date :	Time:	Received by: (signature) 2.
Relinquished by: (signature) 3.	Date :	Time:	Received by: (signature) 3.
Relinquished by: (signature) 4.	Date :	Time:	Received by: (signature) 4.

Turnaround Time (Business days):

Normal _____ **Other** _____
10-Day _____ **7-Day** _____
5-Day _____ **3-Day** _____

Before submitting rush turnaround samples, you **must** notify the laboratory to confirm that the TAT can be achieved.

Additional Requirements/Comments/Remarks:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

PACKING SAMPLES FOR SHIPMENT BACK TO THE LABORATORY

A. Line cooler with bubble wrap and large plastic bag. Use absorbent pad inside the bag if bottles contain preservatives.

B. Wipe outside of bottles and put glass in individual bubble bags & seal. Place bottles & the temperature blank into cooler. Leave room for ice in between bottles & on top.

C. Place double bagged or loose ice randomly around bottles throughout the cooler.

D. Place large bag of ice or loose ice on top of the bottles. In warm weather, the cooler should be packed with as much ice as possible.

E. Close outer bag, compress excess air out of bag, twist top and knot. If necessary, use more bubble wrap to fill the dead air spaces. Place chain of custody (COC) and other paperwork in plastic bag and seal. Place on top of cooler.

F. Close cooler, place signed and dated Custody Seals over opening. Tape over the Custody Seal and seal cooler securely. Fill out overnight shipping waybill and attach to the top or handle of the cooler. Attach Saturday delivery stickers if needed. Ship according to DOT regulations.

Rev 011209

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

PACKING SAMPLES FOR SHIPMENT BACK TO THE LABORATORY

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B. Wipe outside of bottles and put glass in individual bubble bags & seal. Place bottles & the temperature blank into cooler. Leave room for ice in between bottles & on top.

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D. Place large bag of ice or loose ice on top of the bottles. In warm weather, the cooler should be packed with as much ice as possible.

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F. Close cooler, place signed and dated Custody Seals over opening. Tape over the Custody Seal and seal cooler securely. Fill out overnight shipping waybill and attach to the top or handle of the cooler. Attach Saturday delivery stickers if needed. Ship according to DOT regulations.

STANDARD OPERATING PROCEDURE

FD-004 Photo Documentation

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1. Objective

Describe methods to document and retain photographic records.

Keeping a record of photographs taken is crucial to their validity as a representation of existing conditions.

2. Execution

- Photographs of a site, individual samples, or other observations should be taken using a digital camera.
- Set the camera to record the time and date for each photograph.
- All photographic records, along with the following information, should be recorded in the field notebook (SOP FD-001).
    - If applicable, the compass direction describing the direction the photograph was taken (e.g. looking southeast). This may not apply to photographs of individual samples.
    - Brief description of what the photograph is intended to show.
- The field notebook should note who took the photographs.
- The photographs should be electronically backed up on a computer or other data storage device.
- If photographs will be used in a report, memo, or letter, they should be placed on a photograph record template and the relevant information describing the photograph should be inserted into the caption section for each photograph.

3. Limitations

- Some clients and regulatory agencies require photographs of every subsurface soil sample collected. These photographs typically include a "whiteboard" which indicates the site, the boring ID, and the depth of the sample, while logging details are recorded in the field notebook. Under these circumstances, it is not necessary to include compass directions or descriptions.

4. References

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

5. Attachments

Attachment A – Example of Photo Documentation Template

6. Contact

Melissa Felter
Leslie Lombardo

Attachment A – Example of Photo Documentation Template
GEI Consultants, Inc.

Project: Project Name

Location: Project Location

Photographer: K. Barber
Date: 10/25/07
Photo No.: 1
Direction: N

Comments:
Entrance of site with tree mulching operations.

Photographer: K.Barber
Date: 10/25/07
Photo No.: 2
Direction: W

Comments:
On-site building built in 1936.

STANDARD OPERATING PROCEDURE

FD-006 Handheld Global Positioning Receiver Operation

1. Objective

Use handheld global positioning system (GPS) receivers to locate sample points and site features with "Mapping-Grade" accuracy.

Use handheld GPS receivers to "stake out" proposed sample point locations within the limits of "Mapping Grade" accuracy.

2. Execution

- Handheld GPS receivers provide a low-cost and user-friendly method for locating sample points and site features with a fair degree of horizontal accuracy.
- In simplistic terms, GPS works by measuring the distance from numerous orbiting satellites to a point on the earth surface. Individual satellites broadcast their real-time location in terms of x,y and z coordinates, and the distance from each satellite is measured as a function of the length of time that a time-stamped signal takes to reach the receiver. Built-in GPS software derives new points by intersecting the distances from known orbital locations – in much the same way that points are located by intersecting tape-measured distances from building corners or other pre-existing site features.
- Late-model handheld GPS receivers utilize a real-time differential correction technique called WAAS (Wide Area Augmentation System). This system was designed to provide greater confidence and reliability in using GPS data for commercial aircraft landing approaches, and the additional correction improves all GPS operations.
- Handheld GPS receivers display navigational information on a variety of standard pages. Although each manufacturer uses slightly different formats, all receivers toggle back and forth between the following visual presentations:
- A "satellite" page displays the relative orbital location of all GPS satellites that are currently being tracked by the receiver. The display may include information on the real-time geometrical strength of the solution: satellite intercepts that cross at right angles provide more accurate solutions than intercepts that cross at acute or obtuse angles.
- A "track" page that displays the travel path of the receiver while it is turned on, along with the relative location of recorded points. Many GPS models have a "track-back" function that will guide the user on the same path back to the starting point
- A "navigation" page that displays instantaneous location and the real-time direction and velocity of travel. Some units provide two pages to display this information in different formats. Most units will report the overall "course

made good" (straight-line bearing and distance from the starting point) at any point.

- A "waypoint" page that allows users to "Go To" a created point or previously recorded point by providing a straight-line bearing and distance to the point. The information is instantaneously updated as the user moves along; some units display a pointing arrow that directs the user to the direction of travel. Be careful of go-to lines that lead through swamps or over cliffs – if you will be travelling in difficult terrain have a paper copy of the USGS quadrangle and a compass on hand for navigation.
- Signal strength degrades significantly next to buildings and underneath tree canopy. Most GPS receivers have an "averaging" function to improve the accuracy of shielded locations. GPS users can also improve precision by locating points three times, at different times of the day. Two of the solutions will generally be closer to each other than to the third and can be averaged for a more reliable fix.
- Most GPS receivers default to latitude and longitude, but data is more accurate and easier to input and when expressed in UTM coordinates to the nearest meter. The handheld GPS setup will have a function somewhere to change to UTM. Most of Connecticut is in UTM Zone 18 but the easternmost parts are in Zone 19.
- Consult "Corpscon" the datum translator available from the National Geodetic Survey website. Corpscon translates instantly from latitude/longitude to UTM coordinates to state plane coordinates and provides tools to identify UTM Zones. Also consult the Trimble, Garmin and Magellan websites for technological improvements and discussion of advanced techniques.

3. Limitations

- Handheld GPS receivers operating in unobstructed locations are currently reckoned to provide 2-5 meter accuracy, meaning that the true location of measured points lie within an "error ellipse" with axes of 2-5 meters centered on the measured location. In other words, even under the best of conditions a real-time GPS solution may be as much as 20 feet off the true horizontal location of a point.
- Due to geodetic restrictions, vertical locations (elevations) have less than half the accuracy of horizontal locations, meaning that even under the best of conditions, a surface elevation displayed on a handheld GPS receiver may be off by more than 50 feet.
- Horizontal and vertical data derived from handheld GPS receivers should never be considered more than relatively accurate, and this level of uncertainty should be identified in any discussion of positional tolerance.

4. References

Trimble Website: .trimble.com
Garmin Website: .garmin.com

Magellan Website: .**magellan**gps.com
National Geodetic Survey: ://www.ngs.noaa.gov/

5. Contact

Doug Bonoff, PLS

Section 4

Drilling Methods (DM)

STANDARD OPERATING PROCEDURES

DM-001 General Guidance on Determination of Appropriate Drilling Methods

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1. Objective

There are multiple drilling methods which can be employed based on the type of stratum (e.g. overburden or bedrock) and the end use of borehole. End uses include geotechnical investigation, subsurface soil sampling, and monitoring well installation or a combination thereof.

The following text describes different methods of drilling with considerations for their use to collect groundwater and/or subsurface soil samples. Profiles of subsurface conditions encountered and well installation details must be recorded on logs. Procedures for field documentation are provided in Section 4 - Field Documentation.

2. Hollow-Stem Augers (HSAs)

Borings can be installed in unconsolidated formations using solid-stem or hollow-stem augers (HSAs). The augers are advanced by rotation and the drill cuttings are brought to the surface by travelling up the outside of the auger flights in a screw-like manner. HSAs have the advantage of allowing the well to be installed inside the hollow stem of the auger, which prevents the borehole from collapsing. Upon reaching the planned well depth, the casing and screen are placed inside the HSAs and the flights are individually removed while the annular space around the well is filled with the filter pack and grout, as appropriate. Conversely, solid-stem augers must be completely removed from the borehole before well installation, which can lead to collapse of the borehole. For this reason, solid stem augers are seldom used for installation of monitor wells.

HSAs come in a variety of sizes and allow collection of soil samples utilizing split spoons or Shelby tubes. Samples are collected ahead of the augers for determining soil/sediment type, stratigraphy, depth to the water table, and for collecting soil samples for chemical analysis. During this process, the standard penetration test (SPT, ASTM Method D 1586) can also be performed. The HSA method also has an advantage over mud-rotary drilling techniques in that drilling mud is not used. Drilling mud can contaminate the soil samples and potentially reduce the yield of the wells.

A disadvantage of the method is that HSAs cannot be used to drill into competent bedrock or through large boulders. Also, "heaving or running sands" can be forced up inside the augers as a result of strong vertical groundwater gradients, which can hamper efforts to collect soil samples or complete well installation. Furthermore, the maximum depth achievable using HSAs, which is generally shallower than other methods, is dependent not only on the ability of the rig (e.g., horsepower, rig-torque, weight of augers etc.), but also the lithology of the material drilled.

3. Rotary Drilling

Rotary drilling methods include both direct rotary and reverse-circulation rotary. Direct rotary is more commonly used in environmental investigations, whereas reverse-circulation rotary is used in drilling large-diameter water supply wells. In direct rotary drilling the borehole is advanced by rotating the drill pipe (rods) and bit to produce a cutting action. The cuttings are removed from the borehole by continuous circulation of a drilling fluid. The fluid or "mud" is pumped down the inside of the drill pipe and is circulated back to the surface on the outside of the pipe. The fluid removes the drill cuttings from the borehole and cools and lubricates the bit. Mud used during direct rotary consists of additives (e.g., bentonite), water, or air.

Reverse-circulation rotary drilling is similar to direct rotary except the drill rigs are larger and the flow of the drilling fluid is reversed. The drilling fluid moves upward inside the drill pipes and circulates back to the borehole via settling pits. The drilling fluid returns to the borehole via gravity and moves downward in the annular space between the drill pipe and borehole wall. Drilling fluids for reverse-circulation rotary are generally water and any suspended particles picked up from the surrounding formations.

Mud-rotary methods can be used to drill in both unconsolidated and consolidated (bedrock) formations. In addition, drilling mud stabilizes the borehole and limits the potential for borehole collapse. Disadvantages of using the mud-rotary method include the difficulty in determining the depth to the water table, the potential for drilling mud to impact soil samples and dragging of contamination into deeper zones since the drill cuttings are re-circulated in the borehole. Wells installed using this method typically take longer to develop than wells installed using the HSA or air-rotary methods due to the invasion of mud filtrate into the formation.

In air-rotary drilling, compressed air is directed down the inside of the drill pipe. As in mud-rotary drilling, air removes the cuttings and lubricates the bit. However, since air has no viscosity, it cannot be used to stabilize a borehole therefore, casing must be advanced in unconsolidated formations to keep the borehole open. This is why air rotary methods are best suited for drilling in bedrock formations. The percussion-type air-rotary "hammer" bit provides the best penetration rate when drilling bedrock consisting of crystalline rock. However, when drilling above the water table, an air-rotary bit can grind the soil and bedrock to a fine powder which is blown out of the hole with air and which has the potential to be inhaled. Therefore, drilling above the water table using air-rotary methods requires the addition of potable water to the borehole for dust control. In addition, the air compressor should be of the oil-less variety, or have a filter to prevent any oil from entering the borehole.

A disadvantage of using rotary methods while drilling in unconsolidated formations is the requirement of pulling the drill pipe out of the hole each time a split-spoon soil sample is collected (and the SPT is performed). This adds up to considerable amounts of time when deep wells are being installed or when continuous split-spoon sampling is being performed. As stated above, split-spoons used to collect soil samples can become contaminated when they are advanced down a mud-filled borehole.

A special type of rotary drilling is bedrock coring, wherein a special core bit and barrel are used to retrieve relatively undisturbed core samples of the bedrock. Coring allows better characterization of bedrock lithology and other features including orientation of fractures and bedding planes, which can control contaminant migration. Core barrels can either be unoriented or oriented. An oriented core is scribed with respect to magnetic north. Although more expensive than collecting an unoriented core, this method gives the true orientation of the features encountered in the core.

Drilling fluids are generally air (air-rotary) or bentonite and/or water (mud-rotary). Water added to a borehole must be of potable quality. The source of the potable water used during the installation (and development) of monitor wells should be documented (e.g., in the Remedial Investigation Report).

Bentonite is high swelling clay with sodium montmorillonite as its primary clay mineral. Bentonite is added to water to increase the viscosity of the drilling fluid so that drill cuttings can be removed from the borehole more effectively. At the same time, the viscosity must be low enough to allow cuttings and coarse-grained particles to settle out once they are circulated out of the hole. Bentonite also adds weight to the drilling fluid, which helps to maintain borehole stability.

4. Sonic Drilling

The method involves driving a core barrel using vibration, rotation, and a downward force to collect soil samples. A sonic drill rig looks and operates very much like a conventional top-drive rotary or auger rig. The main difference is that a sonic drill rig has a specially designed, hydraulically powered drill head or oscillator, which generates adjustable high-frequency vibrational forces. The oscillator uses two eccentric, counter-rotating balance weights or rollers that are timed to direct 100 percent of the vibrational energy at 0 and 180 degrees. There is an air spring system in the drill head that insulates or separates the vibration from the drill rig itself. The sonic head is attached directly to the drill pipe or outer casing, sending the high-frequency vibrations down through the drill pipe to the bit.

A core barrel is advanced using vibration, rotation, and downward force to collect continuous soil cores up to 20 feet in length. The bit at the end of the core barrel contains carbide teeth allowing the core barrel to be advanced through most overburden, soft bedrock, and minor obstructions such as bricks and boulders. Once the core barrel has been advanced, a secondary or "over-ride" casing is advanced down to the same depth as the inner core barrel. The over-ride casing keeps the borehole from collapsing while the inner core barrel is removed. Once the core barrel is removed, the soil core is pushed out of the core barrel through the use of vibration and either air or water pressure. Soil core diameters are dependent on the size of core barrel used and range from 3 to 12 inches. The use of multiple over-ride casings of increasing diameter allows the borehole to be telescoped down through multiple confining units. The setup used in sonic drilling makes this drilling method amendable to collecting soil cores and installing wells in angled boreholes. With only the bottom of the inner and outer core barrel exposed to the aquifer at any given time, determining the location of the water table can be difficult.

While this drilling method has the capability of drilling through and providing samples of coarse gravels, boulders, and tight clays, these situations will result in slow drilling or advancement of the core barrel. The result is a hotter core barrel and a longer contact time between the core barrel and the encased soil core. The aforementioned conditions will increase the probability that the sonic method will raise the temperature of the soil core and facilitate VOC and SVOC loss.

The ability to quickly install deep borings and wells, while generating a large-diameter continuous soil core, makes this drilling technique invaluable when continuous soil sampling is needed to assess deep or complex geological situations. However, sonic drilling's high cost, relative to other drilling methods, may be prohibitive for small projects or shallow boreholes. The higher cost of the drilling method should be weighed against the cost savings incurred due to its faster drilling rate and high quality of the soil core produced.

5. GeoProbe®-Direct Push

The method involves hydraulically pushing hollow rods into the subsurface for the purpose of collecting soil and/or groundwater samples (e.g., Geoprobe®). The method can be used to collect discrete soil samples or install small-diameter wells used to collect groundwater samples.

Advantages of the direct-push method include the relatively quick collection of groundwater samples and, when used along with a mobile laboratory, collection of data in “real” time. The method allows for collection of multiple samples in a day with the potential for achieving contaminant delineation in one mobilization of the field equipment. The data can also be used to select locations of permanent monitor wells.

Disadvantages of the method include the fact that the data quality achieved is often suitable only for screening purposes. Direct-push methods typically result in very turbid samples since an oversize borehole is not produced and a filter pack is not used. Turbid samples can produce higher metal concentrations in groundwater samples since metals are typically adsorbed onto soil particles. Use of direct-push methods can also cause cross-contamination since contamination from shallow zones may be driven down to deeper zones. Due to the narrow diameter of the direct-push rods, samples are often collected with peristaltic pumps. When samples are collected for volatile organic compounds (VOCs) using peristaltic pumps, some of the volatiles may be lost due to the pressure drop produced by the suction lift. In such cases, the VOC data must be qualified accordingly. For this reason, use of the peristaltic pump for collecting groundwater samples for VOC analysis is not recommended and approval for its use should first be obtained from the project manager or geologist.

Another disadvantage of using direct-push technology for collecting groundwater samples is the potential to breech confining units. To prevent this, soil sampling using direct-push technology or conventional split-spoon sampling techniques should first be performed to identify the presence, depth and lateral extent of confining units. Pushing through confining units should be avoided if the presence of dense, non-aqueous-phase liquid (DNAPL) or very soluble compounds such as Methyl Tertiary Butyl Ether (MTBE) are suspected or the contaminant plume appears to be diving in the aquifer.

6. Contact

Gary Fuerstenberg

STANDARD OPERATING PROCEDURE

DM-002 Hollow-Stem Auger

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1. Objective

Describe standard operating procedures for drilling of overburden soil borings using hollow-stem augers.

2. Execution

- Confirm that the appropriate measures have been taken for clearance of potential subsurface utilities. The responsibility for clearance may vary, depending on the client.
- Inspect the drilling rig to make sure it is clean and that the down-hole equipment has been steam-cleaned or pressure-washed. Record observations in the field notebook (See SOP FD-001).
- Observe that the augers are vertical when the first section is advanced into the ground.
- Use a 140-lb hammer to drive the sampler, unless conditions necessitate using a 300-lb hammer (see SOPs SM-001, *Split-Spoon Sampling* and SM-0003, *Soil Classification,* for details). Count and record the number of blows per 6-inch increments, confirming blow counts with driller if necessary).
- Decontaminate the split-spoon sampler after each use (see *Equipment Decontamination,* SOP QA-001) or use another decontaminated split-spoon sampler.
- Ensure that the drillers advance the augers only after they have inserted the auger plug (to prevent soil from entering the augers while advancing to the next sample interval).
- Request that the drillers remove the auger cutting bit/plug and insert the split-spoon sampler into the interior of the augers. Measure the stick-up of the rods attached to the sampler to ensure that the nose of the spoon is in virgin soil below the augers.
- Watch for signs of a soil strata change at depth during drilling (i.e., change in blow counts, change in soil color, soil wetness, soil contamination, bouncing of the drill rig, etc.). If important to the investigation, stop drilling and collect a soil sample.
- If subsurface soil samples are being collected with split-spoon samplers, ensure that the drillers use a 30-inch drop of the 140-pound hammer. The number of blow-counts for each 0.5 foot penetration provides important geotechnical data.
- Repeat until the borehole has been drilled to the desired depth.
- If a monitoring well is not installed in the soil boring, fill the boring with either cement/bentonite grout or properly-tamped and hydrated bentonite. Check with Project Manager and/or the appropriate regulatory personnel before using drill cuttings to backfill the boring.

- If a monitoring well will be installed, refer to SOP DM-007.
- Complete boring log and, if necessary, well installation logs (SOP SM-003, *Soil Classification*).
- Record boring locations on a site map and in a field notebook sketch. If the boring location will not be surveyed, measure each location from on-site reference points and record the information in the field notebook so that the location can be plotted on site figures.

3. Limitations

- In areas of significant soil contamination, hollow-stem augers may cross-contaminate upper soil layers as contaminated cuttings move up the auger flights. The potential also exists for contaminated augers to carry contamination to deeper soil strata
- If significant unanticipated contamination is encountered during drilling, stop drilling to confer with the project manager and evaluate health and safety conditions. If the borehole is to be advanced below the contaminated strata, use telescoping techniques (see SOP DM-008 *Monitoring Well Telescoping Techniques*) to avoid cross-contaminating underlying geologic strata.
- When drilling below the groundwater table in fine to medium sands, the potential exists for the phenomenon of “running sands” or “blow in” to occur. Frequent measurements inside the hollow-stem augers after the drill bit/plug is removed will indicate if running sands are present. If sands start to flow into the auger, pour clean water into the augers and keep the augers filled during sampling.
- If necessary, arrange for the storage of contaminated soil cuttings and water in drums or other appropriate containers in a secure place at the site. Containers should be labeled.
- Plan the drilling program to drill borings from the least- to most-contaminated areas. Be prepared in advance and know where alternative drilling locations are in the event that problems are encountered at each planned soil boring location. Alternative locations will need to have utility clearance.
- Down-hole drilling equipment should be steam cleaned or pressure-washed between holes unless otherwise directed by the project manager.
- Record when standard operating procedures are deviated from. The drilling inspector should also record any detected odor from the boring and depth encountered.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90

Nielsen, D.M. (1993), “Correct Well Design Improves Monitoring,” Environmental Protection, July, pp. 38-49

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91

5. Attachments

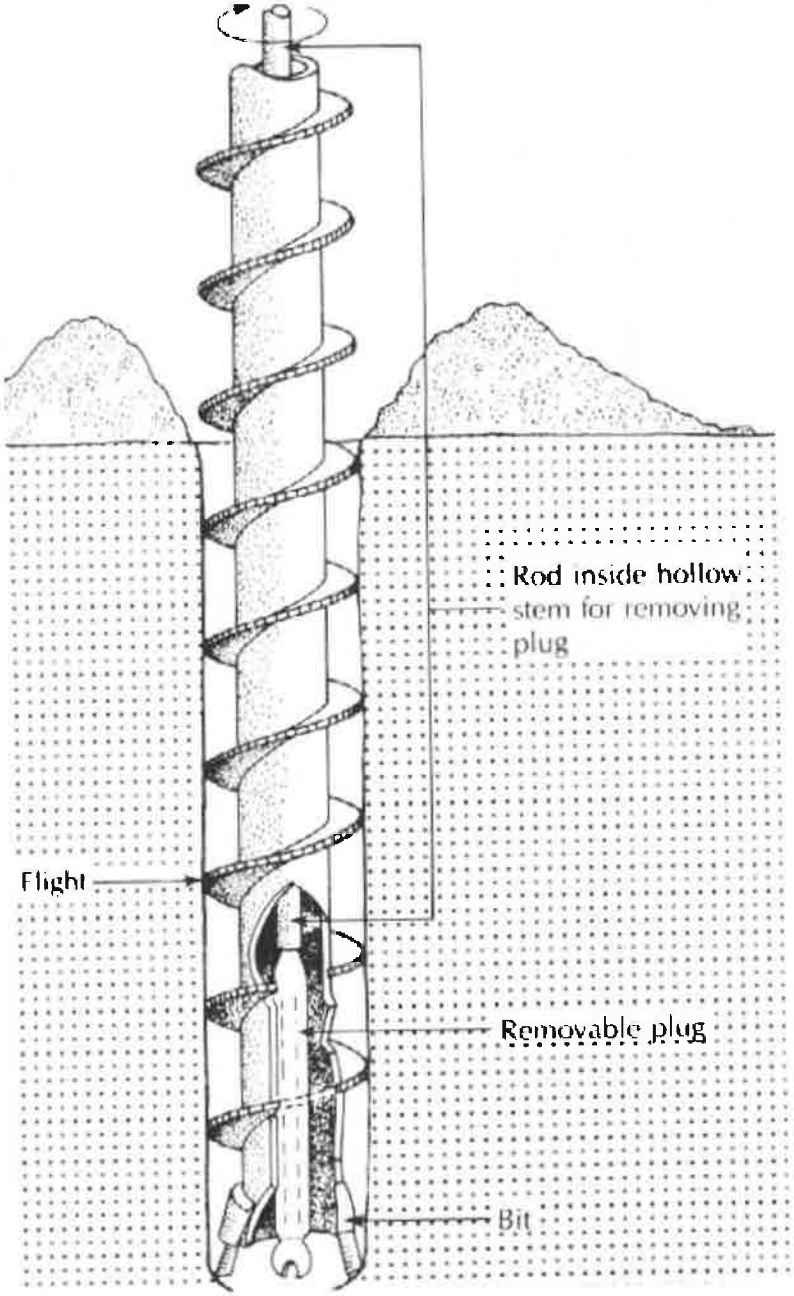
Attachment A – Hollow-Stem Auger

6. Contact

Gary Fuerstenberg
Cathy Johnson

SOP DM-002

Attachment A – Hollow Stem Auger



STANDARD OPERATING PROCEDURE

DM-003 Air Rotary Drilling with Casing

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1. Objective

Describe standard operating procedures (SOP) for drilling of soil borings using casing by either the rotary method or air method.

2. Execution

- Confirm that appropriate measures have been taken for clearance of potential subsurface utilities. The responsibility for clearance may vary, depending on the client.
- Inspect the drilling rig to make sure it is clean and that the down-hole equipment has been steam-cleaned or pressure-washed. Record condition of down-hole drilling equipment. Record all observations in the field notebook (See SOP FD-001).
- Confirm that the casing (i.e., the borehole) is vertical when the first section of casing is advanced into the ground.
- For all soil samples, use a 140-lb hammer to drive the sampler, unless conditions necessitate using a 300-lb hammer (see SOP SM-001 *Split-Spoon Sampling* and SOP SM-003 *Soil Classification*–for details). Count and record the number of blows per 6-inch increments, confirming blow counts with driller if necessary.
- Decontaminate the split-spoon sampler after each use (see SOP QA-001 *Equipment Decontamination).*
- Advance the casing with the drive hammer and periodically clean out cuttings using a pneumatic hammer. A water spray and shield may be used for dust control and to control rock chips.
- Potable water should be used as the drilling fluid. If subsurface soil is sufficiently permeable to require a thicker fluid, drilling mud may be used to increase fluid viscosity, with prior approval from the project manager.
- To continue advancing the boring, additional lengths of casing are added one at a time, repeating this sequence until the required depth is reached.
- If an obstruction is encountered, the driller should attempt to penetrate the obstruction with a pneumatic hammer.
- If a monitoring well is not installed in the soil boring, fill the boring with either cement/bentonite grout or properly-tamped and hydrated bentonite. Check with Project Manager before using drill cuttings to backfill the boring.
- If a monitoring well will be installed, follow SOP DM-007.

- If the boring location is not going to be surveyed, measure each location from on-site reference points in the field notebook so that it can be relocated and plotted on figures.

3. Limitations

- To advance the boring, it may be necessary to use casing to maintain air pressure. Additional lengths of casing are then added one at a time, repeating this sequence until the required depth is reached.
- If unanticipated contamination is encountered, stop drilling to confer with the project manager and evaluate health and safety conditions.
- If the borehole is to be advanced below the contaminated strata, use telescoping techniques (see DM-008 Monitoring Well Telescoping *Techniques)* to avoid cross-contaminating underlying geologic strata.
- When drilling below the groundwater table in fine to medium sands, the potential exists for the phenomenon of "running sands" to occur. A head should be kept on the borehole at all times.
- Arrange for the storage of contaminated soil cuttings and water in drums or other appropriate containers in a secure place at the site (see SOP SC-003, *Investigation Derived Waste Management*).
- Plan the drilling program to drill borings from the least to most contaminated areas. Be prepared in advance and know where alternative drilling locations are in the event that problems are encountered at each planned soil boring location. These locations must also have been cleared by the state utility service prior to drilling.
- Document variations from standard operating procedures.

4. References

ASTM D 5782 – Guide for Use of Direct Air Rotary Drilling for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices

5. Contact

Gary Fuerstenberg
Cathy Johnson

STANDARD OPERATING PROCEDURE

DM-004 Sonic Drilling

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1. Objective

Describe common sonic drilling procedures.

Prior to drilling confirm that utility clearance has been completed and that the drilling rig has been appropriately decontaminated.

2. Execution

- Collect soil cores in runs of 5 to 10 feet. Some sonic rigs can collect a 20 foot sample, but the process generates a significant amount of heat that may degrade sample quality.
- Classify and sample the soil located within the liner.
- Excess soil should be placed in a 55-gallon drum for disposal.
- The core barrel should be cleaned with tap water following each use.
- The core barrel is then advanced within the isolation casing to collect the next soil core interval.
- Add water between the inner core barrel and the outer override casing. This will reduce friction between the casings and adsorb heat.
- Maximize drilling advance rate. The faster the core barrel is advanced, the less likely the core barrel will heat up. Drilling with a 3-inch diameter core barrel and a 5-inch diameter override casing, instead of the standard 4-inch core barrel and 6-inch over-ride casing, may increase advance rates and reduce the potential for soil core heating.
- If a significant decrease in drilling advance rate is observed, stop drilling and remove soil that has accumulated in the core barrel. Resume drilling through the resistant material (gravel, boulder, hard clay, etc.). When the resistant material has been penetrated and the drilling advance rate increases, stop drilling and remove what material has accumulated in the core barrel.
- Wash down the core barrel with cool water to cool the core barrel and associated casing, and resume drilling.
- If a well is to be installed in the borehole, the sandpack and grout are placed as the core-barrel and over-ride casing(s) are selectively vibrated out of the ground. The vibratory action should facilitate settlement of the sandpack and grout. Upon completion, no casing is left in the ground other than the well casing and screen.

3. Limitations

- Disturbance of the soil core is most likely to occur during removal of the soil core from the core barrel. The soil cores are usually vibrated out of the core barrel into plastic bags approximately 5 feet in length. As the plastic bags are a little larger than the soil core itself, fragmentation of the soil core may occur as the core is extruded into the bag or while the bagged core is being moved in an unsupported manner. Soil conditions that are prone to disturbance include wet or dry zones that contain little or no fines, and well graded sands that contain significant volumes of water.

- If integrity of the soil core is of concern, the following procedures should be implemented:
  - Measures should be taken to ensure that the core, from the time it is extruded from the core barrel, is rigidly supported through the use of some type of cradle or carrying device.
  - The core should not be removed from its cradle until all sampling of the core has been completed. Acrylic liners are available for some core sizes and can be used to hold the core together upon removal from the core barrel.
  - If the soil is to be sampled for volatile organic compounds (VOCs), acrylic liners must be used.
  - Sampling of the soil core for VOCs or semi-volatile organic compounds (SVOCs) must be approved on a case by case basis. Proposals for VOC or SVOC soil core sampling must include provisions to minimize core fragmentation and heat generation, such as:
    - Acetate liners in the core barrel so that the soil core does not have to be extruded out of the core barrel.
    - Limit the length of soil core generated during a given downhole run.
    - Implement practices to reduce the residence time of the soil core in the core barrel.
- For the analysis of SVOCs, the use of the acetate liners is not required.
- The large diameter of the core barrel enables ground water sampling equipment to be placed inside the core barrel so that discrete depth groundwater samples can be collected during borehole advancement.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90

5. Contact

Melissa Felter

STANDARD OPERATING PROCEDURE

DM-005 Drive and Wash

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the drilling of overburden soil borings for environmental investigations. This SOP addresses the use of casing with either the drive-and-wash or spin method to drill the soil boring.

2. Execution

- Contact the owner to determine the locations of underground utilities/obstructions. Verify with the contractor that the utility clearance service in the particular state has been contacted. Ask subcontractor to provide a utility clearance authorization number and record the number in the fieldbook (See SOP PM-001 Utility Markout).
- Steam cleaning may be performed by drillers either on site or prior to site mobilization. If performed prior to site mobilization, observe the drilling rig to make sure it is clean and that the down-hole equipment has been steam-cleaned. Check that the steam-cleaner is working properly (i.e., that steam is being produced). Measure and record lengths of all down-hole drilling equipment, including the drive shoes and miscellaneous rods and attachments. Record all observations and measurements in the field notebook (See SOP FD-001).
- If a surface-soil sample is desired, collect this sample with a split-spoon sampler prior to setting the casing up over the borehole. For all soil samples, use a 140-lb hammer to drive the sampler, unless conditions necessitate using a 300-lb hammer (see SOP SM-001 *Split-Spoon Sampling* and SOP SM-003 *Soil Classification* ~~-~~for details). Count and record the number of blow counts per 6-inch increments, confirming blow counts with driller if necessary.
- Decontaminate the split-spoon sampler after each use (see SOP QA-001 *Equipment Decontamination).*
- Instruct drillers to drill the borehole, either by pounding or spinning the casing, to the top of the next sampling interval.
- The wash water should be carefully observed for indications of a soil strata change with depth (i.e., change in soil color and particle size). Record the changes and depth of changes on the boring log. Make sure that the soils in the borehole have been fully removed by the rotary bit before sampling by measuring the depth of the borehole, or by measuring the length of stick-up of drill rods to verify that the driller has sufficiently cleaned out the boring.
- Monitor the return wash water and record water losses from around the borehole onto the ground surface.

- Follow steps 4-8 until the borehole has been drilled to the desired depth. If refusal is encountered, a 5-foot core of the rock (at a minimum) may be required to confirm the bedrock surface (see site-specific field sampling plan).
- If a monitoring well is not installed in the soil boring, fill the boring with either cement/bentonite grout, properly-tamped and hydrated bentonite, or other specified materials as indicated in the site-specific field sampling plan. Backfilling of the environmental borehole should not be completed with drill cuttings (see site-specific field plan for deviations).
- Complete boring log and, if necessary, well installation logs (see SM-006 *Rock Coring Log* SOP).
- Record boring locations on a site map. Measure each location from on-site reference points and record the information in the field book.

3. Limitations

- At all times, follow safety procedures as defined in the site-specific Health and & Safety Plan.
- When the first 5-foot section of casing is pounded into the ground, make sure that the casing (i.e., the borehole) is vertical.
- If significant unanticipated contamination is encountered during drilling, stop drilling to confer with the project manager and evaluate health and safety conditions.
- If the borehole is to be advanced below the contaminated strata, use telescoping techniques (see DM-008 Monitoring Well Telescoping *Techniques)* to avoid cross-contaminating underlying geologic strata.
- While drilling through contaminated strata, do not recirculate the drilling water. Be prepared to containerize the drilling water in these situations.
- When drilling below the groundwater table in fine to medium sands, the potential exists for the phenomenon of “running sands” to occur. To minimize the problem, remove the drill rods with the rotary bit very slowly while adding potable water to the casing. A head should be kept on the borehole at all times.
- Arrange for the storage of contaminated soil cuttings and water in drums or other appropriate containers in a secure place at the site (see SOP SC-003, *Investigation Derived Waste Management*).
- Plan the drilling program to drill borings from the least to most contaminated areas. Be prepared in advance and know where alternative drilling locations are in the event that problems are encountered at each planned soil boring location. These locations must also have been cleared by the state utility service prior to drilling.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91.

ASTM Standard D1586, Standard Method for Penetration Test and Split Barrel Sampling of Soils

5. Contact

Gary Fuerstenberg

STANDARD OPERATING PROCEDURE

DM-006 Geoprobe® Direct Push Boring

1. Objective

Describe standard operating procedures (SOP) for drilling of overburden soil borings using Geoprobe® and MacroCore® technologies.

2. Execution

- Confirm that appropriate measures have been taken for clearance of potential subsurface utilities. The responsibility for clearance may vary, depending on the client.
- Inspect the drilling rig to make sure it is clean and that the down-hole equipment has been decontaminated (QA-001). Record condition of all down-hole drilling equipment.
- Make sure the sampler is fitted with a piston rod assembly to block the sample tube until the desired subsurface sample interval is attained. Upon reaching the target sample depth, the piston tip will be released and the discrete sampler device is then advanced to collect the representative sample. This reduces the volume of slough that is collected.
- When the sampler is brought to the ground surface, it should be opened immediately, and the length of recovery should be measured and recorded.
- Log the soil sample using USCS procedures (SOP SM-003). Collect analytical samples if necessary (SOP SM-001).
- Decontaminate the cutting shoe if necessary (SOP QA-001 Equipment Decontamination) and have driller reassemble the parts with a new liner.
- Repeat the procedure described above until refusal or the boring is terminated.
- Periodically verify that depths cited by drillers are accurate.

3. Limitations

- If significant unanticipated contamination is encountered during drilling, stop drilling to confer with the project manager and re-evaluate health and safety conditions.
- Arrange for the storage of contaminated soil cuttings and water in drums or other appropriate containers in a secure place at the site (see SOP SC-003, *Investigation Derived Waste Management*).
- If possible, plan the drilling program to drill borings from the least to most contaminated areas. Be prepared in advance and know where alternative drilling locations are in the event that problems are encountered at soil boring locations. These locations must also have been cleared by the state or local utility service prior to drilling.

4. References

ASTM D6001-05 Guide for Direct Push Water Sampling for Geoenvironmental Investigations, April 2005

Geoprobe Systems, "Geoprobe MacroCore MC-5 1.25-inch Light Weight Center Rod Soil Sample System SOP", Technical Bulletin No. MK 3139, November 2006

5. Attachments

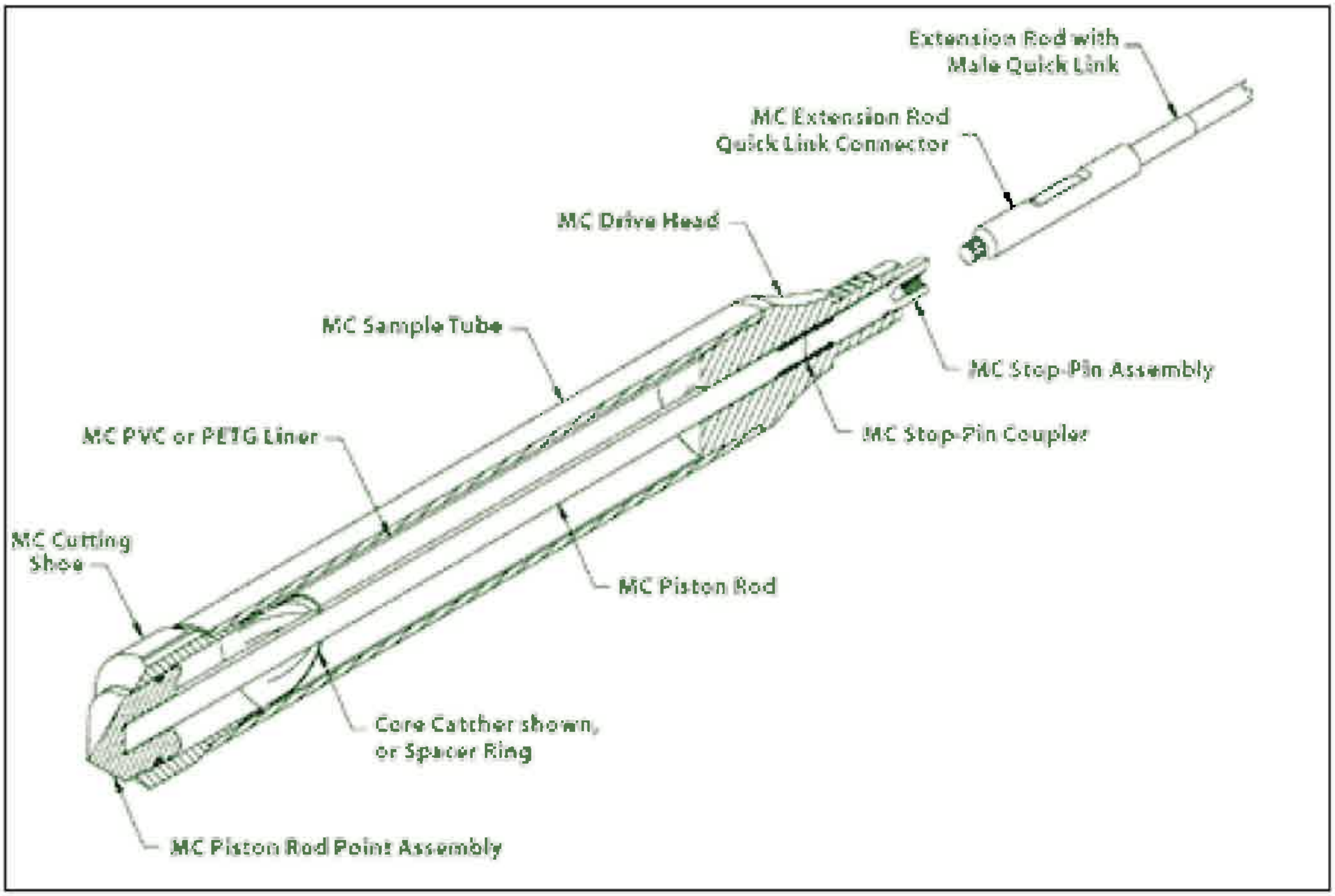
Attachment A – Geoprobe® with Macrocore® Sampler Assembly

6. Contact

Melissa Felter
Cathy Johnson

SOP DM-006

Attachment A – GeoProbe® with Macrocore® Sampler Assembly



Above: Diagram of a Macrocore® sampler

Right: A track-mounted GeoProbe ® Rig

GEI Consultants

STANDARD OPERATING PROCEDURE

DM-007 Monitoring Well Construction and Installation

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1. Objective

Describe installation procedures for overburden monitoring wells screened across or below the groundwater table.

Well dimensions (well diameter, screen length, and screen slot-diameters) will be specified in the Work Plan. This SOP assumes the monitoring wells will be constructed of flush-joint PVC pipe and the screened section will have factory-slotted openings.

2. Execution

Attachment A provides a diagram of typical shallow, intermediate, and deep groundwater monitoring well construction detail. A Groundwater Monitoring Well Installation Log is in Attachment B.

- Measure and record the depth of the completed soil boring before beginning the well installation.
- If possible, measure the depth to groundwater in the borehole over a 10 to 15 minute period to ensure that the groundwater elevation has approximately stabilized. Compare the saturated soil depth estimated from split-spoon samples to the measured water level in the borehole. If drilling water has been used during boring advancement, pump the water out of the borehole to the static water depth, based on examination of the soil samples, and monitor the recovery of groundwater until the level has stabilized.
- If it is not possible to accurately measure the depth to groundwater in the borehole due to low permeability in the formation, use the saturated soil depth observed in the collected samples or measured water depth in a nearby existing monitoring well to estimate the depth to water in the borehole.
- For shallow monitoring wells, select the monitoring well screen and riser lengths so that the slotted section of the screen intersects the groundwater table. Screen lengths of 15 feet or less are preferred and 10 foot screens are most common. If the water table is seasonally high or low or if the well is in a location where the water table is likely to be tidally influenced, appropriately place the screened section to allow for the screen to intersect likely future water tables.
- For intermediate or deep wells screened entirely below the water table, select the monitoring well screen and riser lengths as described in the Work Plan. Screen lengths of 10 feet or less are preferred.
- If the borehole is deeper than the desired well depth or the bottom of the well is close to a change in soil strata, then fill the base of the borehole with bentonite. Keep in mind that bentonite swells when hydrated, and that filter

sand should be placed at the bottom of the borehole above the bentonite before installing the well.

- Prevent well materials from contacting foreign substances during installation. Precautions may include requiring the driller to wear clean gloves while handling well materials and requiring that well materials not be placed onto the ground or pavement without a protective barrier such as polyethylene sheeting being present
- Confirm that the driller installs a minimum one-inch sump with a bottom cap to the bottom of the well screen. See the Work Plan for locations that may require larger sumps.
- Monitoring wells can be constructed of either 1, 1.5, 2 or 4 inch inner diameter (ID) Schedule 40 threaded flush-jointed PVC. Refer to the work plan for the site-specific requirements. Flush-threaded well materials should be used. Do not allow the driller to use glues, as they typically contain solvents that could affect on groundwater quality.
- Stainless steel well materials may be used if required in the Work Plan. Select slot size based on grain size of the formation and on requirements in the Work Plan.
- Confirm that the driller places at least 12 inches of clean uniformly graded medium quartz filter sand pack into the base of the borehole, if required in the Work Plan.
- The driller should remove the drilling casing/augers from the borehole slowly, at a maximum of 2-foot intervals, at the same time that filter sand is added. The drillers should take frequent measurements of the depth to sand.
- Confirm that the driller has added adequate sand to surround the area around the slotted section. The filter sand should extend at least 2 feet above the top of the slotted section.
- The driller should place a bentonite seal above the filter pack. If the seal is above the water table, use at least 5-gallons of potable water to hydrate the bentonite before grouting the remaining annular space, or otherwise backfilling the remaining annular space as discussed with the Project Manager. Tamp seal. It should extend 1 to 2 feet above the filter sand.
- If required by the Work Plan, the driller should use bentonite-cement and grout the annular space from the top of the bentonite seal to the ground surface. Bentonite cement grout should be placed using tremie methods. Grout should be mixed in approximately the following proportions: 7.5 gallons water to one 94-lb bag of cement to 2-4 lbs of pulverized bentonite. The grout must be mixed using a pump (such as one on the rig) to ensure proper mixing.
- The drillers should cut the monitoring well riser at an angle or make "V"-notch in the riser pipe as a benchmark for surveying and groundwater measurements. The driller should cut the well riser so that the top of the well will be approximately 3 inches below the top of protective casing. The top of

the riser should be close enough to the top of the surface casing to allow reading of depth markings on a water level indicator tape.

- The protective surface casing is either a flush-mounted roadbox or a steel "stick up" pipe. The base of either type of casing should extend at least 1 foot into the grout below the ground surface (below the frost line) whenever possible.
- The protective casing should be set by placing cement in the annular space between the protective casing and the borehole up to the ground surface. If possible, the driller should slope the cement radially away from the protective casing at the ground surface to promote surface water runoff.
- In areas of high traffic or areas of parking lots and/or roadways where plowing occurs, set the roadbox flush with the ground surface to avoid damage to the well.
- If the well is installed in a high-traffic area and is completed with a steel "stick up" pipe, additional protection such as steel pole bumpers around the steel "stick up" pipe may be necessary.
- If possible a locking cap should be placed on the steel "stick up" pipe. If the surface casing is flush mounted, a locking expansion plug should be placed, if possible, inside the top of the well riser pipe.
- All well locations should be photodocumented in accordance with SOP FD-004 Photodocumentation.
- Label the outside of the protective well casing with a paint pen. If the well is not going to be surveyed, measure the location to nearby landmarks so that the well may be located in the future and plotted on figures. Make sure to enter this information in the field notebook). If possible, place a brightly colored stake or other identifier adjacent to the well.
- Develop the well (see SOP DM-009, *Monitoring Well Development*).

3. Limitations

- Do not screen across different hydrostratigraphic units (for example, outwash sands, confining layers or till) unless specified in the Work Plan or approved by the Project Manager.

- If the formation is composed of a material that is uniformly coarser than the filter sand, the grain size of the filter sand should be increased. Consideration should also be given to changing the slot size on the well screen. Differences in average grain size should generally not be greater than a factor of two to four times.

- Do not use drill cuttings to backfill during monitoring well installation unless specified by the work plan or project manager.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91.

5. Attachments

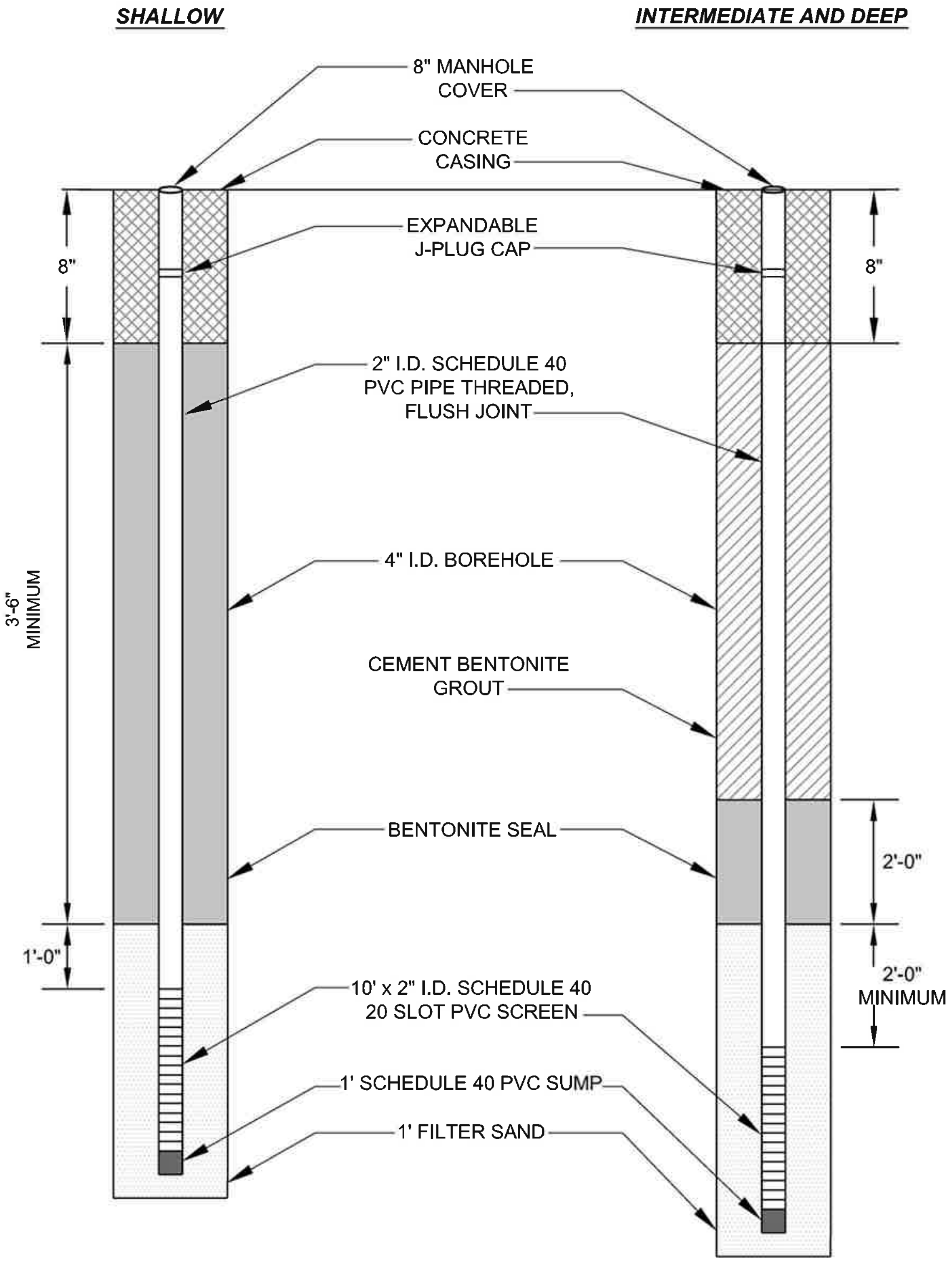
Attachment A – Typical Shallow, Intermediate, and Deep Groundwater Monitoring Well Construction Detail

Attachment B – Groundwater Monitoring Well Installation Log

6. Contact

David Terry
Anne Leifer

Attachment A - Well Detail



NOT TO SCALE

GEI Consultants

TYPICAL SHALLOW, INTERMEDIATE AND DEEP GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

June 2008

I:\GEI\SOPs\ Well Detail.dwg \Jun 10, 2008

Attachment B - Groundwater Monitoring Well Installation Log

Groundwater Well Installation Log

Well ID

Project

City / Town

Client

Contractor

Driller **GEI Rep.**

GEI Proj. No.

Location

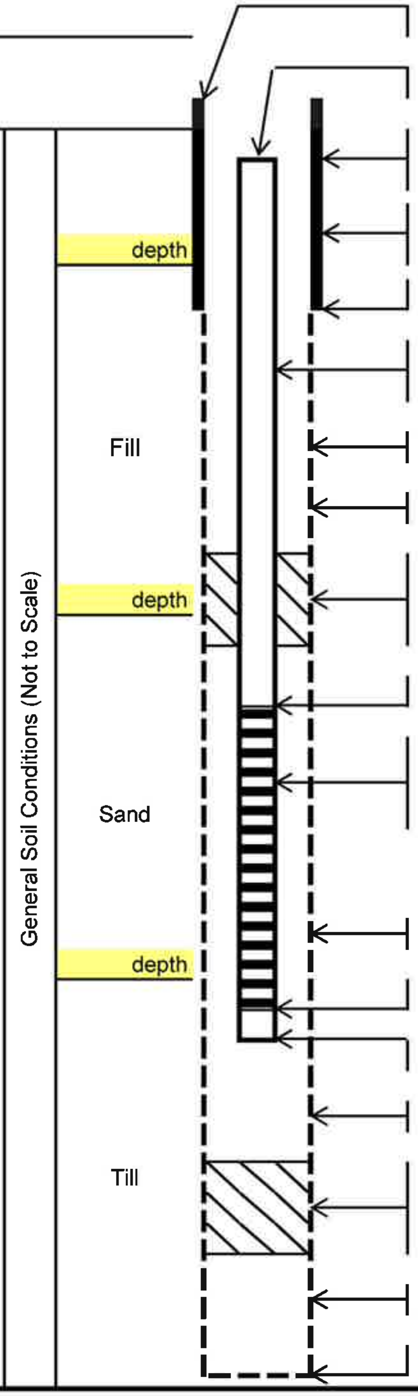
N

E

Install Date

Survey Datum:

Ground Elevation:



Length of Surface Casing above Ground

Dist. Top of Surf. Casing to Top of Riser Pipe

Type and Thickness of Seal around Surface Casing

ID of Surface Casing

Type of Surface Casing

Depth Bottom of Surface Casing

ID and OD of Riser Pipe

Type of Riser Pipe

Type of Backfill around Riser Pipe

Diameter of Borehole

Depth Top of Seal

Type of Seal

Depth Bottom of Seal

Depth Top of Screened Section

Type of Screen

Description of Screen Openings

ID and OD of Screened Section

Type of Filter Material

Depth Bottom of Screened Section

Depth Bottom of Silt Trap

Depth Bottom of Filter Material

Depth Top of Seal

Type of Seal

Depth Bottom of Seal

Type of Backfill below Filter Material

Bottom of Borehole

Date	Time	Distance to ▼ below top of riser pipe

Notes:

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STANDARD OPERATING PROCEDURE

DM-008 Telescoped Drilling

1. Objective

Describe telescoped drilling used to prevent the connection of two stratigraphic layers during boring advancement and/or monitoring well installation. This type of drilling is commonly used to prevent higher density contaminants (such as in coal tar or chlorinated solvents) from migrating downward in a boring.

Telescoped drilling is used with air rotary drilling (SOP DM-003) and drive-and-wash drilling (SOP DM-005). Refer to these SOPs for procedures to be performed prior to installing casing.

2. Execution

- Confirm that drilling tools have been appropriately decontaminated.
- Drill or core at least four feet into the stratigraphic unit (bedrock, till, etc.) to confirm the unit and provide a "socket" into which permanent casing can be grouted.
- The socket diameter should be at least two inches larger that the casing to be installed.
- The casing that will be installed should be large enough to allow smaller diameter drilling tools inside it to advance deeper, without the possibility of cross-contamination or hydraulic connection between the shallower and deeper units. For example, a six-inch casing is large enough for use of 4-inch tools inside it.
- Freshly mixed grout is required to set the large-diameter casing into the unit to be isolated. Depending on application, a mixture of Portland cement and bentonite meets most grouting requirements. For proper consistency, use no more than 6 gallons of water per 94-pound sack of cement. Add a few pounds of bentonite or hydrated lime per sack of cement for better flow.
- The driller should use a tremie pipe to deliver grouting outside the casing. Follow these steps to complete grouting using this method:
    i. Lower the casing to the bottom of the borehole. Make sure that the lower end of the casing is tightly seated at the bottom.
    ii. Mix a sufficient quantity of grout and pump it through the tremie pipe. As the grout is placed, lift the tremie pipe slowly, but keep the lower end submerged in the grout.
    iii. Fill the casing with water as the grout is placed to balance the fluid pressure inside and outside the casing. Doing so prevents grout from leaking under the bottom of the casing.

iv. Allow the grout to set for a minimum of 24 hours. Some regulatory agencies require 48 hours.
v. Using smaller diameter drilling tools, advance through the existing casing into the underlying unit to continue investigation. Install additional casing or PVC into the unit, or leave it as an open borehole.

3. Limitations

- If dense non-aqueous phase liquid (DNAPL) and/or dissolved contamination is suspected in the shallow (weathered) bedrock, then installation of casing in the rock may not be wise. It could hide the DNAPL from detection and/or result in cross-contamination of deeper rock. A shallow bedrock well may be called for to characterize the impacts. Consult with the Project Manager.
- Other casing installation methods, such as pressure-grouting may be more appropriate. Consult with the Project Manager.

4. References

Environmental Protection Agency, Region 4, "Environmental Investigation Standard Operating Procedures and Quality Assurance Manual, Chapter 6 – Design and Installation of Monitoring Wells," November 2001.

5. Contact

Gary Fuerstenburg
Catherine Johnson

STANDARD OPERATING PROCEDURE

DM-009 Monitoring Well Development

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1. Objective

Describe standard procedures to remove fluids from monitoring wells (introduced during drilling) and maximize the movement of groundwater into the well by removing fine particles in the well and sand pack around the screen.

2. Execution

To prevent cross contamination between monitoring wells, use dedicated equipment and/or appropriately decontaminated equipment to perform monitoring well development. See SOP QA-001 Equipment Decontamination and the Work Plan for more information.

For deep or large diameter monitoring wells, it may be necessary to use a re-usable pump system, such as a Grundfos pump, to develop monitoring wells.

- Calculate the volume of water in the monitoring well (one well volume) using the following table:

Well diameter (inches)	Volume (gal/ft)
1	0.04
1.5	0.09
2	0.16
3	0.36
4	0.65
6	1.50

  The equation used to establish these volumes is presented in Section 4.

- Calculate or estimate the amount of water introduced to the borehole during drilling. At a minimum, this is the amount of water that should be removed during development. Removing less water than was introduced and allowing additional time for the surrounding formation to clear of injected drilling fluids may be considered as an alternative if the volume of introduced water was large.

- Record the volume of water purged in the field notebook or on the Monitoring Well Sampling Form (Attachment A).

- Collect a sample of water from the monitoring well with the selected submersible pump (e.g. 12-volt whale pump or Grundfos pump), a bailer, or a

Waterra system. Record the physical properties (color, turbidity, odors, etc.) of the sample.

- The volume of water that should be removed will depend on the work plan, local regulatory guidance, and/or the volume of water that was introduced during drilling and well installation. Typical guidance for the removal volume includes:

    - Ten well volumes.
    - The volume of fluid added during drilling.
    - The volume required to remove enough suspended particles so that the turbidity of the water is less than 50 nephelometric turbidity units.

If needed, pump the ground water into a 5-gallon pail so that the volumetric flow rate and total water volume from the pump or bailer can be calculated.

Measure the groundwater level in the well during development to assess if the pumping rate is sufficient to create a drawdown in the well.

Observe the groundwater every few well volumes during the pumping and record the physical properties (color and turbidity).

If required by the Work Plan, conduct surging in the monitoring well. See the Work Plan for the method of well surging to be used. If surging is necessary, do so only after initial pumping at the well has occurred and fine sediments have been removed.

Slowly move the surge block up and down in the well. Periodically remove the surge block and purge the groundwater until it is relatively clear again. Start at a slow pace and progress to a faster surging action through time.

3. Limitations

Always remove groundwater with fine particles from the well before surging. The fine particles may be forced into the well screen by the surging action. They may also damage the pump.

If the ground water in the monitoring well is contaminated, the water removed during well development may need to be placed in a properly-labeled drum and disposed of in accordance with local, state, and federal regulations (see SC-003 Investigation Derived Waste).

If the soils around the well screen are composed of fine-grained silts and clays, over-pumping and mechanical surging is not recommended since these more vigorous techniques can cause mixing of the fines into the filter pack. To develop these wells, use of a bailer is recommended.

There are occasions when the turbidity of groundwater cannot be meaningfully reduced. On these occasions, a minimum of ten volumes should be removed, and the Project manager should be consulted.

Sampling of groundwater should generally not occur within one week after development. In some regions or regulatory jurisdictions, a minimum of two weeks may be required before sampling. If no water was introduced to the formation during drilling, this waiting period may be shortened if required by the project. See the Work Plan for additional information.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

"The Methods & Mechanics of Well Development, Part 2 of 5," National Drillers Buyers Guide, March 1993, p. 17.

Massachusetts Department of Environmental Protection, "WSC-310-91Standard References for Monitoring Wells, Section 4.5 Decommissioning of Monitoring Wells", January 1991

U. S. EPA Environmental Response Team Standard Operating Procedure SOP: 2044 ," Monitor Well Development" REV: 0.1, 10/23/01

5. Attachments

Attachment A - Monitoring Well Sampling Form

6. Contact

Gary Fuerstenberg
Anne Leifer

GEI Consultants

MONITORING WELL SAMPLING RECORD

PID Reading ______________ Job Name ______________________

Job Number ______________ By ______________ Date __________

Location ______________ Measurement Datum ________________

Well Number ______________

Pre-Development Information Time (start) ________________

Water Level ______________ Total Depth of Well ________________

One Purge Vol ______________ Three Well Volume ________________

Water Characteristics

Color ______________ _____ Clear ____ Cloudy

Odor ____ None ____ Weak _____ Moderate ____ Strong

Any films or immiscible material ______________________________

Volume (gal)	Time	pH	Temp (°C)	Spec. Conductance (µS/cm)	Turbidity (NTU)	DO Conc. (mg/L)	ORP (mV)	TDS

Total Volume Removed (gal) __________ pH __________

Temperature (°C) __________ Specific Conductance (µS/cm) __________

DO Concentration (mg/L) __________ ORP (mV) __________

TDS __________

Post Development Information Time (Finished) __________

Water Level __________ Total Depth of Well __________

Approximate Volume Removed (gal) ______________________

Water Characteristics

Color ______________ ____ Clear ____ Cloudy

Odor ____ None ____ Weak ____ Moderate ____ Strong

Any films or immiscible material ______________________________

Comments

STANDARD OPERATING PROCEDURE

DM-010 General Guidance on Monitoring Well Abandonment

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1. Objective

Describe methods to abandon a monitoring well.

The goal of monitoring well abandonment is to seal the borehole so it cannot act as a conduit for movement of contaminants or liquids from the ground surface to the water table or between aquifers.

General procedures for well abandonment are provided below but do not supersede state or local regulations. Make sure all well abandonment procedures adhere to appropriate regulations.

2. Execution

The following methods for abandoning unconsolidated (overburden) and consolidated (bedrock) monitoring wells should be performed by a licensed drilling contractor, if required by law or regulatory authorities. The following listed methods are general guidance for abandoning monitoring wells. The Work Plan and state and local requirements should be reviewed for additional requirements.

2.1 Unconsolidated (overburden) Monitoring Wells

Unconsolidated (overburden) monitoring wells should be abandoned in the following manner, see the Work Plan for additional requirements:

- Remove the protective casing and concrete pad.
- If possible, overdrill the monitoring well casing and sand pack 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.
- If possible, remove the monitoring well riser, sand pack, bentonite seals and grout.
- Once the well materials have been removed, add cement/bentonite grout using tremie methods starting at from the bottom of the borehole as the augers or casing are removed.
- If the well materials cannot be removed by overdrilling, the riser should be cut off at a depth of between two and five feet below the ground surface and the remaining well materials may be filled with grout using tremie methods. The grout mixture will be as specified for the well installation (see SOP DM-001 General Guidance on Determination of Appropriate Drilling Methods)
- Add grout to the point where the riser was cut off or to a depth of approximately two feet below the ground surface. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

2.2 Consolidated (bedrock) Monitoring Wells

Consolidated (bedrock) monitoring wells or open holes will be abandoned in the following manner. See the Work Plan for additional requirements:

- Remove the protective casing and concrete pad;
- Remove the monitoring well materials from the hole. If the materials cannot be removed, cut off the well riser between two feet to five feet below grade. If feasible, cutting off the riser at five feet is optimal.
- Add cement/bentonite grout via tremie methods from the bottom of the well up to the ground surface. The grout mixture should be as specified for the well installation SOP DM-001 General Guidance on Determination of Appropriate Drilling Methods
- Add grout to the point where the riser was cut off or to a depth of approximately 2 feet below ground surface. From that point up to ground surface, backfill with native soil material surrounding the boring/well.

3. References

Environmental Protection Agency, Region 4, "Environmental Investigation Standard Operating Procedures and Quality Assurance Manual, Chapter 6 – Design and Installation of Monitoring Wells," November 2001.

Massachusetts Department of Environmental Protection, "313 CMR 3.00, Registration of Well Drillers and Filing of Well Completion Reports".

Massachusetts Department of Environmental Protection, "Standard References for Monitoring Wells, Section 4.6 Decommissioning of Monitoring Wells", January 1991

4. Contact

Gary Fuerstenberg
Anne Leifer

Section 5

Sample Collection and Field Screening (SC)

STANDARD OPERATING PROCEDURE

SC-001 Environmental Sample Types and Sampling Strategies

1. Objective

Describe types of samples and strategic approaches to sample locations.

Refer to Attachment A for guidance on compatible sampling materials.

2. Sample Types

Grab Samples

A grab (or discrete) sample is a single aliquot (part of the sampled media) collected from a single location at a specific time.

Surface soil samples are typically "grab" samples. Volatile organic samples are always grab samples because the least amount of sample disturbance is necessary.

Composite Samples

Composite samples are non-discrete samples composed of more than one aliquot collected from different sampling locations and/or at different points in time. Analysis of composite samples produces an average value.

Composite samples are frequently collected to characterize waste soil that has been stockpiled for eventual disposal. Several grab samples are collected from the stockpile and are blended together into a single sample.

Screening Samples

Screening samples may be grab or composite in nature. However, they offer potential advantages such as rapid results and low cost. The trade-off is that they may only provide results within a range and/or they may have elevated detection limits. Screening samples are most often used to evaluate presence/absence and/or indications of the potential magnitude of impacts.

3. Sampling Strategies

Generally, there are three sampling strategies: random, systematic, and judgmental sampling.

- Random sampling involves collection of samples in a non-systematic fashion from the entire site or a specific portion of a site.
- Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established.
- Judgmental sampling is the collection of all other samples. This sampling might be from areas most likely to be contaminated, areas most likely to be clean, or areas where information is lacking.

Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

4. Attachments

Attachment A - General Guidelines for selecting equipment

5. Contacts

Jerry Zak
Ryan Hoffman

General Guidelines for selecting equipment on the basis of construction material and target analyte(s)

[✔, generally appropriate for use shown; Si, silica; Cr, chromium; Ni, nickel; Fe, iron; Mn, manganese; Mo, molybdenum; CFC, chlorofluorocarbon; B, boron]

Construction material for sampling equipment		**Target analyte(s)**	
Material	**Description**	**Inorganic**	**Organic**
		Plastics[1]	
Fluorocarbon ploymers[2] (other varies available for differing applications)	Chemically inert for most analytes	✔ (potential source of fluoride)	✔ (Sorption of some organics)
Polypropylene	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polypropylene (linear)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polyvinyl chloride (PVC)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Silicone	Very porous. Relatively inert for most inorganic analytes	✔ (potential source of Si)	**Do not use**
		Metals	
Stainless steel 316 (SS 316)	SS-316-metal having the greatest corrosion resistance. Comes in various grades. Used for submersible pump casing.	✔ (Potential source of Cr, Ni, Fe, and possible Mn and Mo) **Do not use** for surface water unless encasted in plastic.	✔ Do not use if corroded[3]
Stainless steel 304	Similar to SS-316, but less corrosion resistant	**Do not use**	✔ Do not use if corroded[3]
Other metals: brass, iron, copper, aluminum, galvanized and carbon steels	Refrigeration-grade copper or aluminum tubing are used routinely for collection of CFC samples	**Do not use**	✔ Routinely used for CFCs Do not use if corroded[3]
		Glass	
Glass, borosilicate (laboratory grade)	Relatively inert. Potential sorption of analytes	✔ **Do not use** for trace element analyses. Potential source of B and Si	✔

---

[1] Plastic used in connection with inorganic trace-element sampling should be uncolored or white. Tubing used for trace metal sampling should be cleaned by soaking in 5-10 percent HCl solution for 8-24 hours, rinsing with reagent water (metals free) and allowed to air dry in mercury-free environment. After drying, the tubing is doubled-bagged in clear polyethylene bags, serialized with a unique number, and stored until used.

[2] Fluorocarbon polymers include materials such as Teflon™, Kynar™, and Tefzel™ that are relatively inert for sampling inorganic or organic analytes. Only fluoropolymer should be used for samples that will analyzed for mercury because mercury vapors can diffuse in or out of other materials, resulting in either contaminated or biased results.

[3] Corroded/weathered surfaces are active sorption sites for organic compounds.

GEI CONSULTANTS, INC.
Environmental Standard Operating Procedures
Atlantic and New England Regions

SOP No. SC-002
Revision No. 3
Effective Date: June 2011

STANDARD OPERATING PROCEDURE

SC-002 Environmental Sample Handling

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1. Objective

Describe appropriate environmental sample handling procedures.

The procedures include collection and transport of environmental samples to a laboratory for chemical analysis. Appropriate sample handling should ensure that samples are properly:

- labeled and documented;
- preserved;
- packaged; and
- transported

2. Execution

- Prior to mobilizing to the field, select a shipper or arrange for a courier for sample delivery to the laboratory. If using a shipper (i.e., FedEx or UPS) determine the time constraints for pickup requests, the location and hours of the nearest shipping office, and any size/weight restrictions.
- A waterproof or permanent ink pen should be used for all labels. The label should have an adhesive backing and be placed on the jar or bottle, not on the cap. In addition, clear packing tape can be placed over the sample label to secure it to the bottle as moisture from the samples can loosen the label adhesive.
- Record the following information on the label and in the field notebook (See SOPs FD-001 and FD-003):
    - Project number
    - Sample identification (i.e. MW-201 or SS-2)
    - Date and time (military time) of collection
    - Sampler's initials
    - Analysis methods
    - Preservative, if present
- Pre-preserved laboratory jars are preferable and should be used whenever practicable. If sample jars are not pre-preserved, add preservative as appropriate.
- At each sampling location, samples should be collected in order of volatility, most volatile first. Samples collected for volatile analysis should be placed in sample containers immediately upon retrieval of the sample.
- Aqueous samples for volatile analysis should be collected without air bubbles.
- The collection and preservation method of soil samples for volatile analysis may depend on project, client, or state regulatory requirements. Check with your Project Manager and/or SOPs SM-001 and SM-002 where appropriate.

- Care must be taken to avoid getting soils on the threads of sample jars, which can cause a faulty seal.
- If compositing samples in the field, specify the basis for composite (i.e. volume, weight, spoon recovery, etc.) and record in the field book the procedure for compositing the sample.
- Once samples have been collected and labeled, place samples in a cooler with sufficient bagged ice or freezer packs (blue ice) (if allowed) to chill samples to 4°C. If using ice, use double-bagged ice.
- Complete the chain-of-custody (COC) (SOP FD-003).
- If transporting the samples by way of a shipper:
    i. The sample cooler should have water drains securely sealed with duct tape, both on the inside and outside of the cooler.
    ii. Place a layer of packing material on the bottom of the cooler as a cushion.
    iii. Individually wrap each sample bottle with bubble packing or suitable packing material and place the wrapped bottles upright in the cooler with sufficient packing material between samples to avoid breakage.
    iv. Methanol preserved samples for volatiles analysis should be packed so they remain upright with the soil completely covered by the methanol during transport.
    v. Place a layer of packing material on top of the sample bottles.
    vi. Place bagged ice or freezer packs on top of the packing material. Fill the remaining space in the cooler with packing material to eliminate the possibility of vertical movement of samples.
    vii. Place the completed and signed chain-of-custody form in a sealable plastic bag and place on top of the packing material in the cooler, or tape it to the inside lid of the cooler.
    viii. Fill out the appropriate shipping or courier forms and attach to the top or handle of the cooler. If necessary, place the proper shipping labels on the cooler. Have the courier sign the COC form (or write pickup by FEDEX, UPS, etc. with date and time). Place a signed and dated custody seal on the cooler.
- All samples should be submitted to the laboratory as soon as possible. In many cases, same day shipping will be required by the client or the project manager. Be clear on this before beginning the field work.
- A copy of the waybills should be kept by the field supervisor to track shipments if necessary.

3. Limitations

- If samples are shipped on a Friday, call the laboratory ahead of time to confirm that personnel will be at the laboratory to receive and log-in the samples.
- During warm weather, make sure to use plenty of ice in the shipping container.

- Field personnel should be aware of analyses which have short hold times and schedule sampling events and shipping accordingly. Shipment of samples for analyses with short hold times must be arranged for in advance. Refer to the project work plan, quality assurance project plan, or state/federal regulations for holding time and preservative information. Contact the laboratory ahead of time when shipping samples with short hold time to ensure the lab is prepared for these analyses.
- For glassware containing preservatives (e.g., HCl, HNO_3), take care not to overfill the container, thus flushing the preservative out of the bottle.
- Never composite samples for VOCs in the field. Collect individual aliquots and direct the laboratory to perform compositing, if needed.
- Collection of aqueous samples should not be performed over the opening of a monitoring well. Preservatives from overfilling, a marker pen or other objects could fall into the well.
- If the recharge volume for a monitoring well is low, completely fill all volatile vials and then collect the minimum sample volume required for each remaining analysis.
- During subsurface soil sampling, if the recovery from the split-spoon sample is inadequate, if appropriate, resample the bottom of the borehole to obtain proper sample volume.
- Laboratories will homogenize and test the contents of the sample container, unless directed otherwise. Samples should not contain rocks, twigs, leaves, etc… unless these materials are of interest.

4. References

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory

Preservation Techniques for Volatile Organic Compound (VOC) Soil Sample Analyses, WSC#99-415. Massachusetts Department of Environmental Protection.

5. Contacts

Jennifer Belonsoff
Leslie Lombardo

STANDARD OPERATING PROCEDURE

SC-003 Investigation Derived Waste

1. Objective

Describe characterization and management of Investigation Derived Waste (IDW) resulting from site investigation activities.

IDW is solid and/or aqueous waste generated during environmental site investigations.

2. Execution

- Determine the suspected contamination type and impacted media based on previous investigations, available analytical data, and/or site history.
- Consider the following when selecting IDW management option(s):
  - Anticipated volume of IDW to be generated during on-site activities
  - Potential contaminants and their concentrations
  - Proximity to population centers and the potential for unauthorized site access
  - Potential exposures to workers
  - Potential for environmental impacts
  - Community concerns
  - Potential storage areas
  - Regulatory constraints
  - Potential on-site treatment options
  - Duration of storage
  - Client concerns or requirements
- Review IDW Management Options summarized in Attachment A for each media suspected of contamination.
- Select IDW Management Option(s) prior to the commencement of field activities that will generate waste materials.
- Include the selected IDW Management Option(s) in the Field Plan or other project documents.

Considerations and guidelines for IDW management for specific field tasks are provided below.

2.1. Test Pit Excavation

- Segregate contaminated soil from uncontaminated soil using visual and/or field screening methods.
- Use appropriate barrier (such as two layers of 6-ml plastic sheeting) for temporary stockpiling of contaminated soil adjacent to test pit.

- Backfill test pits with uncontaminated soil, unless otherwise directed by project manager.
- If directed by the Project Manager to return contaminated soil to the test pit, backfill soil in the same order as the soil was excavated from the test pit.

2.2. Boring/Monitoring Well Installation

- For auger borings, segregate contaminated soil (determined by visual and/or field screening methods) from uncontaminated soil during drilling. Segregate residual contaminated soil from split-spoon sampling.
- Auger cuttings or sediment generated by drive and wash may be spread around the ground surface at the boring location if it is acceptable to the client and the governing regulatory agency. If not, IDW may be placed in an appropriate area or container pending characterization and appropriate disposal. (A useful rule of thumb is to assume generation of one 55-gallon drum of cuttings for each 20 feet drilled with 7-¼-inch-I.D. augers).
- Segregate contaminated drilling fluid from uncontaminated fluid for rotary wash borings.
- Drilling fluid management options include pouring the drilling fluid on the ground near the boring location, if acceptable to the client and governing regulatory agency, or containerizing the fluid in drums or tanks.

2.3. Well Development/Sampling

Contaminated groundwater removed from wells by pumping or bailing for the purpose of well development and sampling may be poured on the ground near the well, if it is acceptable to the client and the governing regulatory agency. Otherwise, it should be containerized in drums or tanks.

2.4. Decontamination Fluids

Decontamination fluids may be poured on the ground in the vicinity of the well if approved by the project manager. Alternatively, the fluids may be containerized in drums or tanks.

2.5. Disposable Personal Protective Equipment

Disposable personal protective equipment (PPE) should be managed like any other IDW. However, with the clients' and project manager's approval, it may be removed from the site and disposed of as ordinary rubbish if it has not come into contact with contaminated materials.

3. Limitations

- The simplest IDW management option is to return the IDW to its source location.
- However, the selected IDW management options must meet state/federal regulations and have the client's approval. Consult with state/federal policies for IDW-related matters.

- The client is responsible for the disposal of IDW, should disposal be necessary.

4. References

Guide to Management of Investigation - Derived Wastes (April 1992), United States Environmental Protection Agency, Publication 9345.3-03FS.

Standard References for Monitoring Wells, Massachusetts Department of Environmental Protection, Publication No. WSC-310-91.

5. Attachments

Attachment A - Summary of Investigation Derived Waste Management Options
Attachment B - CTDEP Waste Guidance

6. Contacts

David Terry
Leslie Lombardo

Attachment A: - SUMMARY OF IDW MANAGEMENT OPTIONS
GEI Consultants, Inc. Standard Operating Procedures
Management of Investigation - Derived Waste

Type of IDW	Generation Processes	Management Options	Remarks
Soil	Boring/monitoring well installation Test pit excavation Soil sampling	Return to source location immediately after generation	Acceptable, if authorized by the client, the governing regulatory agency, and the project manager.
		Spread around boring, test pit, or original source location	Acceptable, if authorized by the client, the governing regulatory agency, and the project manager.
		Containerize and temporarily store on site	Can temporarily store in stockpiles or covered containers (i.e. drums, roll-off containers). Stockpiles must be underlain by plastic sheeting and covered with plastic sheeting. Plastic sheeting must be secure. Storage consistent with state/federal regulations.
		Send to off-site, treatment or disposal facility within appropriate timeframes	Requires proper shipping documents (i.e. manifest, Bill of Lading, etc.), analytical characterization
		Store for future treatment and/or disposal.	Storage consistent with state/federal regulations. If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)
		Store temporarily awaiting laboratory analysis.	Storage consistent with state/federal regulations. Can temporarily store in stockpiles or covered containers (i.e. drums, roll-off containers). Stockpiles must be underlain by plastic sheeting and covered with plastic sheeting. Plastic sheeting must be secure.
Sediment/Sludge	Sludge pit sampling Sediment sampling	Return to source immediately after generation	Acceptable, if authorized by the client, the governing regulatory agency, and the project manager.
		Store temporarily on site.	Storage consistent with state/federal regulations.
		Send to off-site facility within 90 days	Requires manifests, analytical characterization
		Store for future treatment and/or disposal.	Storage consistent with state/federal regulations. If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)

Attachment A: - SUMMARY OF IDW MANAGEMENT OPTIONS
GEI Consultants, Inc. Standard Operating Procedures
Management of Investigation - Derived Waste

Type of IDW	Generation Processes	Management Options	Remarks
Aqueous liquids (groundwater, surface water, drilling fluids, other wastewater)	Well installation/development Well purging during sampling Ground water discharge - pump tests Surface water sampling	Pour onto ground close to well	Non-hazardous liquids only. Should not exhibit a sheen or separate phase product. Do not discharge to the ground up-gradient of the source location. Ensure that it is permissible by local, state, and Federal regulations Is acceptable to the client, the governing regulatory agency, and the project manager.
		Store temporarily on site	If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)
		Send to off-site commercial treatment unit within appropriate timeframes	Refer to State regulations for appropriate timeframe. Requires appropriate shipping documents (i.e., manifest, Bill of Lading), analytical characterization
		Send to POTW	Obtain appropriate discharge permit(s)
		Store for future treatment and/or disposal.	Storage consistent with state/federal regulations. Consistent with final remedial action
		Discharge to surface water	OK if it complies with state and federal regulations. Obtain appropriate discharge permit(s).
Decontamination fluids	Decontamination of PPE and equipment	Store temporarily on site	If a RCRA hazardous waste, must meet RCRA Container/Waste Pile/Tank requirements (see notes)
		Send to off-site facility within appropriate timeframes	Requires manifests, analytical characterization
		Store for future treatment and/or disposal. Storage consistent with state/federal regulations.	Consistent with final remedial action
Disposable PPE	Sampling, drilling, and test pit excavation observation, other on-site activities	Store temporarily on site	Dispose of appropriately after characterization
		Place in on-site industrial dumpster	Project-specific determination required – must be acceptable to client and project manager
		Send to off-site facility within 90 days	Project-specific determination required
		Store for future treatment and disposal.	Storage consistent with state/federal regulations. Project-specific determination required

Notes:

1) PPE - personal protective equipment
2) POTW - publicly owned treatment works
3) Generation processes listed here are provided as examples.
   IDW may also be generated as a result of other site activities.
4) RCRA Container/Waste Pile/Tank requirements:
   Containers; 40 CFR 264 Subpart I and 265 Subpart I
   Waste Piles; 40 CFR 264 Subpart L and 265 Subpart L
   Tanks; 40 CFR 264 Subpart J and 265 Subpart J

Connecticut Department of Environmental Protection

Connecticut's RCRA "Contained-In" Policy

Characterization of Contaminated Soil and Groundwater

Policy

RCRA hazardous waste determinations for contaminated soil and groundwater may compare contaminant concentrations with the characterization criteria below. If the concentrations are below these criteria then the soil and groundwater do not need to be managed in Connecticut as RCRA hazardous waste. If the concentrations are above these levels then the soil/water must be treated, stored, transported, and disposed in the same manner as hazardous waste.

Purpose

To simplify the management of non-hazardous contaminated soil and groundwater and to encourage remediation of contaminated sites.

Applicability

This policy applies to contaminated soil and groundwater managed in Connecticut. It does not establish cleanup criteria. When contaminant concentrations are below the levels described in this policy, but are greater than applicable Connecticut Remediation Standard Regulations ("RSR") criteria, then the soil and groundwater must be handled as non-hazardous contaminated soil and groundwater subject to applicable RSR polluted soil reuse requirements and to Connecticut solid waste requirements.

Contaminant	Soil Characterization Criteria	Groundwater Characterization Criteria
Characteristically hazardous waste **"D codes"**	Non-hazardous if below levels in Toxicity Characteristic Table in 40 CFR 261.24 ("TC Table")[1]	Non-hazardous if below levels in Toxicity Characteristic Table in 40 CFR 261.24 ("TC Table")
Listed hazardous waste **"F,K,P,U codes"** See 40 CFR 261.33 for **"P"** & **"U"** See 40 CFR 261 Appendix VII to identify constituents for which **"F"** & **"K"** wastes are listed.	Non-hazardous if below the lower of A and B: **(A)** Industrial/Commercial Direct Exposure Criteria in RSR[2] **and** [choose one method from B]: **(B) either** TC Table[1] **or** 100 x GA Pollutant Mobility Criteria in RSR[3] **or** 100 x Groundwater Protection Criteria in RSR[4]	Non-hazardous if below 100 x GA Groundwater Protection Criteria in RSR

1. via Toxicity Characteristic Leachate Procedure ("TCLP")
2. via mass analysis
3. via mass analysis or leachate analysis
4. via leachate procedure (eg: TCLP or Synthetic Precipitation Leachate Procedure

STANDARD OPERATING PROCEDURE

SC-004 Headspace VOC Screening

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1. Objective

Describe methods to obtain site-specific measurement of the total volatile organic compound (VOC) concentrations present in the headspace of a jar containing soil.

This information can be used for several purposes:

- Segregate soil based on degree of contamination.
- Identify samples for quantitative analysis of VOCs.
- Evaluate the presence or absence of VOCs in soil.

2. Execution

- A photoionization detector (PID) or flame ionization detector (FID) instrument is used to measure VOCs in jar headspace (JHS) screening.
- Select the appropriate instrument, lamp, and calibration gas for the site-specific contaminants. Calibrate the instrument in accordance with the manufacturer's instructions before JHS screening begins. Record the type of calibration gas, detector, lamp, and results of calibration in the field notebook.
- Note the highest VOC concentration that the instrument measures in air in the work area before performing JHS screening. Record this as the initial background concentration.
- Half-fill a clean, glass jar with the soil. Quickly cover the open top with one or two sheets of clean, aluminum foil and screw on the cap to tightly seal the jar. Label the jar with the sample location and sample depth.
- Allow headspace development for at least 10 minutes at an ambient temperature of 50°F or greater. Vigorously shake the jar for 15 seconds at the beginning and end of the headspace development period. When ambient temperatures are below 50°F, place the jar in a heated vehicle or building during the headspace development period.
- After headspace development, remove the screw cap to expose the foil seal. Quickly puncture the foil seal with the instrument's sampling probe and insert it to a point at about one-half of the headspace depth.
- Record the highest VOC concentration that the instrument displays as the JHS concentration. The highest concentration should occur between 2 and 5 seconds after probe insertion.

3. Limitations

- The instruments may work poorly in the rain and in freezing temperatures. Under such conditions, operate the instrument in a heated vehicle or building if possible.

- Prevent water and soil particles from entering the tip of the instrument probe. Use a filter on the instrument's probe.
- Measure background VOC conditions and perform JHS screening away from non-site-related VOC sources, such as vehicle and heavy equipment exhaust.
- The VOC concentration on the instrument's display may vary when the air contains high VOC concentrations or high moisture.
- JHS screening is a guide that helps the screener to segregate soils into broadly defined categories. JHS screening results may differ by orders of magnitude from laboratory testing results.
- Note that states may have specific procedures for field monitoring. In Massachusetts, the Massachusetts Department of Environmental Protection (DEP) requires that screening of gasoline-contaminated soil be performed in accordance with Attachment II of the DEP's policy #WSC-94-400 Interim Remediation Waste Management Policy for Petroleum Contaminated Soils. Consult this procedure or any relevant guidance documents for assistance.

4. References

Interim Remediation Waste Management Policy for Petroleum Contaminated Soils. (April 1994), Massachusetts Department of Environmental Protection, Policy #WSC-94-400.

5. Contacts

Lynn Willey
Leslie Lombardo

STANDARD OPERATING PROCEDURE

SC-005 Ultraviolet Fluorescence (UVF) Detection Method

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1. Objective

Describe standard procedures for the field analysis of petroleum hydrocarbons in soil and water using the SiteLAB™ UVF-3100 Ultraviolet Fluorescence (UVF) detection method.

2. Background

Ultraviolet Fluorescence is a selective detection method useful for testing many types of environmental contaminants. The principle of operation relies on the electronic configuration of the molecular structure for each contaminant. When a hydrocarbon molecule is exposed to certain wavelengths of light, the molecule emits energy at a specific wavelength. The light energy emitted by an environmental sample exposed to a UV source is directly proportional to the concentration of hydrocarbons present. The fluorescence response of each sample is then quantified using a 5 point linear calibration curve. A specific range of target compounds can be quantified by first selecting the appropriate wavelengths of light to be detected by the UVF-3100 and then using certified standards, sensitive to the wavelengths of interest, to establish the linear range of the calibration curve. The UVF-3100 can be calibrated to detect the following types of hydrocarbon ranges:

- Volatile Petroleum Hydrocarbons (C9-C10 molecular weights) including benzene, toluene ethylbenzene and xylene (BTEX)
- Gasoline Range Organics (C5-C10) including BTEX
- Extractable Petroleum Hydrocarbons (C11-C22)
- Extractable Diesel Range Organics (C10-C40) (weathered Diesel)
- Polycyclic Aromatic Hydrocarbons (PAH Mix)
- #2 Fuel Oil
- #6 Fuel Oil
- Motor Oil Range Organics
- Polychlorinated Biphenyls (PCBs)

After calibrating the instrument and performing the sample extraction step, the UVF-3100's actual analysis time is less than 5 seconds.

3. Execution

- Upon receipt of the instrument, inspect all shipping cartons to ensure that all components have been received and verify that the unit is operational.
- On site, assemble the unit according to the manufacturer's instructions. Install the UVF-3100 software onto the field laptop computer.
- The UVF-3100 is equipped with an internal battery. However, the AC adapter may be needed for extended operation. Be prepared to switch to AC power if necessary.

- Operate the UVF-3100 for 20 minutes prior to use to ensure that the instrument is operating at full performance.
- Select the applicable standards based on the target hydrocarbon range (i.e., BTEX, PAHs, etc.).
- Calibrate the UVF-3100 in accordance with the instructions provided with the appropriate calibration kit. Proper calibration of the instrument is critical.
- For optimal use of the UVF-3100, approximately 20 samples (maximum of 20 samples) should be screened during each run.
- Extract samples using the SiteLAB™ UVF Analytical Test Kit (Product Number EXTR010-20).
- Sample extracts can be stored for up to 3 months if kept refrigerated.
- Field personnel should be familiar with both the sample extraction and the calibration procedure before attempting to record data.
- Operate instrument as per manufacturer's instructions:

    i. Select the appropriate optical filter for the specific test to be run.
    ii. Select the proper wavelength for the specific test to be run.
    iii. Perform the 5-point calibration using the appropriate standards.
    iv. Perform the sample extraction procedure.
    v. Make any necessary dilutions.
    vi. Analyze the samples and record the results on the record sheet included with the extraction kit. Include test run number, Sample ID, Fluorescence, Sample Concentration, and Dilution Factor on the sheet.
    vii. Calculate result by multiplying the sample result by the dilution factor.
    viii. Repeat for each sample. Make addition dilutions if necessary.

- **Sample dilution -** Samples exhibiting a yellowish color should be diluted until a minimal yellow tint is observed. Analyze both the diluted sample and the undiluted sample for comparison. Follow dilution procedure outlined in the manual. Addition methanol may be necessary for further dilution.

- **Field duplicate** – a duplicate sample should be collected from a sample location suspected of being contaminated with the target hydrocarbon and extracted in a manner identical to the original sample. Field duplicates should be taken at a frequency of one per twenty samples or one per weekly sampling whichever is the greater.

4. Contacts

Brian Conte
Leslie Lombardo

Section 6

Solid Matrix Sampling (SM)

STANDARD OPERATING PROCEDURE

SM-001 Soil Sampling Techniques Including Split-Spoon

1. Objective

Describe standard procedures for the collection of surface and subsurface soil samples.

The definition of “surface” soil varies considerably between regulatory organizations. Surface soils may be classified as soils between the ground surface and 2 inches below ground surface, ground surface and 6 inches below ground surface, and even as much as ground surface and 24 inches below ground surface.

The definition of subsurface soil will vary in relation to the definition of surface soil. In general, subsurface soil is everything deeper than surface soil.

Refer to state-specific regulations for the definitions of surface and subsurface soils.

2. Execution

2.1. Surface Soil Sampling

Collection of surface soil samples can be accomplished with tools such as spades, shovels, trowels, scoops, etc. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required.

- Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
- Using a decontaminated stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
- If volatile organic compound (VOC) analysis is to be performed, transfer the sample directly into an appropriate labeled sample container with a stainless steel lab spoon, small diameter core device, or equivalent and secure the cap tightly.
- Place the remainder of the sample into a decontaminated stainless steel, plastic, or other appropriate container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.
- Either place the sample into appropriate labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the container and mix thoroughly.
- When compositing is complete, place the sample into appropriate labeled containers and secure the caps tightly.

2.2. Sampling with Hand Augers and Thin Wall Tube Samplers

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are generally better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and generally cannot be used below a depth of approximately three feet.

2.2.1 Auger Sampling

- Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.
- Attach the decontaminated auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
- Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
- After reaching the desired depth, carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole.

2.2.2 Thin-Walled Core Sampling

- Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.
- Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
- Remove the tube sampler, and unscrew the drill rods.
- Remove the cutting tip and the core from the device.
- Discard the top of the core (approximately 1 inch), as this may represent material knocked down from the sides of the boring and not the layer of interest. Place the remaining core into the appropriate labeled sample container.

One type of thin-wall sampler is depicted in Attachment A (this is typically used with a mechanical drill rig).

For either method, If VOC analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, small diameter core sampler, or equivalent and secure the cap tightly. VOC samples should be collected first to minimize the potential for losing volatiles prior to sample collection.

Place the remainder of the sample into a stainless steel, plastic, or other appropriate container and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the container and mix thoroughly.

When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow previous steps, making sure to decontaminate the auger and tube sampler between samples.

Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

2.3. Sampling at Depth with a Split-Spoon (Barrel) Sampler

Split-spoon sampling is generally used with a mechanical drill rig to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split-spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split-spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted. A diagram of the split-spoon sampler assembly is provided as Attachment A.

When split-spoon soil sampling is performed to gain geologic information, work should be performed in accordance with ASTM D1586-08a, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". The following procedures are used for collecting soil samples with a split-spoon:

- Select the size (length and diameter) of split-spoon sampler based on the amount of soil that is needed for characterization. The ASTM standard for N-values is 1 3/8 - inch I.D (2-inch O.D.). Specify spoon size and basket type to driller prior to mobilization to the site. Split spoon samplers are typically available in 1 3/8 – and 3 – inch I.D. sizes. A larger barrel may be necessary to obtain the required sample volume. Note on the boring log where larger split spoon barrels are used because the ASTM standard penetration test does not apply when driving split spoons larger than 1 3/8 I.D. (2-inch O.D.).

- Select a soft or stiff basket for the spoon (a softer basket generally works better for loose or soft material).
- Prior to hammering the split spoon to collect the sample, verify that the split-spoon is seated at the beginning of the desired sample interval. If it is seated above the interval, have driller clean out the hole prior to sampling. Record all depth measurements relative to ground surface.
- Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top. See diagram in Attachment A.
- Place the sampler in a perpendicular position on the sample material.
- For all soil samples, use a 140-lb hammer falling 30 inches to drive the sampler, unless conditions necessitate using a 300-lb hammer.
- Record in the site fieldbook or on field data sheets the length of the tube used to penetrate the material being sampled, the split-spoon inside and outside diameters, and the hammer weight,
- Count and record the number of blow counts per 6-inch increments (confirming blow counts with driller if necessary).
- Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The length of recovery and soil type should be recorded on the boring log. If a soil sample is desired, a decontaminated stainless steel knife or spatula should be used to divide the tube contents in half, longitudinally. If possible, avoid collecting soil that has come in contact with the walls of the spoon, and soil at the top of the spoon.
- Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.
- Note any material in the nose (shoe) of the spoon.
- Immediately collect a sample for VOCs (if required by the site-specific field sampling plan) by collecting soil from the entire length of the split spoon, unless otherwise specified by the project manager. When the most impacted interval is sampled for laboratory analysis, screen the spoon with the field instrument first, then collect the soil sample for VOC analysis from the appropriate interval.

3. Limitations

- Weather conditions (e.g., frozen ground) may prevent the collection of samples and should be considered prior to sample collection.
- Tools plated with chrome or other materials should not be used.
- Be aware of local laws regarding subsurface utility clearance prior to conducting subsurface investigations. Contact DigSafe or local utility companies as required.
- Be aware of the length of the drill string, the sample depth, and the required stickup of the drill string to ensure accurate sample interval measurement.
- If drilling with hollow-stem augers, the removal of the drill string from the hole, prior to attaching the split-spoon sampler, may cause soils to be sucked up

into the augers (blow-in running sands). Upon recovery, determine if there is blow-in in the split spoon sampler. In general, blow-in is more unconsolidated than the rest of the sample and lacks stratification (do not include blow-in for recovery of sample collection).

- If soils consist of loose sands or soft clay, the drill string and sampler may advance slightly under its own weight, giving a false depth for soil collection.
- Never sample more than two spoons consecutively without advancing the augers unless material is tight. Do not let the split spoon penetrate more than it can hold.
- In many instances, groundwater will fill the auger and the split-spoon.

4. References

ASTM D1586-08a, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". 2008.

United States Environmental Protection Agency, SOP 2012 “Soil Sampling”, Revision 0.0, February 18, 2000.

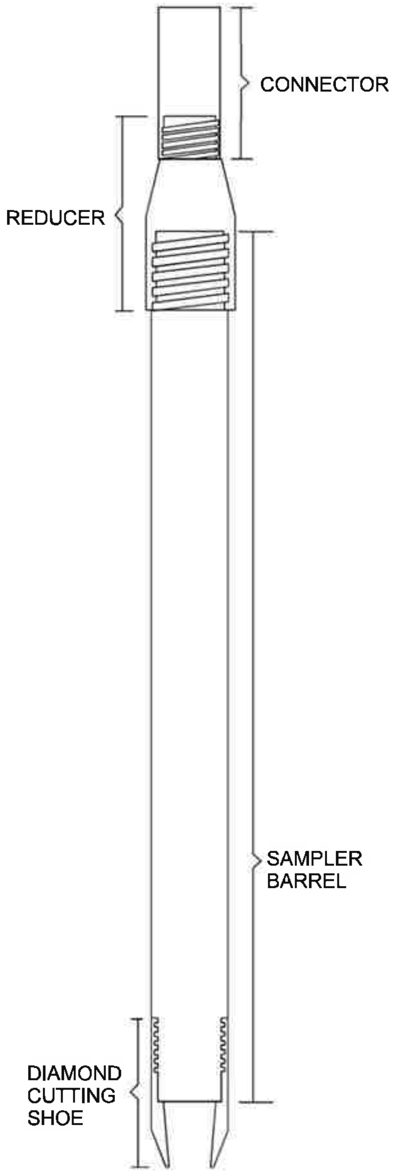
5. Attachments

Attachment A - Sampler Design Assembly

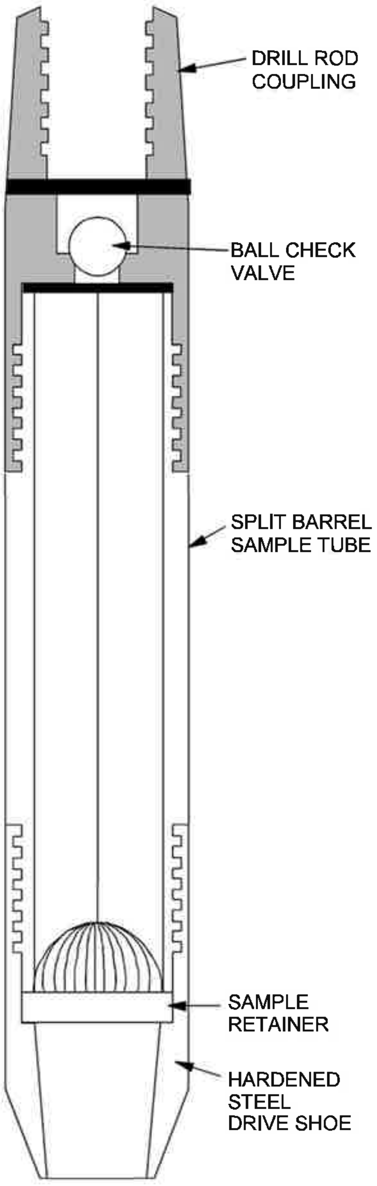
6. Contacts

Gary Fuerstenberg
Mark Ensign

THIN WALL HQ CORE SAMPLER
(2" width x 60" length)



SPLIT-SPOON SAMPLER
(2" width x 24" length)



STANDARD OPERATING PROCEDURES
SM-001

NEW ENGLAND AND ATLANTIC REGIONS

GEI Consultants

June 2011

THIN WALL AND SPLIT-SPOON SAMPLERS

Attachment A

I:\STANDARD\DETAILS\SUBSURFACE\SAMPLERS\SPLIT-SPOON.ppt

STANDARD OPERATING PROCEDURE

SM-002 VOC Soil Sample Collection and Preservation Method

1. Objective

Describe methods to collect and preserve soil samples for analysis of Volatile Organic Compounds (VOCs) in accordance with the U.S. Environmental Protection Agency (EPA) Method 5035.

Some states have adopted soil sampling and preservation methods that vary from the procedures presented herein. Confirm that this method is appropriate for your project.

2. Execution

VOCs evaporate readily at normal temperatures and pressures. Care should be taken during sampling and preservation to limit the potential for VOCs to off-gas from the soil sample prior to being analyzed by the laboratory.

Soil samples should be obtained utilizing a small diameter core sampler such as a 10 milliliter (ml) plastic disposable syringe, an EnCore® sampler, an EasyDraw Syringe®. The EnCore® sampler is the only EPA-approved small diameter core sampler that can be used to collect the sample, store the sample, and transport the sample to the lab.

A separate soil sample must be collected and submitted to the laboratory for percent solids testing. At least approximately 20 grams of soil must be collected in a separate glass or plastic sampling container.

2.1. Collection and Preservation of Soil Samples

Three types of soil samples may be collected for VOCs analysis:

- High (typically >200 µg/kg) VOC concentration soil sample (Section 2.2 below)
- Low (typically 0.05-200 µg/kg) VOC concentration soil sample (Section 2.3 below)
- Synthetic Precipitation Leaching Procedure/Toxicity Characteristic Leaching Procedure (SPLP/TCLP) soil sample (Section 2.4 below)

2.2. Collection and Preservation of a Soil Sample with "High" Concentrations of VOCs (typically >200 µg/kg)

2.2.1. Option 1 – Methanol Preservation Method

Supplies include: an electronic field balance (in some cases), two VOC vials (per sample) with 10 ml methanol (the number of vials and amount of methanol might vary among labs), and a small diameter core sampler to collect an approximately 10 gram soil sample. Some labs, and EPA method 5035, specify a 5 gram soil sample. Check with the lab or project manager for the amount to collect.

Sampling Procedure:

- Weigh the VOC vials containing the methanol and record the weight. Some laboratories provide pre-weighed VOC vials.
- If you are weighing your samples, take a test sample with the sampler and weigh it to evaluate how close you are to the appropriate sample weight. If the laboratory VOC vial is pre-marked with a line, then you do not need to weigh the soil, just fill the VOC vial with soil until the methanol and soil mixture reaches the line.
- Collect the sample using the sampling device and extrude the sample into the preserved VOC vial. Be sure that the VOC vial and cap threads are free of soil, and then screw the cap tightly onto the VOC vial. Gently swirl the methanol in the VOC vial to coat the soil sample. Do not vigorously shake the vial.
- If necessary, weigh the VOC vial and record the weight. Some laboratories will weigh the vials at the lab, and it is not required in the field.
- Collect separate soil samples from the same area for percent solids and head space sampling.
- Samples must be frozen or analyzed within 14 days.

2.2.2. Option 2 – EnCore® Sampling Method

Supplies needed: One 5 or 10 ml EnCore® sampler.

Sampling Procedure:

- Label the EnCore® sampling container.
- Collect the soil sample quickly, wipe the sampler free of soil, and seal the sampler.
- Place sampler in a clean ziplock bag and place on ice in a cooler.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen, or preserved, or analyzed within 48 hours (requires coordination with the laboratory).

2.3. Collection and Preservation of a Soil Sample with "Low" Concentrations of VOCs (typically 0.5 to 200 µg/kg)

2.3.1. Option 1 – Water Preservation Method

Supplies required: an electronic field balance, two 40 ml VOC vials pre-weighed and containing 5 ml of water, a magnetic stirrer, and a sampling device.

Sampling Procedure:

- Use a small diameter core sampler to collect two soil samples (5 grams each) into pre-weighed 40 ml VOC vials with 5 ml of water and a magnetic stirrer. Wipe threads and cap and seal the VOC vial. Repeat for the second VOC vial.
- Weigh the VOC vials and record the weights.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen or analyzed within 14 days.

2.3.2. Option 2 – Collection into Unpreserved VOC Vials

Supplies required: electronic field balance, two 40 ml VOC vials pre-weighed, and a sampling device.

Sampling Procedure:

- Collect the sample using the sampling device and extrude the sample into the VOC vial. Be sure that the threads are free of soil, and cap and seal the VOC vial. Repeat for the second vial.
- Weigh the VOC vials and record the weights.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen or analyzed within 48 hours (requires coordination with the laboratory).

2.3.3. Option 3 – Collection in VOC Vials Preserved with Sodium Bisulfate

Supplies required: electronic field balance, two VOC vials pre-weighed with 5 ml of sodium bisulfate, a magnetic stir bar, and a sampling device.

Sampling Procedure:

- Collect the sample using the sampling device and extrude a 5 gram sample into the VOC vial containing the sodium bisulfate. Wipe threads and cap and seal the VOC vial. Repeat for the second VOC vial.
- Weigh the VOC vials and record the weights.

- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen or analyzed within 14 days.

2.3.4. Option 4 –EnCore® Sampling Method

Supplies required: two 5 gram EnCore® samplers.

Sampling Procedure:

- Label the EnCore® sampling container.
- Collect the soil sample quickly, wipe the sampler free of soil, and seal the sampler.
- Place sampler in a clean ziplock bag and place on ice in a cooler.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Repeat previous steps with the second EnCore® device.
  Samples must be frozen, or preserved, or analyzed within 48 hours (requires coordination with the laboratory).

2.4. Collection of samples being analyzed for VOCs by the TCLP or SPLP method

Sampling methods for TCLP or SPLP are similar to the methods presented above. The appropriate method is determined by local regulations. If using an EnCore® sampler, a 25 gram sampler should be used.

3. General Guidance

- Each state and federal regulatory agency has unique soil preservation requirements. Always verify collection and preservation methods with governing bodies.
- Verify preservation techniques with laboratory prior to sample collection.

4. Contacts

Lynn Willey
Mark Ensign

STANDARD OPERATING PROCEDURE

SM-003 Classification of Soil Samples in the Field

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1. Objective

Describe methods to classify soil samples collected in the field in a consistent manner.

2. Execution

- Describe soil samples according to *ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) and* Attachments A and B. This standard is the basis for the Unified oil Classification System.
- Identify and record the soil in terms of the major and minor constituents (i.e., sand gravel, silt, clay), Unified Soil Classification Symbol, sample structure, plasticity and dilatancy for fine-grained soils, color, local or geologic name if known (e.g., Boston Blue Clay or glacial till), odor, presence of iron or other staining, and presence of organic matter, shells, debris, or other unusual characteristics of the same.
- If a soil split-spoon sample contains more than one soil type (for example, the upper portion is silty sand and the lower portion is clay) describe each type separately.
- Record sampler type, blow counts, soil description, etc. on the boring log (see Attachment C).
- GEI consistently applies one modification to the ASTM standard: Use "widely graded" and "narrowly graded" instead of "well-graded" and "poorly graded," respectively.

3. Limitations

Certain projects or clients will require the use of other classification systems. Other classification systems should not be used unless specifically required by the client. If the client requires that we use the Burmister method, obtain the details from the client. An example breakdown is shown below, but some clients (MassDOT, for example) have their own breakdown.

- “and” = 35-50%
- “some” = 20-35%
- “little” = 10-20%
- “trace” = 1-10%

- Describing soil samples is often difficult during cold or wet weather. Make sure your field notes describe these conditions. When possible, collect archive samples and verify sample descriptions in the office.

- The ASTM Standard Practice for Classification of Soils for Engineering Purposes (D2487) may be used in conjunction with the Visual-Manual Method to confirm the soil classification. D2487 includes laboratory testing.

4. References

ASTM D2487-06e1, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM, 2006.

ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM, 2009.

Field Guide for Soil and Stratigraphic Analysis, Midwest Geosciences Group Press, 2001-2005.

Coarse-Grained Soils Visual-Manual Descriptions, GEI Consultants, Soil Description Chart.

Fine-Grained Soils Visual-Manual Descriptions, GEI Consultants, Soil Description Chart.

5. Attachments

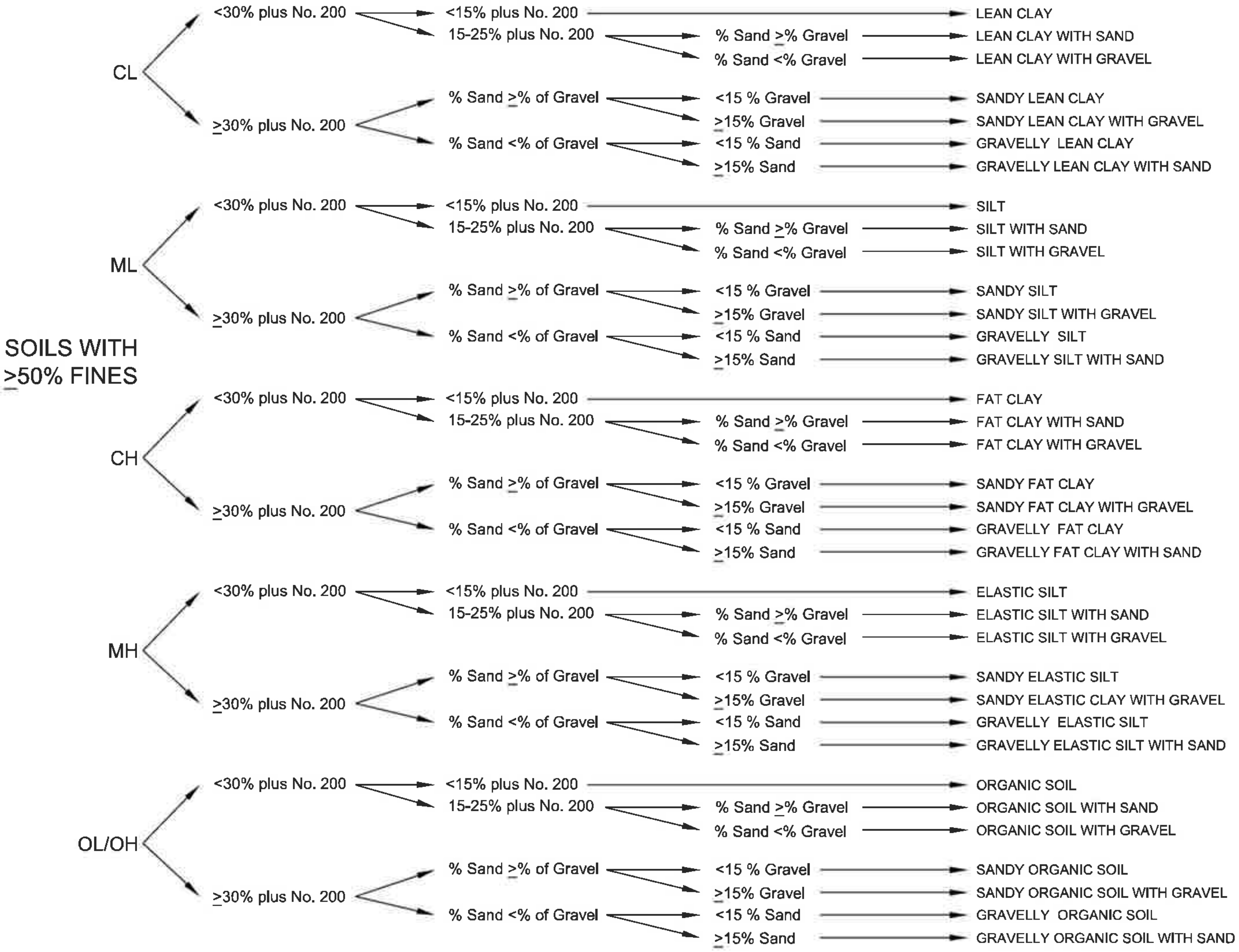
Attachment A – GEI Soil Description Charts (2007)
Attachment B – Visual Manual Descriptions with example boring log
Attachment C – Describing the Plasticity of Soil Samples

6. Contacts

Lynn Willey
Cathy Johnson

GEI Consultants

FINE-GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS



ID OF INORGANIC FINE SOILS FROM MANUAL TESTS

Symbol	Name	Dry Strength	Dilatancy	Toughness*
ML	Silt	None to low	Slow to rapid	Low or thread cannot be formed
CL	Lean Clay	Medium to high	None to slow	Medium
MH	Elastic Silt	Low to medium	None to slow	Low to medium
CH	Fat Clay	High to very high	None	High

1. GROUP NAME and (SYMBOL)
2. Describe fines, sand, and gravel components, in order of predominance. Include plasticity of fines. Include percentages of sand and gravel.
3. Color
4. Sheen, odor, roots, ash, brick, cementation, torvane and penetrometer results, etc.
5. "Fill," local name or geologic name, if known

PEAT

Peat refers to a sample composed primarily of vegetable matter in varying stages of decomposition. The description should begin: PEAT (PT) and need not include percentages of sand, gravel or fines.

CRITERIA FOR DESCRIBING PLASTICITY

Description	Criteria
Nonplastic ML	A 1/8-in. (3 -mm) thread cannot be rolled at any water content
Low Plasticity ML, MH	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit *
Medium Plasticity MH, CL	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High Plasticity CH	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

* Toughness refers to the strength of the thread near plastic limit. The lump refers to a lump of soil drier than the plastic, similar to dry strength.

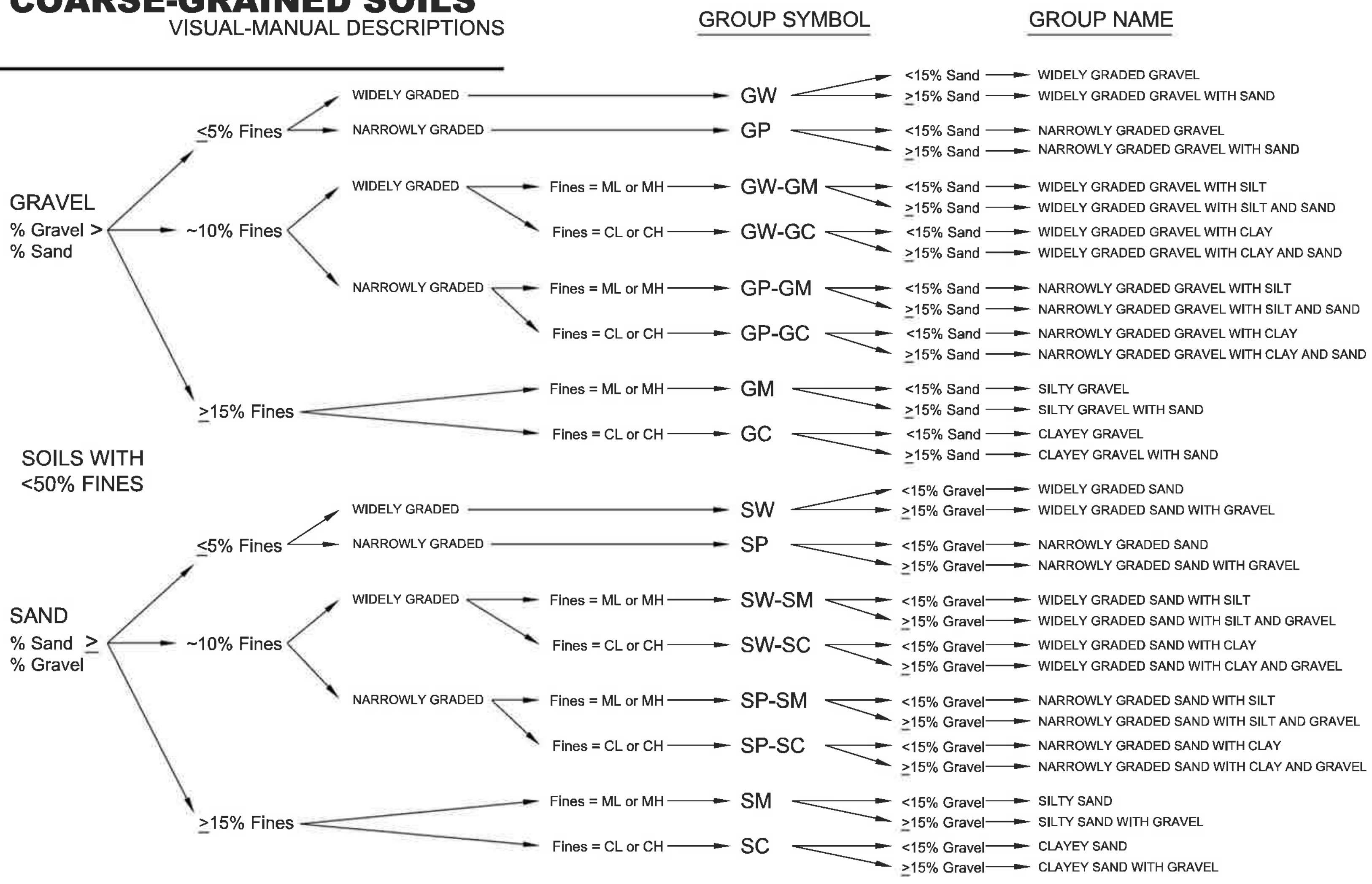
GEI Consultants

COARSE-GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS

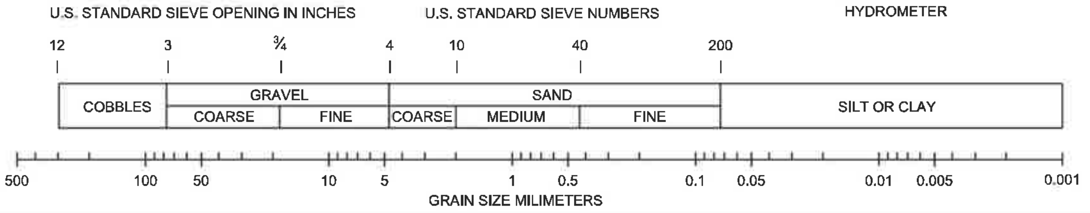
TYPICAL SOIL COLORS

- 🟨 YELLOW
- 🟩 OLIVE
- 🟫 LIGHT BROWN
- 🟫 BROWN
- 🟥 REDDISH BROWN
- 🟥 RED
- ⬛ GRAY
- ⬛ BLACK

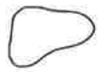


SOILS WITH <50% FINES

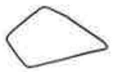
				GROUP SYMBOL		GROUP NAME
GRAVEL % Gravel > % Sand	<5% Fines	WIDELY GRADED		GW	<15% Sand	WIDELY GRADED GRAVEL
					≥15% Sand	WIDELY GRADED GRAVEL WITH SAND
		NARROWLY GRADED		GP	<15% Sand	NARROWLY GRADED GRAVEL
					≥15% Sand	NARROWLY GRADED GRAVEL WITH SAND
	~10% Fines	WIDELY GRADED	Fines = ML or MH	GW-GM	<15% Sand	WIDELY GRADED GRAVEL WITH SILT
					≥15% Sand	WIDELY GRADED GRAVEL WITH SILT AND SAND
			Fines = CL or CH	GW-GC	<15% Sand	WIDELY GRADED GRAVEL WITH CLAY
					≥15% Sand	WIDELY GRADED GRAVEL WITH CLAY AND SAND
		NARROWLY GRADED	Fines = ML or MH	GP-GM	<15% Sand	NARROWLY GRADED GRAVEL WITH SILT
					≥15% Sand	NARROWLY GRADED GRAVEL WITH SILT AND SAND
			Fines = CL or CH	GP-GC	<15% Sand	NARROWLY GRADED GRAVEL WITH CLAY
					≥15% Sand	NARROWLY GRADED GRAVEL WITH CLAY AND SAND
	≥15% Fines		Fines = ML or MH	GM	<15% Sand	SILTY GRAVEL
					≥15% Sand	SILTY GRAVEL WITH SAND
			Fines = CL or CH	GC	<15% Sand	CLAYEY GRAVEL
					≥15% Sand	CLAYEY GRAVEL WITH SAND
SAND % Sand ≥ % Gravel	<5% Fines	WIDELY GRADED		SW	<15% Gravel	WIDELY GRADED SAND
					≥15% Gravel	WIDELY GRADED SAND WITH GRAVEL
		NARROWLY GRADED		SP	<15% Gravel	NARROWLY GRADED SAND
					≥15% Gravel	NARROWLY GRADED SAND WITH GRAVEL
	~10% Fines	WIDELY GRADED	Fines = ML or MH	SW-SM	<15% Gravel	WIDELY GRADED SAND WITH SILT
					≥15% Gravel	WIDELY GRADED SAND WITH SILT AND GRAVEL
			Fines = CL or CH	SW-SC	<15% Gravel	WIDELY GRADED SAND WITH CLAY
					≥15% Gravel	WIDELY GRADED SAND WITH CLAY AND GRAVEL
		NARROWLY GRADED	Fines = ML or MH	SP-SM	<15% Gravel	NARROWLY GRADED SAND WITH SILT
					≥15% Gravel	NARROWLY GRADED SAND WITH SILT AND GRAVEL
			Fines = CL or CH	SP-SC	<15% Gravel	NARROWLY GRADED SAND WITH CLAY
					≥15% Gravel	NARROWLY GRADED SAND WITH CLAY AND GRAVEL
	≥15% Fines		Fines = ML or MH	SM	<15% Gravel	SILTY SAND
					≥15% Gravel	SILTY SAND WITH GRAVEL
			Fines = CL or CH	SC	<15% Gravel	CLAYEY SAND
					≥15% Gravel	CLAYEY SAND WITH GRAVEL



ROUNDED



SUBROUNDED



SUBANGULAR

ANGULAR

1. GROUP NAME and (SYMBOL)
2. Structure , if any. (stratified layer thicknesses, lenses, varves, gradational changes)
3. Describe sand, gravel and fines components, with percentages, in order of predominance. Include max gravel size. For test pits give percent cobbles and boulders, by volume, and include max size.
4. Color
5. Sheen, odor, roots, ash, brick, cementation, reaction with HCL, etc.
6. "Fill," local name or geologic name, if known

Describing the Plasticity of Soil Samples

M. Paster – November 2008

References ASTM D 2487 – Soil descriptions – lab
ASTM D 2488 – Soil descriptions – field
ASTM D 4318 – Atterberg limits testing

GEI Practice for Boring and Test Pit Logs

Describe the fines as:

Non-plastic
Low plasticity (The GEI laminated sheets incorrectly use "slightly plastic" for "low plasticity.")
Medium plasticity
High plasticity

Example: ~25% low plasticity fines

Toughness and dry strength:

You should use these tests to help decide how plastic the fines are. Record the results in the remarks column of the field log, but not in the soil description and not necessarily in the typed log.

On final logs, if Atterberg limits tests have been performed:

Do not use the descriptive terms non-plastic, low plasticity, etc. for samples on which Atterberg limits tests have been run. Instead, just give the percentage of fines and then report the actual Atterberg limits at the end of the description.

For example, the end of a silty sand description might be:
. . . ~25% fines, ~10% gravel max size ½ inch, gray. PL=23, LL=35.

(Atterberg limits tests are performed on the fraction of the sample finer than the No. 40 sieve, not just the fines. So the Atterberg limits data applies to the sample, not just to the fines.)

Hints:

High plasticity soils are rare in New England. If you think it's high plasticity, it's probably medium. Some Boston blue clay and some Connecticut River varved clays are high plasticity, but if you think you've found some, check with the project manager.

In New England, if ~10% fines or more, generally stick with GM, SM, ML, and CL. Occasionally GC, SC, CH. Don't use MH unless you have Atterberg limits data.

Estimating plasticity in the field, GEI guidance based on ASTM D 2488:

Plasticity	1/8-inch thread	Dry strength	Toughness
non	Cannot be rolled at any water content.	Dry specimen crumbles when handled.	Only slight pressure needed to roll thread near plastic limit.
low	Thread can barely be rolled.	Dry specimen crumbles with some finger pressure.	Slight to medium pressure needed to roll thread near plastic limit.
medium	Thread is easy to roll. Not much time needed to reach plastic limit.	Dry specimen crumbles with considerable finger pressure.	Medium pressure needed to roll thread near plastic limit.
high	Takes considerable time rolling and kneading to reach plastic limit.	Dry specimen cannot be broken with finger pressure.	Considerable pressure needed to roll thread near plastic limit.

Non-plastic vs. low plasticity:

ASTM D 2488 (soil descriptions - field) defines non-plastic and low plasticity based on the 1/8-inch thread as shown in the table above.

ASTM D 4318 (Atterberg limits testing) indicates that a sample should be called non-plastic for either of the following cases:

- The liquid limit test (dropping the cup) or the plastic limit test (rolling out the thread) cannot be performed because the plasticity is too low.
- The plastic limit is greater than or equal to the liquid limit.

Unfortunately, there are some soils that are low plasticity based on D 2488 (a thread can be rolled), but are non-plastic based on D 4318 (the liquid limit cannot be measured or $PL \geq LL$).

GEI considers these soils to have low plasticity, because that is how they "look" and "feel." We want to document this information so that other people will have a better feel for what the soil looks like and how it behaves. So, if the soil was low plasticity based on D 2488, but non-plastic based on D 4318, that should be explained in the letter or report, and possibly in a note on the log.

BORING LOCATION Maple Ave Sidewalk
GROUND ELEVATION (NGVD)
GROUNDWATER EL. DATE
DATE START/FINISH 2/14/07 - 2/15/07
DRILLED BY Geologic: M. Costigan
LOGGED BY T. Kahl/M. Yako TOTAL DEPTH (FT) 25

B101

PG. 1 OF 1

EL. FT.	DEPTH FT.	SAMPLE TYPE and NO.	SAMPLE BLOWS PER 6 IN.	SAMPLE PEN IN.	SAMPLE REC IN.	PID JAR HS / REMARKS	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
							FILL	4" pavement
	2.5	S1	13-9 17-14	24	0	0.5 ppm		S1: Redrove 0.5 to 3.5 ft. Recovery 11": WIDELY GRADED SAND (SW) ~85% sand, ~10% gravel to 1", <5% nonplastic fines, brown. Contains brick fragments and ash. Fill.
	5					hard drilling 3 to 4 ft, possible boulder		
	7.5	S2	7-7 11-13	24	8	2.0 ppm		S2: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) ~65% mostly fine sand, ~25% gravel to 3/4 inch ~10% non-plastic fines, brown. Fill.
		S3	9-10 2-1	24	16	0.0 ppm		S3 (0-10"): Similar to S2.
	10						ORGANICS	S3 (10"-16")": ORGANIC SILT (OL) ~100% slightly plastic fines, dark gray, organic odor, contains white shell fragments.
	12.5	S4	WOH 1-2 1	24	15	0.0 ppm		
	15					hard drilling at 15.5 ft		S4: Similar to S3, bot 6".
	17.5	S5	20-35 50/3"	15	8	Top of rock ~19 ft. Roller bit to 20 ft.	TILL	S5: SILTY SAND WITH GRAVEL (SM) ~60% mostly fine sand, ~25% slightly plastic fines, ~15% gravel to 1/2 inch, olive. Glacial Till.
	20							
	22.5	C1	RQD 70%	60	54	lost ~10 gallons drill fluid from 23 to 25 ft	ROCK	C1: SCHIST, hard, slight weathering at joint surfaces, joints at ~30 degrees from horizontal and generally parallel to foliation, gray. Marlborough Formation.
	25 27.5 30							Bottom of Boring 25 ft Truck-mounted drill rig. 4-inch casing to 19 ft. Safety-hammer with rope and cathead for SPT. Backfilled with drill cuttings.

BLOWS PER 6 IN.–140 LB. HAMMER FALLING 30 IN. TO DRIVE A 2.0 IN. OD SPLIT SPOON SAMPLER
PEN–PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC–RECOVERY LENGTH OF SAMPLE
RQD–LENGTH OF SOUND CORES > 4 IN./ LENGTH CORED, %
S–SPLIT SPOON SAMPLE
U–UNDISTURBED SAMPLES, UF–FIXED PISTON
UO–OSTERBERG
⊻ GROUNDWATER

NOTES:
1: Groundwater at 10 ft depth at start of day 2/15/07.

PROJECT 07999-0
DATE

GEI Consultants

EXAMPLE SOIL DESCRIPTIONS

SANDY SILT (ML) ~60% slightly plastic fines, ~40% mostly fine sand, 1" thick layer of fine to medium sand with <20% fines, gray.

LEAN CLAY (CL) ~90% moderately plastic fines, ~10% fine sand, olive. Boston Blue Clay. Sv = 0.5, 0.5, 0.8 tsf, Qp = 1.0, 1.5, 1.6 tsf

Stratified CLAYEY SAND (SC) and WIDELY GRADED SAND (SW) SC layers 1 to 2 inches thick consist of fine sand with ~30% moderately plastic fines, gray. SW layers 1 to 4 inches thick consist of fine to coarse sand, ~10% gravel to 1/2 inch, <5% fines, brown. Hydraulic Fill.

EXAMPLE ROCK DESCRIPTIONS

(0-9"): GRANITE, hard, one piece, joint surface slightly weathered, pink.
(6-60"): PHYLLITE, joints ~ 45° generally parallel to foliation, 9" to 44" moderate to severe jointing and joint weathering. 44" to 60" single piece, green-gray.

ARGILLITE, medium hard, moderately weathered joints, gray. Cambridge Argillite.

GEOPROBE AND ROTOSONIC

When SPTs are not performed, note sample density (sands) or stiffness (clays) in description.

CRITERIA FOR DESCRIBING DILATANCY OF FINE-GRAINED SOILS

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

SPT: Standard Penetration Test

30-inch drop with 140-lb hammer
1 3/4 to 2 1/4 turns around cathead
2-inch O.D. split spoon sampler

ENV'L TERMINOLOGY FOR SOIL DESCRIPTIONS

- **Ash** - Typically silt-size to medium sand-size.
- Do not use the term "cinders." This is not a technical term. Instead, use "ash," "burnt wood," "burnt material," or a similar term.
- **Coal-like material** - If it looks like coal but you aren't sure.
- **Clinker** - Vitrified (glass-like) or heat-fused material. Often burned impurities in coal. Often looks like pumice, but heavier.
- **Slag** - Similar to clinker, but normally refers to residue from metal ore processing.

- **Sheen -** Iridescent petroleum-like sheen. Not to be used for a "bacterial sheen," which can be distinguished by its tendency to break up on the water surface at angles. Petroleum sheen will be continuous and will not break up.
- **Stained -** Use with a color ("brown-stained") to indicate that the soil is stained a color other than its natural (unimpacted) color.
- **Coated** - Soil grains are coated with NAPL (oil, tar, etc.). There is not enough NAPL to saturate the pore spaces. ("Split spoon sampler coated with brown oil." "Soil grains coated with gray substance with slight gasoline-like odor.")
- **Saturated -** The entire sample pore space is saturated with NAPL. If you use this term, be sure it is not water saturating the pore spaces. Depending on viscosity, the NAPL may drain from a soil sample. ("Sample saturated with green, sticky substance.")
- **Blebs -** Discrete sphericals of NAPL in a soil matrix that was not visibly coated or saturated. ("Occasional blebs of reddish-brown tar.")
- **Oil -** Exhibits a petroleum odor, different from MGP odors.
- **Tar -** Exhibits an MGP odor (e.g. naphthalene-like odor).

- **Odors -** Use terms such as "naphthalene-like odor" or "petroleum-like odor." Use modifiers (strong, moderate, slight) to indicate odor intensity.

STANDARD OPERATING PROCEDURE

SM-004 Test Pit Excavation

---

1. Objective

Describe methods for excavating test pits and documenting findings.

The test pit is used to characterize geologic strata, subsurface conditions and provide access for collection of representative soil samples from these strata.

2. Execution

- Before digging begins, proper permits and notifications must be obtained, in accordance with applicable rules or regulations.
- Make sure that utility clearance has been conducted. Contact the property owner to determine the location of underground utilities. Verify, with the contractor that local/regional utility clearance service has been contacted. Ask subcontractor to provide local/regional utility clearance service authorization number and record this in the field notebook. Show the contractor the approximate excavation area, and have the contractor confirm that the area is suitable for excavation. Clearance may require marking of subsurface explorations prior to contacting utility clearance service.
- Have contractors pressure wash or steam clean equipment before beginning field activities, if necessary.
- Observe the contractor excavating the designated area.
- If contamination is suspected, have the contractor place excavated material on plastic sheeting.
- During excavation, monitor ambient air for contaminants of concern identified in the site-specific Health and Safety Plan. Record readings in field notebook (see SOP FD-001 Field Notebook).
- Record in a field book or test pit log:

    - Test pit dimensions,
    - Soil classifications (see SOP SM-003 Soil Classification)
    - Visual and olfactory indications of contamination
    - Subsurface structures
    - Obstructions to excavation
    - Any other observations relevant to the project objectives
    - Take photographs of excavation and completed test pit walls, etc. (SOP FD-004 Photodocumentation).

- Record technical information on a PDA, test pit log form, or a field book.
- Label sample bottles (see SOP SC-002 Sample Handling).
- Screen soil samples for contaminants of concern and record results in the field notebook or test pit log.
- Collect soil samples from the test pit as designated in the work plan including sidewalls and bottom at designated depths, at strata changes, or based upon

field screening using remote sampling equipment (backhoe bucket, stainless steel remote sampler, etc.). Do not enter a test pit unless side slopes satisfy Occupational Safety and Health Administration (OSHA) regulations and other health and safety concerns have been addressed.

- Transfer soil samples to the appropriate glassware according to soil sampling SOPs (SOP SM-002 VOC Soil Collection and Preservation Method, etc.).
- Store samples on ice in a cooler (see SOP SC-002 Sample Handling and SOP FD-003 Chain-of-Custody).
- Backfill excavation as soon as possible with material as described in the field plan. Place the excavated material back in the excavation in approximately the same strata it came from.
- Segregate contaminated soil as necessary (see SOP SC-003 IDW). Properly identify segregated material and secure as described in the work plan.
- Measure dimensions of excavation and record in the field notebook or test pit log. If sampling locations are to be surveyed, mark the corners and provide surveyor with location ID.
- Sketch dimension and location of the test pit relative to a site reference point and record in the field notebook. Note the sample locations by number on a cross-section sketch and plan view sketch.

3. Limitations

- Never enter the excavation unless it is shored or the sidewalls are sloped in accordance with OSHA regulations and all proper personal protective safety precautions have been considered and implemented.
- Terminate excavation if the flow of groundwater into the excavation adversely affects the stability of the excavation (i.e., slumping). Make sure to note in the field notebook or test pit log the depth to ground water.
- Terminate excavation if drums, tanks, or other potential sources of contamination are observed. Record visible drum markings, labels, and any other pertinent information on the test pit log and in the field notebook. Photograph drums and materials. Consult with the project manager before filling the excavation.
- Do not leave an open test pit unattended.

4. References

Earth Manual (1968), United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, D.C., pp. 134-139.

OSHA Standards for Excavations, Department of Labor, Federal Register, 29 CFR Part 1926, Aug. 9, 1994.

5. Contacts

Douglas Bonoff
Mark Ensign

Field Descriptions of Samples at Urban Impacted Sites

The intent of this document is to provide field personnel guidelines for logging soil conditions and observed impacts in a consistent and factual manner. This guidance recognizes that prejudging field conclusions regarding the potential source(s) or nature of a particular impact should be avoided and instead conclusions should be based on multiple lines of evidence (field observations, laboratory physical and chemical analyses, historic site uses, location of observed impacts, etc.).

SOIL LOGGING

- All soils are to be logged using the **Unified Soil Classification System** (ASTM D 2488 field descriptions).
- A photograph of the entire sample core should be taken. Additional photographs may be necessary to document impacted material.
- A calibrated **PID** (Photoionization Detector) should be used to screen all soil samples. PID readings should be taken every 6 inches of recovery and the interval reading should be included on the boring logs.
- The soil sample core should be scored or cut along the long axis so that the all of the soil lithology can be observed, when practical.
- **Moisture terms**: dry, moist and wet.
- **Color terms –**Color terms should be used to describe the “natural color” of the sample as opposed to staining caused by contamination (see below).
- **Representativeness –** Soil logs should include specific notes if the field representative believes that there is a possibility the soil sample being described is not representative of the interval sampled or is indicative of multiple sources of contamination.
- **Intervals for Description –** the field description should be for discrete intervals within the sampler, specifically pointing out small-scale units and changes within each sample interval. The description should also include the amount of sample recovered and note other conditions (such as a change in drilling conditions, etc.), as well as consistently adjusting the sample interval described (i.e. – identify the percentage of sample actually recovered and note any potential causes of the loss if possible) and note other conditions (such as a change in drilling conditions, etc.).

DESCRIPTION OF CONTAMINANTS

Visual Contamination Descriptors

- **NAPL** (Non Aqueous Phase Liquid) – a separate phase liquid that may be lighter than water (LNAPL) or denser than water (DNAPL). NAPL arises from a variety of industrial sources and can have varying consistency (viscosity) and can range from non-viscous to highly viscous (taffy-like). NAPL observations should be accompanied by applicable olfactory with smell for industrial sources (see descriptors below) and other visual observations (e.g., color and viscosity).

- **Sheen –** iridescent sheen. This is not to be used to describe a "bacterial sheen", which can be distinguished by its tendency to break up at angles on the water surface; whereas a non-bacterial sheen will be continuous and will not break up.

- **Blebs –** discrete, spherical shaped NAPL in or on the soil matrix. Include additional descriptors to the extent practicable such as the approximate size and quantity (number of blebs or qualitative estimate) to the extent practical.

- **Coated –** soil grains are coated with NAPL – there is not sufficient NAPL present to saturate the pore spaces. Use modifiers such as light, moderate or heavy to indicate the degree of coating.

- **Saturated –** the entirety of the pore space for a sample interval is saturated with NAPL. Care should be taken to ensure that the saturation described is not related to water in the sample. Depending on the viscosity, NAPL saturated materials may freely drain from a soil sample and should be documented accordingly.

- **Stained –** visible, unnatural discoloration of the soil, with no visible free product.

- **Solid NAPL –** NAPL that is in a solid or semi-solid phase. The magnitude of the observed solid NAPL should be described (discrete granules or a solid layer).

  Other Visual Impacts and Descriptors– Other visual impacts that are not naturally occurring should also be noted along with appropriate visual descriptors. These other visual observations could include the observation of debris, wood chips, staining, anthropogenic materials, or other notable visual characteristics and general observations characterizing common urban fill. The above impacts should be described using other visual descriptors as applicable. Descriptors may include, but not be limited to, color, consistency, thickness, etc.

Olfactory Descriptors

- Note odors similar to mothballs, driveway sealer, highway paving oil or other odors that are acrid, burnt, or sulfur-like, etc.
- Other odors that are not believed to be natural should also be identified with descriptors such as organic, ammonia, sweet, chemical etc., as applicable.
- Use modifiers such as strong, moderate or slight to indicate intensity of the observed odor.
- In instances where multiple odors are present, a combination of descriptors should be used to clearly identify where these co-mingled impacts are present.

DNAPL/LNAPL

- **Density of NAPL –** a jar shake test can be performed to preliminarily determine in the field whether observed NAPL is either denser or lighter than water. Care should be taken in recording and interpreting the results, as experience indicates that the apparent result immediately following the test may change with time. Laboratory testing for density of the NAPL is recommended to confirm results. The depth at which the NAPL is encountered on soil with respect to the groundwater surface is not diagnostic and should not be used a basis for identifying the density of NAPL in the field.

- **Viscosity of NAPL –** if NAPL is present a qualitative description of viscosity should be made. The following should be used:

  Highly Viscous (taffy-like)
  Viscous (No. 6 fuel oil or bunker crude-like)
  Low viscosity (No. 2 fuel oil-like or water-like)

GROUNDWATER SAMPLING OBSERVATIONS

- Any observations of sheen, blebs, NAPL, smearing or coating of the sampling equipment, odor, etc. made during groundwater sampling are to be included in the groundwater sample collection log.

COLOR CHART (ATTACHED) For Use in Cross-Sections, Extent Maps, and Similar Interpretative Depictions

The color chart attached is intended to help visually depict the nature and location of impacts observed during an investigation. The chart would be used for new sites or sites transitioning from the Site Characterization to the Remedial Investigation phase (or are in the early stages of the Remedial Investigation phase). The colors should be included in investigation summaries on cross sections to support an understanding of the nature and extent of impacts. In addition, the colors may also be placed on boring logs (although not a requirement) in the final report. In either case, the colors will be used in interpretive depictions of nature and extent once the lines of evidence support a determination of the appropriate color selection. Since the investigation of a site is dynamic, the use of a particular color or a combination of colors may change if other lines of evidence suggest such a change is appropriate.

In instances where multiple impacts are present, a combination of colors should be used (such as a color with cross hatching) to clearly identify where these co-mingled impacts are present.

Color Descriptions of Samples at Urban Impacted Sites

		RGB Color	Auto Cad Index
🟥	**NAPL SATURATED**	255,0,0	10
🟪	**NAPL COATED MATERIAL**	255,0,255	210
🟫	**SOLID NAPL**	129,64,0	34
🟧	**NAPL BLEBS, GLOBS, SHEEN**	255,191,0	40
🟨	**STAINING, ODOR**	255,255,0	50
🟦	**INDUSTRIAL IMPACTS - (PETROLEUM OR OTHER UNNATURAL) SATURATION & SHEENS**	0,191,255	140
🟦	**INDUSTRIAL IMPACTS - (PETROLEUM OR OTHER UNNATURAL) STAINING & ODORS**	170,234,255	141
🟦	**WOOD CHIPS/BLUE DISCOLORATION/SULFER-LIKE ODOR**	0,0,255	170
🟩	**NO OBSERVED IMPACTS**	0,165,0	92

Note: In instances where multiple impacts are present, a combination of colors should be used (such as a color with cross hatching) to clearly identify where these co-mingled impacts are present.

Section 7

Groundwater (GW)

STANDARD OPERATING PROCEDURE

GW-001 Water Level and NAPL Measurement

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1. Objective

Describe procedures to measure the depth to water and non-aqueous phase liquid (NAPL) thickness in an open borehole, cased borehole, monitoring well or piezometer.

2. Equipment and Materials

Field forms and/or field notebook.

- Decontamination fluids
- Bailer
- Weighted cotton string
- Oil/Water interface probe
- Water level meter (if oil/water interface probe is not available)

Water level and NAPL measurements can be collected by a variety of methods. A water level meter is used to collect depth to water measurements however an oil/water interface probe or other methods must be used to gauge NAPL depths. An electronic oil/water interface meter, consists of a cable divided into incremental measurements of 0.01 feet, and probe that consists of an infra-red circuit that detects the presence of a liquid, and a conductivity circuit that differentiates between conductive liquid (water) and non-conductive liquid (LNAPL or dense non-aqueous phase liquid [DNAPL] product). Typically, a steady tone and light indicate a non-conductive liquid (e.g. product) and an intermittent tone and light indicate a conductive liquid (e.g. water). Refer to the manufacturer’s instructions for details. Alternately, water level and NAPL measurements can be collected using a water level meter, clear bailer and weighted cotton string. Each method of data collection is described below.

3. General Information

- The water level in a monitoring well or piezometer should be allowed to stabilize for a minimum of 24 hours after development or construction before groundwater elevation and/or NAPL measurements are collected. The water level in a borehole can be measured during drilling; however, this should be noted in the field notebook.
- Water levels in multiple wells should be collected within the shortest timeframe practicable.
- Water and NAPL levels should be measured from the designated survey point as specified by the surveyor or highest point (or “V” notch) on the PVC. If the well is new, mark the datum point with an indelible marker and note reference location in

field book. Discuss with the project manager what reference point should be used to collect water measurements for specific sites.

- Water level and/or NAPL measurements should be made before any water is removed from wells because doing so may influence groundwater levels in the area of the investigation.
- Measurements should be made approximately three times to confirm the measurement. Each time a measurement is made it should be determined to the nearest one-hundredth of a foot (0.01).
- Water level and/or NAPL measurements should first be collected at the wells that are least contaminated and proceed towards the wells that are most contaminated. Decontaminate the water level meter or oil/water interface probe prior to initial use and after use at each location. If NAPL is encountered at a well where it was previously not observed, contact your project manager before continuing.
- Refer to the oil/water interface probe or water level meter instruction manual for guidance on indicator signals, as these may differ by manufacturer.

4. Execution

4.1 Water Level and NAPL Measurements Using Interface Probe

- Open wells to the atmosphere and allow them to equilibrate prior to collecting LNAPL depth measurements.
- LNAPL Depth (if present): Measure the LNAPL/air interface by slowly lowering the interface probe to the LNAPL surface. Be ready to stop as soon as the probe signals the LNAPL surface.
- Record the depth to LNAPL.
- Groundwater Depth: Continue slowly lowering the probe until it signals the presence of water.
- Record the depth to water.
- The LNAPL thickness is determined by subtracting the water depth from the LNAPL depth.

The depth and thickness of DNAPL can sometimes be determined by slowly lowering the interface probe past the LNAPL (if present) and water layers. Record the depth to the DNAPL layer. Finally, measure the depth to the well bottom.

The DNAPL thickness is determined by subtracting the DNAPL depth from the depth to well bottom.

- Decontaminate the interface probe and tape according to SOP QA-001.
- Dispose of any NAPL-impacted debris properly.
- Check with the Project Manager if you are uncertain of the appropriate disposal method.

4.2 LNAPL Measurements Using Clear Bailer

If LNAPL is suspected at a site, an oil/water interface probe should be used when gauging water level and NAPL measurements. However, a water level meter and a clear bailer may be used instead to estimate approximate LNAPL thickness if an oil/water interface probe is not available.

- Open wells to the atmosphere and allow them to equilibrate prior to collecting LNAPL depth measurements.
- Slowly lower the water level meter until contact with fluid is indicated by the meter.
- Record the depth to fluid measurement.
- Lower a clear bailer into the well and slowly into the LNAPL. Do not submerge the bailer.
- Slowly raise the bailer out of the well and measure LNAPL thickness in the bailer using a ruler or tape measure.

Calculating Depth to Groundwater

The depth to water can be calculated as follows:

DTW = DTF + PT
DTW = Depth to Groundwater
DTF = Depth to Fluid
PT = Measured Product Thickness

Calculating Corrected Depth to Groundwater

Once the LNAPL thickness is known and the depth to groundwater is known, the corrected depth to groundwater can be calculated.

Corrected DTW = Static DTW – (PT x G)
DTW = Depth to Ground Water
PT = Measured Product Thickness
G = Specific Gravity (density of free product / density of water)

4.3 DNAPL Measurements Using Weighted Cotton String

A weighted cotton string may be used to estimate approximate DNAPL thickness.

- Secure cotton string.
- Secure clean steel nuts and/or washers.

- Tie the string to the nuts/washers, so that there is adequate weight.
- Lower the weighted string into the well slowly, until a firm bottom is sensed.
- Remove the weighed string and measure the DNAPL coated portion of the string.
- Record the thickness.
- Dispose of any NAPL-impacted debris properly. Check with the Project Manager if you are uncertain of the appropriate disposal method.

5. Health and Safety Considerations

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the site specific Health and Safety Plan (HASP). The collection and accumulation of NAPL presents the potential for significant hazards that need to be managed. A detailed job safety analysis (JSA) should be completed prior to the start of work.

6. Considerations

- Weak batteries in water level and oil/water interface meters frequently produce weak or gradual auditory and/or visual responses, making it difficult to accurately determine when the probe of the unit has come in contact with ground water or NAPL. As such, it is recommended that electronic ground water-level indicators be tested before they are brought out into the field.
- Electronic oil/water interface meters do not respond to distilled water. Do not use de-ionized water to test these units.
- Wells that are not vertical may result in probe contact with the side of the well casing providing a false measurement. Once the probe has come in contact with ground water in the well, water may be trapped by capillary action between the probe and the well casing. If this happens, the unit may continue to signal even after the probe has been raised above the ground water surface. The deeper the well, the more likely this problem may occur. To correct this, the cable should be raised several feet above the water and shaken to remove water from the probe. A new ground water-level measurement should then be collected. If the signals from the unit are not abrupt or reproducible, the probe and tape may need to be retrieved and dried off before trying again.
- Accumulation of sediment, organic material, or floating debris in the probe may also result in gradual or non-reproducible readings. Wells that are constructed with metal inner casings may lead to difficulties in collecting reproducible ground water-level measurements because the inner sides of the well casing are conductive.

- In some cases, a rubber grommet or metal centralizer may need to be placed on the probe so that it cannot contact the inner casing.
- Well gauging equipment should be properly decontaminated between wells and piezometers to avoid cross contamination.
- Water levels in wells may be influenced by changes in river stages, pumping of nearby wells, precipitation, tides, etc.
- Using a bailer to estimate LNAPL thickness can result in inaccuracies because successful use of the bailer is dependent upon the expertise of the operator and assumes the check valve does not leak upon retrieval.
- The optical sensor on interface probes may become damaged if solvents are used to clean NAPL from the probes.
- The optical sensor may become smeared when used to measure NAPL, rendering pinpoint accuracy to an estimate at best.
- Close attention to decontamination procedures will improve accuracy, operational life, and reduce the risk of cross contamination with other wells.
- LNAPL thickness can be affected by fluctuations in the water table. In some cases, an LNAPL's thickness may decrease when the water table rises, while its thickness increases as the water table drops. In other cases, fluctuating water tables may cause sudden appearances and disappearances of LNAPL layers.
- Monitoring points with LNAPL can pose a problem when measuring the level of groundwater. Floating LNAPL can depress the groundwater level in a monitoring well or piezometer and distort the measurement. Therefore, the Corrected Depth (CD) formula shown above should be applied to groundwater level measurements in monitoring points where LNAPL are present:
- Some interface probes are factory-calibrated based on an assumed conductivity of NAPL and water, both of which may vary. An interface probe that is functioning properly may not be able to discern different NAPLs at all sites.
- An interface probe may not successfully provide both LNAPL and DNAPL measurements in the same well because the probe is coated by LNAPL and loses its ability to detect DNAPL.
- DNAPL, in particular, may be only slightly heavier than water, or may be neutrally buoyant. As a result, it can be easily disturbed. Once it is disturbed, meaningful measurements can be difficult or impossible to obtain. As such, all tapes or probes used for measurements should be used slowly.

7. References

U.S. EPA Environmental Response Team Standard Operating Procedures SOP: 2043,"Water Level Measurement" REV: 0.0, 2/11/00

U.S. EPA Environmental Response Team Standard Operating Procedures SOP: 2044," Monitor Well Development" REV: 0.1, 10/23/01.

8. Contacts

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STANDARD OPERATING PROCEDURE

GW-002 Non-Aqueous Phase Liquid (NAPL) Recovery

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1. Objective

Provide procedural guidance for routine recovery of non-aqueous phase liquids (NAPL).

2. Equipment and Materials

The following materials and equipment may be necessary for this procedure:

- SOP GW-001 Water Level and NAPL Measurement
- Oil/water interface probe
- Appropriate pump and required tubing/piping
- Double check valve bailers and string
- Drums or buckets for NAPL collection
- Proper personal protective equipment (PPE) including gloves and protective eyewear
- Drum labels
- Field data sheets or logbooks
- Decontamination supplies and plastic sheeting
- Additional equipment identified by site-specific work plan and health and safety plan (HASP)

3. General Information

Refer to SOP GW-001 and record the depth to NAPL and depth to water measurements If you are using an oil/water interface probe, first check to see if the unit is functioning correctly. Note: De-ionized water will not provide a correct reading. Check the interface probe battery and replace if necessary.

Interface probes usually distinguish between NAPL and water by sounding solid or intermittent tones. See the manufacturer's instructions for details.

4. Execution

4.1 General Measurement Procedures

Using an oil/water interface probe will provide a depth to water and a depth to NAPL in each monitoring well. Refer to probe manual to determine changes between liquid types (water, light non-aqueous phase liquid [LNAPL] and dense non-aqueous phase liquid [DNAPL]). To achieve accurate depth measurements, ensure the oil/water interface probe is decontaminated (GEI SOP QA-001) prior to and between each measurement taken at each well.

To calculate the volume of NAPL in monitoring wells with well diameters specified below, use the following respective equations:

Light non-aqueous Phase Liquid (LNAPL) Volume

$$LNAPL\ V = (DTW - P_1) \times C$$

Dense Non-Aqueous Phase Liquid (DNAPL) Volume

$$DNAPL\ V = (TD - P_2) \times C$$

Where, V = Volume
DTW = Depth to Water
TD = Total Depth
P_1 = Depth to LNAPL
P_2 = Depth to DNAPL

Conversion factors (C) for wells based on well diameter size are noted in the table below.

Well Diameter (inches)	Conversion Factor (liters)	Conversion Factor (gallons)
2	0.6178	0.1632
4	2.4711	0.6528
6	5.561	1.469

Note: Well diameter sizes are noted for outer diameter. Conversion factors assume Schedule 40 PVC riser and screen, if well is constructed of different material appropriate conversion factors must be used to calculate accurate NAPL volume.

Once measurements have been taken and calculations have been made, collection of NAPL may commence.

4.2 NAPL Collection Procedures

Collection of NAPL shall be accomplished using common recovery techniques or technologies including:

- Peristaltic pump
- Bailer

Some projects require on-going NAPL recovery efforts. For these projects installation of dedicated recovery methods should be considered.

Special care shall be taken to prevent any recovered NAPL from spilling or coming into contact with the ground and sampling personnel. This includes the use of proper personal protective equipment (PPE), including gloves and protective eyewear (Tyvek® if necessary), along with plastic sheeting set beneath the pump, tubing, and collection container (sealed top 55-gallon drum or 5-gallon bucket with lid), and the surrounding work area. A site-specific work plan, HASP and job specific job safety analysis need to be developed prior to the start of work. The specific operating procedures for common recovery methods are discussed in the following sections.

4.2.1 Sampling and Recovery via Peristaltic Pump:

LNAPL

- Take and record the required measurements prior to commencing pumping.
- Cut a length of poly tubing (T1) that is long enough to extend approximately 12-inches beyond the LNAPL layer. Cut an additional length of poly tubing (T2) that will be connected to the discharge side of the peristaltic pump silicone tubing that is long enough to extend from the pump to the NAPL collection container. Cut a length of silicone tubing (approximately 8-inches) for use in the peristaltic pump head.
- Insert the silicone tubing into the peristaltic pump head. Check the flow direction of the pump to ensure that the pump will be removing fluid and not pumping air into the well when removal begins.
- Insert T1 into the intake side of the silicone tubing. Lower the intake side into the well and secure in place just below the top of LNAPL.
- Insert T2 into the discharge side of silicone tubing and secure to the NAPL collection container with a clamp.
- Turn pump flow rate to lowest setting. Turn the pump on and slowly increase the pump rate to begin LNAPL removal from the well. Use the oil/water interface meter to measure the depth to LNAPL. Lower the intake tubing as necessary until all of the LNAPL has been recovered from the well.
- Once the LNAPL has been recovered from the well, collect and preserve a sample if required, in accordance with laboratory standards.
- Following completion of LNAPL recovery, disconnect the tubing from the pump, secure the well and road box, and clean/decontaminate the pump and oil/water interface probe, prior to moving to the next location.
- Impacted tubing will either be containerized for proper disposal or left in well for reuse.

DNAPL

- Take and record the required measurements prior to commencing pumping.
- Cut a length of poly tubing (T1) that is long enough to extend to the bottom of the well including additional length to attach to the pump intake. Cut an additional length of poly tubing (T2) that will be connected to the discharge side of the

peristaltic pump silicone tubing that is long enough to extend from the pump to the NAPL collection container. Cut a length of silicone tubing (approximately 8-inches) for use in the peristaltic pump head.

- Insert the silicone tubing into the peristaltic pump head. Check the flow direction of the pump to ensure that the pump will be removing fluid and not pumping air into the well when removal begins.
- Insert T1 into the intake side of the silicone tubing. Lower the intake side into the well and secure in place just above the bottom of the well.
- Insert T2 into the discharge side of silicone tubing and secure to the NAPL collection container with a clamp.
- Turn pump flow rate to lowest setting. Turn the pump on and slowly begin to remove DNAPL from the well. DNAPL removal will be complete when the pump begins to discharge water. Use the oil/water interface meter to check the DNAPL thickness during the removal process. Take care not to pump an excessive amount of water.
- Once the DNAPL has been purged from the well, collect and preserve a sample if required, in accordance with laboratory standards.
- Following completion of DNAPL recovery, disconnect the tubing from the pump, secure the well and road box, and clean/decontaminate the pump and oil/water interface probe, prior to moving to the next location.
- Impacted tubing will either be containerized for proper disposal or left in well for reuse.

4.2.2 Sampling and Recovery via Double Check Valve Bailer:

LNAPL

- Take and record the required measurements prior to commencing bailing.
- Ensure the work area is covered in plastic sheeting to avoid potential spills of water and/or NAPL.
- Tie the bailer to a piece of string that will allow the bailer to reach just below the LNAPL layer. Use the oil/water interface meter to determine the appropriate depth.
- Using slow and controlled motions while lowering (and raising) the bailer to the appropriate depth, commence bailing LNAPL out of the well and draining the bailer directly into collection container.
- Once the LNAPL has been purged from the well, collect and preserve a sample, if required, in accordance with laboratory standards.

DNAPL

- Take and record the required measurements prior to commencing bailing.
- Ensure the work area is covered in plastic sheeting to avoid potential spills of water and/or NAPL.
- Tie the bailer to a piece of string that will allow the bailer to reach the bottom of the well.
- Using slow and controlled motions while lowering (and raising) the bailer to the bottom, commence bailing DNAPL out of the well and draining the bailer directly into collection container.
- Once the DNAPL has been purged from the well, collect and preserve a sample, if required, in accordance with laboratory standards.

4.3 Waste Management and Disposal

Investigation derived waste should be managed in accordance with GEI SOP SC-003. DNAPL waste management and disposal should be evaluated on a site by site basis.

4.4 Troubleshooting Information

If there are any performance problems with the oil/water interface probe which result in inability to achieve the proper measurements presented in Section 5.1, or if there are any problems with the peristaltic pump, consult the appropriate section of the probe instruction manual for the checkout and self-test procedures. If the problem persists, consult the manufacturer's customer service department immediately for further instructions.

Lower temperatures can affect the ability to pump and/or bail NAPL. Weather should be taken into consideration when scheduling gauging and recovery sampling events.

4.5 Data and Records Management

All information pertaining to maintenance of the oil/water interface probe and the peristaltic pump shall be maintained in the project file. Field measurements (depth to water, NAPL, etc.) and all calculations (NAPL column length, volume of NAPL, etc.) shall be recorded on the appropriate field data sheets or in the logbook consistent with GEI SOP Section 5.

4.6 Limitations

- NAPL gauging and recovery can be challenging and requires adaptive thinking. A variety of measurement and collection techniques may be necessary to properly execute the work.
- Exposure to NAPL can accelerate the required maintenance/replacement intervals for tools and equipment.

5. Health and Safety Considerations

The health and safety considerations for the work associated with this standard operation procedure, including both potential physical and chemical hazards, will be addressed in the site specific Health and Safety Plan (HASP). The collection and accumulation of NAPL presents the potential for significant hazards that need to be managed. A detailed JSA should be completed prior to the start of work.

6. References

U.S. EPA. Ground Water Issue: Dense Non-aqueous Phase Liquids, EPA/540/4-91-002, March 1991.

7. Contact

Jerry Zak (860) 368-5404 Glastonbury

STANDARD OPERATING PROCEDURE

GW-003 Low Flow (Low Stress) Groundwater Sampling

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1. Objective

Describe methods to collect groundwater samples most likely to produce results that represent aquifer conditions.

Low-flow purging is limited to wells that, with sustained pumping, exhibit no continuous drawdown.

2. Execution

- Prior to groundwater sampling consult with the project manager to confirm that the type of pump is appropriate and consistent with the approved work plan.
- Record activities in the field notebook (see SOP FD-001 Field Notebook) and on a Monitoring Well Sampling Record such as the examples in Attachment A. Use a separate form for each sampling location and event. You may forego the forms and record all information in the field notebook if the Project Manager approves.
- Calibrate pH, temperature, Specific Conductance (SC), turbidity, Dissolved Oxygen (DO), and Oxidation-Reduction Potential (ORP) on the meter(s). Use calibration methods provided by the manufacturer of the equipment. Note that appropriate calibration for dissolved oxygen requires a water saturated air environment, along with measured temperature and barometric pressure.
- Begin with the monitoring well believed to have the least contaminated groundwater and proceed systematically to the well with the most contaminated groundwater. Check the well, the lock, and the locking cap for damage or evidence of tampering.
- Slowly and gently measure the depth to water with a water level probe and/or oil-water interface probe. Do not measure depth to well bottom at this time (wait until sampling has been completed). Measure water level in accordance with SOP GW-001 Water Level Measurement.
- Attach new polyethylene or Teflon lined tubing to the sampling pump and the flow-through cell that contains the meter probes.
- Slowly and gently insert new polyethylene or Teflon lined tubing to the pump intake (or use dedicated tubing that remains in the well) and to the middle of the saturated screened interval or to the pre-determined sampling depth.
- The tubing intake should be kept at least two (2) feet above the bottom of the well to prevent disturbance or suspension of any sediment or Non-Aqueous Phase Liquid (NAPL) present in the bottom of the well. Record the depth of the pump intake.

- If possible, position your sampling equipment and tubing so that it is in the shade. The goal is to minimize the effect of sunlight raising the temperature of water being collected.
- Start the pump on the lowest setting and increase slowly until flow begins. Adjust the pumping rate so that drawdown in the well is minimal (0.3 feet or less, is desirable but not mandatory). Use a pumping rate between 100 to 1,000 milliliters per minute (mL/min) (or approximately 0.1 to 1 quarts per minute). Measure flow rate on the pump or using a graduated container every 3 to 5 minutes and record. The minimum purge volume will be twice the combined volumes of the sampling string (i.e. pump, tubing, and flow-through cell).
- While purging, record water levels every 3 to 5 minutes and monitor and record the water quality indicator parameters: pH, temperature, specific conductance (SC), dissolved oxygen (DO), and turbidity. If specified in the field sampling plan also include ORP.
- Purging is complete when, after three consecutive measurements, the water quality parameters have stabilized as follows:
    - pH (+/- 0.1 standard units)
    - temperature (+/- 3%)
    - SC (+/- 3%)
    - turbidity (+/- 10% if >5 NTU; if 3 values are <5 NTU, consider the values as stabilized)
    - DO (+/-10% if >0.5 mg/L; if 3 values are <0.5 mg/L, consider the values as stabilized)
    - ORP (+/- 10 mV)

- Dispose of purge water according to the field plan.

Sample Collection:

- Following purge, remove the discharge tubing from the flow-through cell. Do not disturb pump and tubing between stabilization and sample collection.
- Fill sample containers directly from the sampling device in order of decreasing volatility (i.e., Volatile Organic Compounds (VOC) samples are collected first; see SOP SC-002 Sampling Handling). Fill all containers from the discharge end of the tubing. Collect samples at a flow rate equal to the steady state purge rate.
- If not using a dedicated pump, remove sampling device and decontaminate (see SOP QA-001 Equipment Decontamination). Discard used tubing.
- Store samples in a cooler on ice for transport to the laboratory.
- Measure depth to bottom of well.

- Secure the well cap.

3. Limitations

- Prior to departure for the field, obtain available information on well construction for use in field investigation (i.e., screen and riser material, well diameter and depth, screened interval, optimum sampling depth, etc.).
- If possible, when using dedicated equipment, install equipment into well at least 24 hours before sample collection to minimize disturbance of the water column and/or suspension of sediments or NAPL on bottom.
- If water quality indicator parameters do not stabilize after removing 3 to 5 well volumes or 2 hours, contact the Project Manager. Three options will be available: 1) continue purging until stabilization; 2) discontinue purging and do not sample; or 3) discontinue purging and sample.
- The key indicator parameter for VOCs is DO. The key indicator parameter for all other samples is turbidity.
- Fill all sample containers with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.
- Consult with the project manager before field filtering samples for metals if using low-flow sampling.
- Be aware of any preservatives in the sample bottles and handle with care, in accordance with the Health and Safety Plan.

4. References

Standard Reference for Monitoring Wells (April 19, 1991), Massachusetts DEP, DEP Publication No. WSC-310-91.

Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground Water Sampling (1994), M.J. Barcelona, H. A. Wehram, and M.D. Varljen, Ground Water, Vol. 32, No. 1, 12-22.

Low-Flow Purging and Sampling of Ground Water Monitoring Wells with Dedicated Systems (1995), R.W. Puls, and C.J. Paul, Groundwater Monitoring and Review, Summer 1995 116-123.

Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (2010), EQASOP-GW 001 Low Stress (Low Flow) SOP, Revision 3, U.S. Environmental Protection Agency, Region I, January 19, 2010.

Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling, (1998), Ground-Water Sampling SOP, Final, U.S. Environmental Protection Agency, Region II, March 16, 1998.

RCRA Ground-Water Monitoring: Draft Technical Guidance, (1993), U.S. Environmental Protection Agency, EPA/530-R-93-001.

To Filter, or Not to Filter, That is the Question, (1997), Special Topics Subcommittee Letter Report EPA-SAF-EEC-LTR-97-011, April 29, 1997, Meeting, U.S. Environmental Protection Agency, Science Advisory Board Environmental Engineering Committee, September 5, 1997.

Should Filtered or Unfiltered Groundwater and Surface Water Samples be Collected for the Risk Assessment?, (1995), MCP Q&A: Subparts I and J, Special #4, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection (DEP), February, 1995.

5. Attachments

Attachment A - Monitoring Well Sampling Record

6. Contacts

Brian Conte
Saskia Oosting

GEI Consultants

MONITORING WELL SAMPLING RECORD

PID Reading ______________

Job Number ______________

Location ______________

Well Number ______________

Job Name ______________

By ______________ Date ______________

Measurement Datum ______________

Pre-Development Information

Time (start) ______________

Water Level ______________

Total Depth of Well ______________

One Purge Vol ______________

Three Well Volume ______________

Water Characteristics

Color ______________ ______ Clear ______ Cloudy

Odor ______ None ______ Weak ______ Moderate ______ Strong

Any films or immiscible material ______________

***Volume* (gal)**	**Time**	**pH**	**Temp (°C)**	**Spec. Conductance (µS/cm)**	**Turbidity (NTU)**	**DO Conc. (mg/L)**	**ORP (mV)**	**TDS**

Total Volume Removed (gal) ______________

Temperature (°C) ______________

DO Concentration (mg/L) ______________

pH ______________

Specific Conductance (µS/cm) ______________

ORP (mV) ______________

TDS ______________

Post Development Information Time (Finished) ______________

Water Level ______________ Total Depth of Well ______________

Approximate Volume Removed (gal) ______________________________

Water Characteristics

Color ______________________ _____ Clear _____ Cloudy

Odor _____ None _____ Weak _____ Moderate _____ Strong

Any films or immiscible material ____

Comments

Low-Flow Groundwater Sampling Form

Project number and name ______________________ Sampling personnel ______________________ Sample date ____________ Well ID ____________

Well location description: ______________________

____

Well Construction

Well diameter ______________

Well measurement point ______________

Roadbox condition ______________

Well screen interval ______________

Well depth ______________

Sampling Information

Initial depth to water ____________ Time: ____________

Sample intake depth ______________________

Pump type and ID ______________________

Stabilized flow rate ______________________

Stabilized flow rate = flow rate with no further drawdown

Samples Collected

VOCs 8260 ☐

SVOCs 8270 ☐

VPH ☐

EPH ☐

Metals ☐

PCBs ☐

Other ☐

Field values at time of sample collection:

Time: ____________ Depth to water: ____________

Sp.Cond. ____________ mS/cm

DO ____________ mg/L

ORP ____________ mV

pH ____________ s.u.

Temp. ____________ °C

Turb. ____________ NTU

Cumulative Time (min.)	Volume (gal)	Water depth (ft)	Temp. (°C)	Sp.Cond. (mS/cm)	D.O. (mg/L)	pH (s.u.)	ORP (mV)	Turb. (NTU)
Typical Groundwater Values			5 to 15	0.05 to 5	0 to 4	5 to 7	-100 to +500	aim for <10

Notes: ______________________

Sample Information:

Sample ID ______________________

Sample Time: ______________________

Color: ______________________

Turbidity: ______________________

Field Filtered YES / NO Analyses: ____________

Filter type: ______________________

Odor/Sheen/NAPL ______________________

Duplicate Collected YES / NO

If yes, duplicate ID: ______________________

Purge water disposal? to ground drummed other:

Well Volume Conversion:

Diam. (in)	Factor (gal/ft)
1	0.04
1.5	0.09
2	0.16
4	0.65
6	1.50

well volume =
3.14 x (r)^2 x 7.48 gal/ft
where r = 1/2 diameter in ft

Stabilization Criteria:

Sp.Cond. +/- 3%
DO +/- 10%
ORP +/- 10 mV
pH +/- 0.1 Std Units
Temp. +/- 3%
Turb. +/- 10% if values >1 NTU

Guidance:

1. Position tubing at midpoint of saturated screened interval
2. Minimize drop in water level and purge until parameters are stable
3. Disconnect flow thru cell during sampling
4. Call Project Manager if issues arise (e.g. stabilization takes more than 2 hrs, well goes dry, odd data).
5. For VPH and VOC samples, if stabilization flow rate is less than 200 ml/min, contact PM

STANDARD OPERATING PROCEDURE

GW-004 pH and Temperature Measurement

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1. Objective

Describe methods for measuring the pH and temperature of liquids using a combination pH/temperature meter.

2. Execution

Calibration

- Calibrate the meter according to the equipment manufacturer's instructions at the beginning of each day of use. Calibration for pH shall be performed using at least two buffer solutions. Solutions chosen should be similar to the expected pH of the liquids tested (pH 7 and 4 buffer solutions are preferred in most cases for groundwater or surface water measurements).
- Check calibration at the end of the day by reading the two solutions used in calibration. Also perform additional field checks as needed based on observed readings (i.e., inconsistent readings). Record measurements and time of measurement in the field book or sample sheet. If the readings are outside +/– 0.2 pH units, recalibrate the meter.

Sample Measurement

- Immediately prior to testing a sample, decontaminate testing container and probe assembly with one rinse of distilled water. Do not use methanol to rinse the probe. Methanol rinses could damage the probe.
- Gently dry the probe with a paper towel and shake beaker to remove excess solution. Visually inspect the bottom of the probe to ensure that liquid or sediment is not trapped between outer casing and probe.
- Pour the sample into the testing container and insert both temperature and pH probe. Stir sample for 30 seconds using both probes. Let the probes equilibrate in the sample solution for another 30 seconds. Measure and record the temperature. Measure and record pH reading after stabilization or 60 seconds, whichever is sooner. A reading has stabilized if pH units have not changed +/– 0.1 pH units during a 30 second period.
- Record pH to the nearest 0.1 unit and temperature to the nearest whole number.

3. Limitations

- Coatings and particulates may affect the response of the probe; more thorough cleaning using a weak alconox solution and distilled water rinse and gently wiping the probe surface with a paper towel may be required to clean the surface of the probe.

- Temperature affects both the response of the instrument to pH and the actual pH of the sample. The Automatic Temperature Compensation (ATC) function compensates for the variation in the response of the meter only. Therefore, the pH must always be reported with temperature.
- The probe is a fragile thin glass bulb surrounded on three sides by a plastic casing. Care must be taken in handling the probe to avoid breakage.
- Do not use buffer solutions past their expiration date.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Contacts

Brian Conte
Saskia Oosting

STANDARD OPERATING PROCEDURE

GW-005 Turbidity Measurement

1. Objective

Describe calibration and use of a Hach nephelometer/turbidimeter.

The meter is used to measure turbidity of liquids by quantifying how much light passes through them. Turbidiity readings are required to be read using a portable (e.g Hach) instrument directly from the tubing before going through the flow-through cell.

This SOP is specific to a Hach turbidimeter. Follow manufacturer's recommendations for other meters.

2. Execution

i. Turn the meter "ON".
ii. Rinse the sample cell 3 times with distilled water.
iii. Fill the cell to the fill line with distilled water and then cap the cell.
iv. Wipe off excess water and streaks with a non-abrasive lint-free paper or cloth (preferably lens paper).
v. Open the cover and insert the cell (arrow to the front) into the unit and close the cover.
vi. Press "READ" and wait for the 'light bulb' icon to go off. Record the reading.
vii. Using the Gelex standards, repeat steps above. Record all measurements (note anomalies).
viii. Fill the cell with sample liquid to the fill line (about 15 mL) and replace the cap on the cell.
ix. Wipe off excess water and any streaks with a non-abrasive lint-free paper or cloth (lens paper).
x. Press "I/O" and the instrument will turn on. Place the meter on a flat, sturdy surface. Do not hold the instrument while making measurements.
xi. Insert the sample cell, arrow to the front, in the instrument. Close the lid.
xii. Select manual or automatic range selection by pressing the range key.
xiii. Use signal average mode if the sample causes a noisy signal (display changes constantly). Select signal averaging mode by pressing the "Signal Average" key.
xiv. Press Read. The display will show "---- NTU" and then the turbidity in NTU. Record the result after the lamp symbol turns off.
xv. Rinse the cell with distilled water.
xvi. Confirm the validity of the sample measurement by double-checking with one of the Gelex standards.

xvii. Periodically check the turbidity meter during the day by using the Gelex secondary standards provided.

xviii. Perform a post calibration at the end of the day and record all measurements.

3. Limitations

If the turbidity measurements are for National Pollutant Discharge Elimination System (NPDES) reporting purposes, all samples with values above 40 NTU must be diluted with turbidity free water (e.g. distilled water) and sample turbidity is calculated by multiplying the reading of the diluted sample by the dilution factor.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Contacts

Brian Conte
Saskia Oosting

STANDARD OPERATING PROCEDURE

GW-006 Specific Conductance Measurement

1. Objective

Describe standard methods to measure conductivity of water using a field conductivity meter.

2. Execution

- Calibrate the meter according to equipment manufacturer's instructions at the beginning of each day of use. Calibration shall be performed using a standard KCl or other solution recommended by the manufacturer.
- Record the make, model, and serial or identification number of the instrument and calibration information in the field notebook.
- Check calibration at the end of the day by measuring the standard used in calibration and record in field book. Also perform additional field checks as needed based on observed readings (i.e., inconsistent readings). If the readings are outside +/- 0.02 mS/cm, the meter must be recalibrated. Initial calibration should be conducted under the same conditions (i.e., temperature, and location) of field testing.
- Immediately prior to testing a sample, decontaminate testing container and probe assembly with distilled water.
- Gently dry the probe with a paper towel and shake container to remove excess solution.
- Pour sample into the container and insert probe. Stir sample with the probe for approximately 10 seconds. Let the probe equilibrate in the sample solution for another 30 seconds. Measure conductivity and record in the field notebook.
- Record conductivity to the nearest whole number.

3. Limitations

- Oily coatings and particulates may affect the probe's response; more thorough cleaning using a weak alconox solution and distilled water rinse and gently wiping the probe surface may be required to clean the surface of the probe.
- If sample liquid is contaminated, (e.g. stained, conductance >0.75 mS/cm), rinse probe with distilled water immediately after measuring sample to minimize fouling of probe.
- Do not use calibration solutions past their expiration date.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Contact

Brian Conte
Saskia Oosting

STANDARD OPERATING PROCEDURE

GW-007 Dissolved Oxygen Measurement

1. Objective

Describe calibration and field use of dissolved oxygen meter.

2. Execution

- Place instrument in the intended operating position (vertical, tilted, or horizontal) before it is prepared for use and calibrated.
- Recalibration may be necessary when the instrument operating position is changed.
- Attach the prepared probe to the Probe connector of the instrument and adjust the retaining ring finger tight. Check that membrane is intact and check for presence of air bubbles under membrane. If bubbles are present or membrane is damaged, prepare probe again according to manufacturer's instruction.
- Place approximately 1/8 inch of water into the bottom of the calibration cup. Place the probe into the cup and engage only one thread of the calibration cup onto the probe to ensure that the DO probe is readily vented to the atmosphere. Make sure the DO and temperature probes are not in contact with the water. Wait approximately 10 minutes for the air in the calibration cup to become water saturated and for the temperature to equilibrate.
- Calibrate meter according to the procedures outline in the instrument manual. Calibrate probe to a zero oxygen solution provided by manufacturer, and water saturated air.
- The calibration procedure may require correction factors or input of site-specific barometric pressure and temperature. Correction factors can be found at:

  http://water.usgs.gov/owq/FieldManual/Chapter6/6.2_v2.1.pdf

- Otherwise, use appropriate instruments at the site to determine temperature and pressure.
- Perform Dissolved Oxygen Measurement using the following procedure:
  - i. Submerge probe in flow-through chamber or water body.
  - ii. Gently raise and lower probe in sample.
  - iii. Allow sufficient time for probe to stabilize to sample temperature and dissolved oxygen.
  - iv. Read and record the temperature and the value of the dissolved oxygen in mg/L.
  - v. Document field analysis data and general observations in the field log book or groundwater sampling sheet.

3. Limitations

- Collect DO measurements in the field during sampling. Storing samples in containers will alter the DO concentration of the sample.
- Detection Limit (DL) = 0.1 mg/L for 0-10 mg/L range; do not record values less than Detection Limit: a zero reading is recorded < 0.1 mg/L.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Contacts

Brian Conte
Saskia Oosting

STANDARD OPERATING PROCEDURE

GW-008 Temporary Groundwater Sampling Points

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1. Objective

To define the procedures for installation of temporary groundwater sampling points (hereafter referred to as well point) for measuring depth to groundwater and collecting groundwater samples. Well points may aid in the placement of permanent monitoring wells.

A well point is a small diameter (1-2 inch) probe constructed of continuously wrapped stainless steel or wrapped stainless steel gauze screen over perforated carbon steel pipe. No filter or gravel pack is used in the installation.

Well point installations are not the only type of temporary monitoring wells. Alternative temporarily well constructions should be discussed with the project manager and may be more appropriate based on-site conditions.

2. Execution

2.1. Installation

- The well point can be placed with the use of a conventional hollow-stem auger rig, Geoprobe®, slide hammer, jack hammer, rotary hammer, or by hand.

- The well point may be driven through the unsaturated zone only in known "clean" soils. Driving the well point through contaminated soil may carry contamination downward with the point resulting in analytical sample results which are biased high. In areas with contamination above the desired screening zone, the well points should be installed with the aid of either hollow-stem augers or Geoprobe®, to “case off” contamination from the upper layer.

- If the well point is to be installed in an oversized (20% larger than the well point) pre-drilled hole, the hollow-stem augers or bull drive point must be advanced to a point which is just above the targeted sample zone. The well point is then placed in the hole and advanced beyond the bottom of the hole by hammering or pushing into place. The use of pre-drilled holes will reduce clogging of well point screens when driving.

- If the well point is used for piezometeric data, make a survey mark on top of the casing as a reference point for water level measurements.

- Caution must be used when using well points in areas of contaminated soil. Possible cross contamination may be introduced to the screen as it passes through the zone of contamination.

2.2. Sampling Procedures

Development of a well point is not required prior to sampling. Sampling of groundwater or collecting piezometric data must be performed by one of several recommended methods described in this manual.

After sample collection, (See Groundwater Sampling SOP) the well point is removed by back hammering or pulling the tool out with the rig hydraulics.

3. References

ASTM D6001 - 05 Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

Ground Water and Wells. Johnson Division, UOP Inc.; St. Paul, Minn. 1982. p277-294.

Ground Water Manual - A Water Resources Technical Publication; U.S. Dept. of Interior, Bureau of Reclamation. Government Printing Office, Washington DC 1977.

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91.

4. Contacts

Brian Conte
Saskia Oosting

STANDARD OPERATING PROCEDURE

GW-009 Potable Well Sampling

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1. Objective

Describe methods to collect a drinking water supply sample and to reduce the bias of system related variables (pumps, piping, holding tanks, etc.).

2. General Information

- Inquire if any treatment units are used on the system. Softening (pH adjustment), iron removal, turbidity removal, and chlorination are often used; these may give misleading results depending upon the parameters of interest. Consult with the project manager if these treatment units may affect the sample to be collected.
- Home carbon filters used for the removal of organics have become increasingly popular. Basement and outside faucets may by-pass such treatment systems.
- Important considerations to record in the field book, if available, are:
    - Well driller and date drilled
    - Construction of well and casing depth
    - Well and pump location
    - Well depth and pump capacity (if available)
    - Storage tank capacity
    - Treatment or conditioning unit (if any)
    - Plumbing arrangement
    - Possible sample collection points
    - Distance of well to any septic systems or underground storage tanks
    - Aesthetic information (color, odor, observed suspended material)
- If possible, obtain the name(s) of the resident or water supply owner/operator, the resident's mailing address, and the resident's home and work telephone numbers. The information is needed so that the residents or water supply owner/operators can be informed of the results of the sampling program.
- For long term monitoring projects a specific tap or faucet should be designated as the target sample access point for consistency and data comparability of future samples.

3. Execution

- If possible, collect the sample from a tap or spigot located at or near the well head or pump house and before the water supply is introduced into any storage tanks or treatment units.
- It may not be possible to collect the sample at or near the well head or pump house.
- If the sample must be collected at the downstream side water tanks/system equipment, calculate the volume of water in the system prior to the sampling point. For example, if the closest sampling point follows a 30-gallon pressure

tank and four gallons of water in the piping then a 34 gallon volume should be recorded.

- If possible, purge at least three volumes of water in the system prior to the sampling point. Purge a minimum of one-volume. This allows a complete exchange of fresh water where the sample is collected and avoids sampling stagnant water.
- If the volume of water cannot be determined or the owner prohibits purging of the full one-volume, then a 15-minute purge time should be used. The project manager should be informed that the sample was collected in this manner and the information should be recorded in the field book.
- Home faucets, particularly kitchen faucets, usually have a screen (aerator) installed on the discharge. The screen must be removed prior to sampling for bacteria or for volatile organics, since the screen tends to aerate the water and some organics may be lost. Also, when sampling for bacteria, do not take a sample from a swivel faucet since the joint may harbor a significant bacterial population.
- Open several taps during the purge to ensure a rapid and complete exchange of water in the tanks and reduce system backflow.
- After purging for several minutes, measure the turbidity, pH, specific conductivity, and temperature of the water. Continue to monitor these parameters until three consistent readings are obtained. Consistent readings means:
    - pH remains constant within 0.1 standard units.
    - Specific conductance and turbidity does not vary more than 10 percent. Turbidity readings should be below 10 Nephelometric Turbidity Units (NTUs).
    - Temperature remains constant.
- After three consistent readings have been obtained, collect the sample.
- If consistent readings cannot be attained, but adequate volume has been purged, collect the sample.

4. Limitations

- When sampling for bacterial content, the sample container should not be rinsed before use due to possible contamination of the sample container or removal of the thiosulfate dechlorinating agent (if used).
- Homeowners' plumbing systems should not be tampered with in any way except for removal of the faucet screen (aerator) with permission of the homeowner.
- When filling any sample container, care should be taken that no splashing drops of water from the ground or sink enter into either the bottle or cap.
- When sampling at a water treatment plant, samples are often collected from the raw water supply and the treated water after chlorination.
- Do not remove the pump from a homeowner's well unless the removal is authorized by the homeowner and is performed by a licensed pump installer.
- Continually running wells do not require purging and can be sampled immediately.

5. References

Potable Water Supply Sampling, United States Environmental Protection Agency, Region 4, SESDPROC-305-R1, November 1, 2007.

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

Ground Water and Wells. Johnson Division, UOP Inc.; St. Paul, Minn. 1982. p277-294.

Ground Water Manual - A Water Resources Technical Publication; U.S. Dept. of Interior, Bureau of Reclamation. Government Printing Office, Washington DC 1977.

6. Contacts

Brian Conte
Saskia Oosting

STANDARD OPERATING PROCEDURE
GW-010 Slug Tests

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1. Objective

Describe methods to use slugs, pressure transducers, and data loggers to collect data that will support calculation of horizontal hydraulic conductivity of distinct geologic strata.

General Information

Slug tests are performed on single monitoring wells to estimate the hydraulic conductivity of the aquifer in which the well is screened. The test consists of adding or removing a known volume (slug) to or from the well to instantaneously change the water level. Subsequently, the recovery of the water level back to the static water level is measured. The resulting data are used to determine the hydraulic conductivity of the aquifer test zone using an appropriate analytical method.

Falling head tests can only be performed in fully-penetrating wells (well screened completely below the water table). Rising head tests can be performed in both fully- and partial-penetrating wells.

2. Execution

2.1 Setup

- Determine how water levels will be recorded. If the geologic materials in the test zone are expected to be slightly permeable (e.g., a glacial till or clay), then measurements may be recorded manually with an electronic water level indicator. If the geologic materials in the test zone are expected to be moderately- or highly-permeable (e.g., outwash sands), record measurements using a pressure transducer attached to an automatic data logger.

  The remainder of this SOP assumes that an automatic data logger is being used to measure water levels.

- Check to see if test equipment functions prior to leaving for the site.
- Decontaminate the transducer and cable using alconox and distilled water. Do not use methanol. Do not use transducer in wells containing non-aqueous phase liquid (NAPL).
- Make initial water level measurements
- Test wells in the following order: from the least contaminated to the most contaminated, and from low to high expected permeability, where possible.
- Measure the static water level (i.e., depth to water) in the well to be tested manually using an electronic water level indicator. Record all

measurements taken during the test in the field log book or on the attached log form.

- Install the pressure transducer as far below the deepest point of insertion of the slug bar or bailer as possible. Allow the transducer to thermally equilibrate for 15 to 30 minutes (to allow instrumentation wiring to expand/contract) before measurements are taken.
- Secure the transducer cable at ground surface with tape or weight to keep the transducer at a constant depth.
- Cover sharp edges of the well casing with duct tape to protect the transducer cables.
- Transducer measurement setup: For wells screened in sand and silty sand, a linear setting of one reading per second is generally used. In coarser soil where full recovery may occur over a few seconds, a linear setting for more frequent readings is necessary. If a transducer is used for silt and clay, a linear setting of one reading per minute, or a logarithmic setting, may be used to avoid risk of exceeding the memory capacity of the transducer.

2.2 Field Procedure – Rising Head Test

In this test, a slug is inserted in the well prior to the test and the water level is allowed to return back to static level. The test is then started by removing the slug from the well and immediately measuring rising water levels. In wells where recovery is slow, this test can be performed by pumping or bailing water from the well and immediately starting measurements.

- Record the initial water level and other setup information on the attached form.
- Fully submerge the slug bar or bailer into the water column of the well.
- Allow the water level in the well to return to static condition after both the slug and transducer have been inserted. The transducer readout should indicate the height of water above the transducer.
- When the water level in the well has returned to static condition, start the transducer (“Start Test” if using Win Situ software). Periodically view graphical data during the test, to confirm adequate data collection.
- Rapidly remove the slug bar or bailer from the water column and well. Avoid moving or pulling up the transducer cable when removing the slug.
- Continue recording water levels with the transducer until the water level has recovered to within 15 percent of the original static water level relative to the initial test displacement (85 percent recovery), or until one hour has elapsed. If less than 50 percent recovery has been achieved after one hour, continue to collect measurements every 10 to 20 minutes.
- Where possible, repeat the test to establish the repeatability of measurements and calculated hydraulic conductivity results.
- As soon as practicable, download data stored in the transducer and transfer data.

2.3 Field Procedure – Falling Head Test

In this test, a slug is inserted in the well at the start of the test and the falling water levels are measured immediately. In wells where recovery is slow, this test can be performed by adding water to the well and immediately starting measurements.

- Record the initial water level and other set up information on the attached form.
- Allow the water level in the well to return to static conditions after the transducer has been inserted. The transducer readout should indicate the height of water above the transducer.
- When the water level in the well has returned to a static condition, begin recording transducer readings ("Start Test" if using Win Situ software).
- Fully submerge the slug bar or bailer into the water column of the well.
- Periodically view graphical data during test, to confirm adequate data collection. The transducer should continue to record water levels until the water level has recovered to within 15 percent of the original static water level relative to the initial test displacement (85 percent recovery), or until one hour has elapsed. If less than 50 percent recovery has been achieved after one hour, continue to collect a measurement every 10 to 20 minutes.
- Where possible, repeat the test to establish the repeatability of measurements and calculated hydraulic conductivity results.
- As soon as practicable, download data stored in the transducer and transfer data.

3. Additional Information

- Do not perform hydraulic conductivity tests on wells that have not previously been developed and allowed to equilibrate.
- It is critical to either add or remove the slug to the well as quickly as possible and to start collecting depth-to-water measurements immediately.
- The early-time data is critical because the rate of recovery of head in the well is exponential. Collect measurements frequently at the start of all variable head tests.
- The time required for a slug test to be completed is a function of the volume of the slug, the hydraulic conductivity of the formation, and the type of well completion. The slug volume should be large enough that a sufficient number of water level measurements can be made before the water level returns to equilibrium conditions. Two bailers connected in series can be used to increase the slug volume, provided the water column is deep enough.
- Decontaminate all down well equipment before using it in the well.

- NAPL will damage the transducer. Gauge recovery manually in these instances.
- Where possible, take periodic water level readings manually during recovery. The manual data are used to check for transducer noise or movement.
- If using automatic data loggers, download the data as soon as possible. Batteries in the data loggers may run down and result in a loss of data.
- Be prepared to containerize water generated from rising head tests if the water is contaminated.
- Where possible, take more than one pressure transducer to site. This will provide backup and allow testing of multiple wells simultaneously.

4. Calculations

The simplest interpretations of piezometer recovery are Hvorslev (1951) and Bouwer and Rice (1976). The analyses assume a homogenous, isotropic medium in which soil and water are incompressible. Spreadsheets and software are available to calculate hydraulic conductivity from slug test data according to the methods below.

Hvorslev's expression for hydraulic conductivity (K) is:

$$K = \frac{r^2 \ln(L/R)}{2\,L\,T_0} \qquad \mathit{for}\ L/R > 8$$

where:
K = hydraulic conductivity [ft/sec]
r = casing radius [ft]
L = length of open screen (or borehole) [ft]
R = filter pack (borehole) radius [ft]
$\boldsymbol{T_0}$ = Basic Time Lag [sec]; value of t on semi-logarithmic plot of H-h/H-H_0 vs. t, where H-h/H-Ho = 0.37
H = initial water level prior to removal of slug
$\boldsymbol{H_0}$ = water level at t = 0
h = recorded water level at t > 0

(Hvorslev, 1951; Freeze and Cherry, 1979)

The Bouwer-Rice expression for hydraulic conductivity (K) is:

$$K = \frac{r^2 \ln(R_e/R)\ln(h_o/h_t)}{2\,L\,t}$$

where:
r = casing radius [ft]
t = time of drawdown measurement since start of test [sec]

h = drawdown of water in well at time = t [ft]
h_o = drawdown of water in well at t = 0 (initial drawdown) [ft]
L = length of open screen (or borehole) [ft]
R_e = effective radius (radius of influence) [ft]
R = gravel pack radius [ft]

Both the Hvorslev and Bouwer-Rice methods can be applied for partially-penetrating wells. Hvorslev is generally applicable only to fully penetrating wells.

5. References

Bouwer, H., "The Bouwer and Rice Slug Test – An Update," Ground Water, vol. 27(3), 304, 1989.

Butler, James, J., Jr. "Improving the Quality of Parameter Estimates Obtained from Slug Tests", Ground Water, Vol. 34, No. 3, May-June 1996.

Butler, James J., Jr., "The Design, Performance, and Analysis of Slug Tests", Kansas Geological Survey, Lewis Publishers, 1997.
Chirlin, G.R. (1989), A Critique of the Hvorslev Method for Slug Test Analysis: The Fully Penetrating Well.

Fetter, C.W. (1994), Applied Hydrogeology, 3rd edition.

Freeze, R. Allen and John A. Cherry, 1979. Groundwater, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Hvorslev, M.J., "Time Lag and Soil Permeability In Ground-water Observations," U.S. Army Corps of Engrs. Waterways Experiment Station Bulletin No. 36, 1951.

Lambe, T.W, and R.V. Whitman (1969), Soil Mechanics.

Sanders, Laura L., "A Manual of Field Hydrogeology", Prentice-Hall, Inc., 1998.

U. S. EPA ENVIRONMENTAL RESPONSE TEAM STANDARD OPERATING PROCEDURES SOP: 2043,"Water Level Measurement" REV: 0.0, 10/03/94.

U. S. EPA ENVIRONMENTAL RESPONSE TEAM STANDARD OPERATING PROCEDURES SOP: 2046,"Slug Tests" REV: 0.0, 10/03/94

6. Attachments

Attachment A – Slug Test Data Form

7. Contacts

Andy Adinolfi
Saskia Oosting

Attachment A. Slug Test Data Form

SITE ID: ________________

LOCATION/WELL ID ___________

DATE: _______________________

FIELD PERSONNEL: ______________

____

DATALOGGER TYPE:

____

____

SLUG TYPE (solid/bailer/pumped)

SLUG DIAMETER: _____________

SLUG LENGTH: _____________

METHOD:

RISING HEAD ____________

FALLING HEAD __________

COMMENTS:

____

____

===

SETUP

Time _______________
Depth to Water - Initial Static(before installing troll/slug) ___________
Confirm well recovers to static after installing slug, or note otherwise

____

===

MANUAL CONFIRMATORY MEASUREMENTS

ELAPSED TIME (min.)	DTW	ELAPSED TIME	DTW

Form based on:
USEPA, 1994; Sanders, 1998.

STANDARD OPERATING PROCEDURE

GW-011 Constant Head Permeability Testing

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1. Objective

Describe procedures for performing constant head borehole permeability testing in granular soils. Constant head permeability testing is used when the soil permeability is sufficiently high for testing to be practical.

2. Execution

- All borehole permeability testing shall be performed below the static groundwater table. As the boring is advanced, attempt to determine the static groundwater level by:
    - Observing the water content of samples collected from the boring to identify the transition from moist to saturated soil.
    - For higher permeable soils, allowing the water level in the borehole to stabilize before performing the test.
    - If the borehole is left open overnight or for an extended period, measure the static groundwater level in the borehole at the beginning of the next day.
    - Measure the water level in nearby observation wells or piezometers.
    - If a well or piezometer is installed in the borehole, measure the water level in the well or piezometer after the water level has stabilized.
- Advance the drill casing to the top of the test zone and clean the borehole to the bottom of the casing.
- Obtain a split spoon sample in the test zone below the bottom of the casing.
- Advance the borehole 2 feet below the bottom of the casing using a side discharge roller bit. The roller bit should be only slightly smaller than the inside diameter of the casing. Record the diameter of the casing and the diameter of the roller bit. Avoid jetting the borehole walls or bottom during cleaning. Continue flushing the borehole until return water is clear.
- Measure the depth to groundwater in the borehole over a 10 to 15 minute period to observe if the groundwater elevation has approximately stabilized. Compare the saturated soil depth estimated from split-spoon samples to the measured water level in the borehole.
- Using a weighted tape, sound the bottom of the borehole to verify that the hole is cleaned to the correct depth and caving hasn't occurred. If more than 3 inches of wash remains in the borehole, lower the roller bit back to the bottom of the borehole and continue to clean the borehole.
- Measure and record the depth to the bottom of the borehole to the nearest 0.05 feet.
- Determine the length of the test zone (L = distance from the bottom of the casing to the bottom of the borehole) to the nearest 0.05 feet and record on the field form.
- Add clean water to fill the casing.

- Using a calibrated flow meter, adjust the flow rate into the casing so the water level remains within 0.5 inches of the top of the casing. Once the water level has stabilized, take a flow meter reading at the start of the test (time=0). Record the inflow volume at regular intervals (generally 1 minute) for a period of 10 minutes.
- Check the depth to the bottom of the borehole after completion of the test to check for caving.
- Record all measurements and observations on the Borehole Permeability Test Field Data Form.

3. Limitations

Site-specific conditions must be evaluated to determine appropriate test intervals. Test interval shall be determined by the Project Manager or their designee.

4. References

GEI Procedure No. 44, Borehole Permeability Testing in Granular Soils

U.S. Department of the Interior Bureau of Reclamation Ground Water Manual, Chapter 10: Permeability Tests in Individual Drill Holes and Wells.

5. Attachments

Attachment A - GEI Borehole Permeability Test Field Data Form – Constant Head

6. Contacts

Steve Hawkins
Kari Weber

BOREHOLE PERMEABILITY TEST - CONSTANT HEAD
FIELD DATA FORM

PROJECT:
LOCATION:
CLIENT:
PERF'D BY: DATE:
CALC'D BY: DATE:
CHECKED: DATE:

BORING :
PROJ NO.:
TEST NO.:
PAGE NO.:
GROUND SURF. EL.:

STANDPIPE/RISER DETAILS

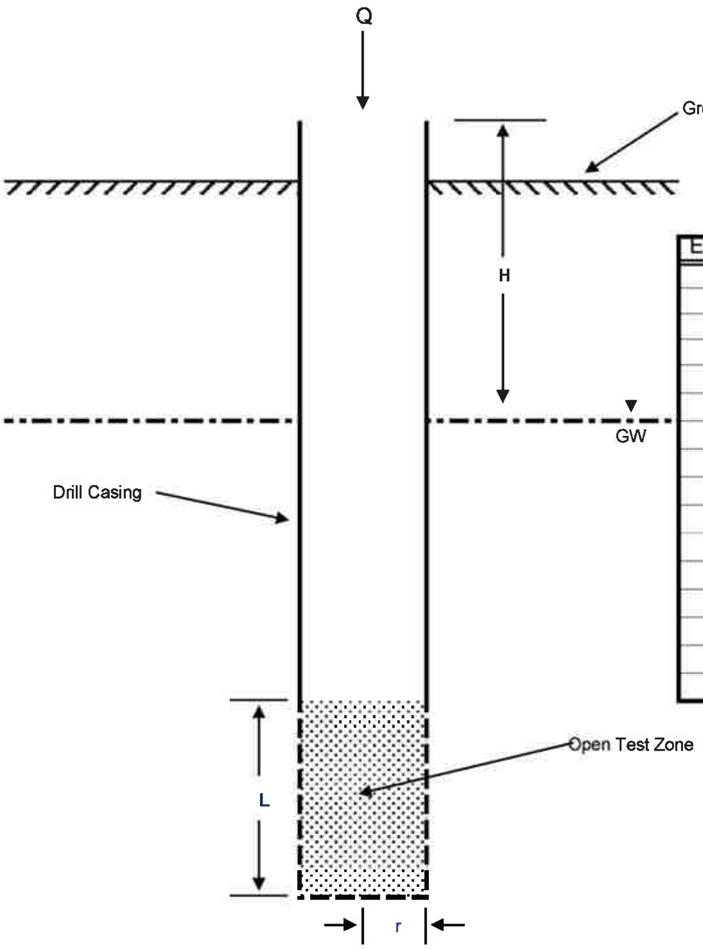
Riser inside diameter,d,inches: ________
Riser length, feet: ________
Riser stick up above ground surface, feet: ________
Groundwater depth below ground surface, H, feet: ________

Test Start Time: ________
Test End Time: ________

TEST INTERVAL DETAILS

Depth to bottom, feet (below ground surface): ________
Depth to top, feet (below ground surface): ________
Length, L, inches: ________

Water flow to achieve constant head, Q: ________
(volume/time)



Elapsed Time	Inflow	Overflow
0		

NOTES: 1. Based on the Constant Head Permeability Test SOP:
Created for the CT River Levee Projects, GEI Consultants
October 2008.

STANDARD OPERATING PROCEDURE

GW-012 Open Standpipe Piezometer

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1. Objective

The objective of this standard operating procedure (SOP) is to standardize the installation of open standpipe piezometers for geotechnical evaluations. This SOP assumes the piezometers will be constructed from threaded, flush-joint PVC pipe; the piezometer tip will either be constructed from a factory-slotted pipe or a porous stone. Piezometer dimensions (riser diameter, riser length, piezometer tip length, and slot-diameters for screened tip or pore size for porous tips) and filter sand gradation will be specified in the Work Plan.

2. Execution

All measurements taken during the installation are to be recorded on the GEI Open Standpipe Piezometer Installation Report Form.

- Using a weighted tape, measure and record the depth of the completed soil boring before beginning the piezometer installation.
- Measure the depth to groundwater in the borehole over a 10 to 15 minute period to observe that the groundwater elevation has approximately stabilized. Compare the saturated soil depth estimated from split-spoon samples to the measured water level in the borehole.
- Choose the riser length so that the piezometer tip (slotted section or porous stone) is located in the appropriate zone as specified in the Work Plan or determined by the project manager or their designee.
- If the borehole is deeper than the desired piezometer depth, then fill the base of the borehole with bentonite up to a depth equal to 12 inches below the bottom of the piezometer. If bentonite is added, slowly extract the casing or augers while adding the bentonite to maintain the level of bentonite at or near the bottom of the casing or augers. As an alternative to bentonite, the driller may, at their option, replace the bentonite with grout, but the grout must be allowed to set up overnight before proceeding with the installation.
- Pour at least 12 inches of clean filter sand into the borehole. As sand is added to the borehole, slowly extract the casing or augers to maintain the sand level at or near the bottom of the casing or augers. The bottom of the casing or augers should not extend more than 6 inches above the top of the filter sand at any time. Allow the filter sand enough time to settle. Measure and record the depth to the top of the filter sand to the nearest 0.1 foot.
- Assemble the piezometer including the riser, screen, silt trap, etc. Install and secure a bottom cap. The bottom cap should be secured with either a threaded coupling and/or stainless steel screws.
- Temporarily cover the top of the riser pipe and lower the complete piezometer plus riser into the borehole allowing the base to rest on the filter sand placed previously. Make sure that the piezometer is centered in the borehole.

- Pour sand around the piezometer, frequently checking the depth to confirm that the sand is not bridging. As sand is added to the borehole, slowly extract the casing or augers to maintain the sand level at or near the bottom of the casing or augers. The bottom of the casing or augers should not extend more than 6 inches above the top of the filter sand at any time.
- Add enough filter sand to fill the annulus between the piezometer and the borehole to a height of approximately 2 feet above the top of the slotted or porous section of the piezometer tip. Record the depth to the top of the filter sand to the nearest 0.1 foot.
- Slowly pour bentonite chips into the annulus between the piezometer riser and the borehole. As bentonite is added to the borehole, slowly extract the casing or augers to maintain the bentonite level at or near the bottom of the casing or augers. Frequently check the level of the bentonite in the borehole to ensure that the bentonite is not bridging.
- Place bentonite to form a minimum 3-foot-thick seal above the filter sand pack. Record the depths to the top and bottom of the bentonite seal to the nearest 0.1 foot. If the seal extends above the water table, use at least 5 gallons of potable water to hydrate the bentonite.
- Before removing the casing or augers, lower a tremie pipe to the bottom of the borehole, and begin to pump bentonite-cement grout into the borehole. Grout should be mixed in approximately the following proportions: 7.5 gallons water to one 94-lb. bag of cement to 2-4 lbs of pulverized bentonite. The grout must be mixed using the pump on the rig to ensure proper mixing.
- As grout is added to the borehole, slowly extract the casing or augers to maintain the grout level at or near the bottom of the casing or augers. The bottom of the casing or augers should not extend more than 6 inches above the top of the grout at any time.
- Continue pumping grout to fill the borehole. The driller should use caution to ensure that grout does not enter the piezometer riser. Protective surface casing will consist of either a flush-mounted road box or a steel guard pipe. If a road box is to be used for surface casing, measure the length of the road box. Fill the grout so that the level reaches 4” to 6” below the bottom of the roadbox length. Fill the annular space with filter sand for drainage.
- If a steel guard pipe is used as protective casing, place the protective surface casing in the grout before it sets. The base of the guard pipe must extend at least 3.5 feet below the ground surface (below the frost line), and have a stick-up of no more than 3 feet above the ground surface.
- Cut the piezometer riser flat and place a mark or "V"-notch or an arrow on the casing with an indelible marker at one point for surveying and groundwater measurements. Cut the riser so that the top of the riser is 3 to 6 inches below the top of the protective casing.
- In areas of high traffic or areas of parking lots and/or roadways where plowing occurs, set the road box FLUSH with the ground surface to avoid damage to the piezometer. Additional protection such as steel pole bumpers around the guard pipe may be necessary.
- Place a vented, locking cap on the piezometer pipe.

- All piezometer locations should be photo documented in accordance with SOP FD-004 Photo documentation.
- Label the protective casing with a paint pen and tape out the location to nearby landmarks so that the piezometer may be located in the future. Make sure to enter this information in the field notebook). If possible, place a brightly colored stake or other identifier adjacent to the piezometer.
- Develop the piezometer (see SOP DM-009, *Monitoring Well Development*).

3. Limitations

- If drilling mud is used to advance the borehole, the drilling mud MUST be Revert or other biodegradable drilling mud approved by the project manager.
- At all times, follow safety procedures as defined in the site-specific Health and & Safety Plan.
- Site-specific conditions must be evaluated to determine appropriate materials.
- Do not screen across different hydrostratigraphic units if possible (for example, outwash sands and till) unless specified in the Work Plan or approved by the Project Manager.
- If the formation is composed of a material that is uniformly coarser than the filter sand, the grain size of the filter sand must be increased. Consideration should also be given to changing the slot size on the well screen. Differences in average grain size should generally not be greater than a factor of two to four times. Gradation of filter sand used is to be reviewed and approved by the project manager or their designee.
- Do not use borehole/auger cuttings for backfill during monitoring well installation. If the cuttings are suspected to contain contamination which was identified during drilling, cuttings are to be containerized for later characterization and not used for filter pack materials.
- Do not screen across a confining layer (e.g., silt or clay). Backfill all confining layers with hydrated bentonite or grout.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49

5. Contact(s)

Steve Hawkins
Kari Weber

STANDARD OPERATING PROCEDURE
GW-013 Vibrating Wire Piezometer Construction and Installation

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1. Objective

The objective of this standard operating procedure (SOP) is to standardize the installation of vibrating wire piezometers for geotechnical evaluations. This SOP assumes the piezometers will be supplied by the manufacturer ready for installation and accompanied by factory calibration data. Piezometer details (installation depth and cable length) will be specified in the Work Plan.

2. Execution

- All measurements taken during the installation, including the manufacturer's serial number and calibration data are to be recorded on the GEI Vibrating Wire Piezometer Installation Report Form.
- Using a weighted tape, measure and record the depth of the completed soil boring before beginning the piezometer installation.
- Measure the length of the cable required to set the piezometer tip at the depth specified in the Work Plan or determined by the project manager or their designee. Make a mark on the cable with a permanent marker or electrical tape at a distance from the piezometer tip equal to the planned installation depth. Record the distance from the piezometer tip to the mark to the nearest 0.05 feet. This mark should line up with the top of the borehole when the piezometer tip is lowered to the correct depth. Place an additional mark 5 feet above the initial mark. The additional mark can be used to determine the final piezometer depth in the event that the first mark becomes obscured.
- Place the piezometer in a piece of slotted PVC pipe or a porous filter bag filled with filter sand, and attach the PVC or bag to the piezometer cable. This will aid in removing slack from the instrument cable during installation.
- If the borehole is deeper than the bottom of the desired sand filter zone depth, slowly fill the borehole with bentonite chips to a depth of approximately 2 feet below the planned piezometer tip elevation. Take a borehole depth measurement after adding bentonite to make sure the bentonite did not bridge.
- Slowly raise the casing or augers and simultaneously pour clean filter sand in the borehole to maintain the level of the filter sand near the bottom of the casing or augers. The bottom of the casing or augers should not be raised more than 6 inches above the top of the filter sand at any point during the installation.
- Continue placing sand until the level of the sand is approximately 6 inches below the planned piezometer tip elevation.
- Lower the piezometer into the borehole to a point just above the water level in the casing, and allow the piezometer to stabilize thermally. Thermal stabilization usually takes about 5 to 15 minutes. Thermal stabilization is assumed to have occurred once

the piezometer reading has stopped changing while the piezometer is suspended in the borehole.

- Obtain the initial zero reading from the piezometer using a read-out box. Record the zero reading and the temperature reading. If the read-out box does not have a temperature read-out, use an ohm meter to measure the resistance across the thermistor. This resistance can be converted to a temperature reading. Compare the measured zero reading to the factory zero reading. The zero reading should be within 20 digits of the factory zero reading after barometric and temperature corrections are made.
- Lower the piezometer in the borehole to the planned installation depth, and allow the piezometer to thermally stabilize for 15 to 20 minutes.
- Measure the depth to the water level in the borehole using a water level indicator, determine the height of the water column above the piezometer tip, and estimate the water pressure at the piezometer tip (height of water column times the unit weight of water). Record the measured water level and estimated water pressure.
- Take a piezometer reading to verify that the vibrating wire piezometer is reading correctly. Calculate the temperature-corrected pressure head. Record the piezometer reading, temperature, and pressure head. The piezometer is reading correctly if the measured pressure head approximately equals the estimated water pressure at the piezometer tip, calculated based on the measured water level. The piezometer reading should be within 0.5% of the estimated water pressure.
- Raise the piezometer 5 to10 feet, measure the water level in the borehole, and calculate the water pressure at the piezometer tip. Take a piezometer reading, and calculate the temperature-corrected pressure head. Record the piezometer reading, temperature, and pressure head. Compare the pressure head from the piezometer with the estimated water pressure. Again, the piezometer reading should be within 0.5% of the estimated water pressure.
- Lower the piezometer tip back to the planned installation depth, measure the water level in the borehole, and calculate the water pressure at the piezometer tip. Take a piezometer reading, and calculate the temperature-corrected pressure head. Record the piezometer reading, temperature, and pressure head. Compare the pressure head from the piezometer with the estimated water pressure. Again, the piezometer reading should be within 0.5% of the estimated water pressure.
- Tie off the piezometer cable to prevent the cable from falling into the borehole while the casing or augers are removed. The cable should be kept free of slack during the casing or auger removal and backfilling of the borehole.
- Remove the drill casing or augers from the borehole slowly at a maximum of 6inch intervals. As the casing or augers are raised, the driller should slowly add filter sand to maintain the level of the filter sand near the bottom of the casing or augers. As the driller pours the sand into the borehole, take frequent measurements of the depth to the top of the sand. Do not let the sand "bridge" in the borehole.
- Using the marks placed on the cable at the start of the installation, confirm that the piezometer is installed to the correct depth.
- Continue slowly removing the casing or augers and slowly add adequate filter sand to surround the piezometer and fill the borehole to a height of approximately 2 feet above the piezometer tip and record the depth to the nearest 0.1 foot.

- Confirm that the piezometer is installed to the correct depth.
- Measure the water level in the borehole.
- Place at least 3 feet of bentonite chips above the filter pack to create a seal. Record the depths of the top and bottom of the bentonite seal to the nearest 0.1 foot.
- Before removing the drill casing or augers from the borehole, lower a tremie pipe to the bottom of the borehole, and pump bentonite-cement grout through the tremie pipe until good quality, undiluted grout return is observed at the ground surface. Grout should be mixed in approximately the following proportions: 7.5 gallons of water to one 94-lb. bag of cement to 2-4 lbs. of pulverized bentonite. The grout must be mixed using the pump on the drill rig or other high shear mixer to ensure proper mixing.
- After grouting the borehole and removing the drill casing or augers, place the protective surface casing in the grout before it sets. The protective surface casing will be either a flush-mounted road box or a steel guard pipe. If a steel guard pipe is used, the base of the guard pipe must extend at least 3.5 feet below the ground surface (below the frost line), and have a stick-up of no more than 3 feet above the ground surface.
- Confirm that the piezometer is installed to the correct depth.
- Record a second set of readings to verify that the piezometer continues to operate as expected. Coil any excess cable inside the protective surface casing. The cable must be accessible from the top of the protective surface casing.
- Place concrete in the annular space between the protective casing and the borehole up to the ground surface. Slope the concrete radially away from the protective casing at the ground surface to promote surface water runoff. In areas of high traffic or areas of parking lots and/or roadways where plowing occurs, set the road box FLUSH with the ground surface to avoid damage to the road box.
- If the piezometer is installed in a high-traffic area with a guard pipe, additional protection such as steel pole bumpers around the guard pipe may be necessary.
- All piezometer locations should be photo documented in accordance with SOP FD-004 Photo documentation.
- Label the protective surface casing with a paint pen and tape out the location to nearby landmarks so that the piezometer may be located in the future. Enter this information in the field notebook. If possible, place a brightly colored stake or other identifier adjacent to the surface casing.

3. Limitations

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- Site-specific conditions must be evaluated to determine appropriate materials.
- The gradation of the filter sand should be selected based on the gradation of the formation material. The gradation of the filter sand is to be reviewed and approved by the project manager or their designee.

- Do not use drill cuttings for backfill during piezometer installation. If the cuttings are suspected to contain contamination which was identified during drilling, cuttings are to be containerized for later characterization.

4. References

Dunnicliff, J. (1988), Geotechnical Instrumentation for Monitoring Field Performance,John Wiley and Sons, Inc.

Instruction Manual, Model 4500 Vibrating Wire Piezometer (2005), Geokon, Inc.

5. Attachments

Attachment A - GEI Pressure Calculation and Temperature Correction Sheet
Attachment B - GEI Vibrating Wire Piezometer Installation Report Form

6. Contacts

Steve Hawkins
Kari Weber

Attachment A

Pressure calculation and Temperature correction Sheet

Vibrating Wire Piezometer

Pressure = (Initial Reading – Current Reading) x Linear Gage Factor

Or

$$P = (R_0 - R_1) \times G$$

Temperature Correction = (Current Temp. – Initial Temp.) x Thermal Factor

Or

$$P_T = (T_1 - T_0) \times K$$

Corrected Pressure = Pressure + Temperature Correction

Or

$$P_{corrected} = ((R_0 - R_1) \times G) + ((T_1 - T_0) \times K)$$

1	2	3

Note: If the Linear Gage Factor with the units of psi/digit and the Thermal Factor with the units of psi/°C are used, the calculated pressures will be in units of psi. To convert from psi to feet of water, multiply by 144 and divide by 62.4.

Estimated water pressure at piezometer tip = height of water above tip x unit wt. of water
Unit weight of water = 62.4 lb/ft^3

Note: The height of water must be in units of feet. The water pressure will be in units of feet of water.

Calculation Results:

1.) Initial Calculation – Planned installation depth:

Temperature-corrected pressure head: ______________________________

Estimated water pressure at piezometer tip: ______________________________

2.) Second Calculation – Raise piezometer 5 to 10 feet:

Temperature-corrected pressure head: ______________________________

Estimated water pressure at piezometer tip: ______________________________

3.) Third Calculation – Lower piezometer back to planned installation depth:

Temperature-corrected pressure head: ______________________________

Estimated water pressure at piezometer tip: ______________________________

Attachment B

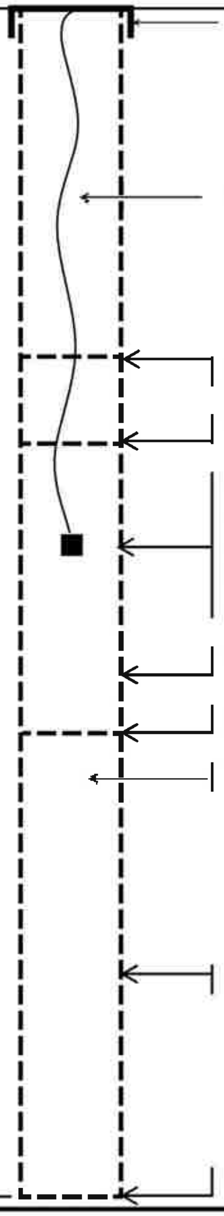
Vibrating Wire Piezometer Installation Report

PROJECT	Hartford Levee Certification Phase II	**PROJECT NO.**	
LOCATION	Hartford, Connecticut	**BORING NO.**	
CLIENT	The City of Hartford	**LOCATION**	
CONTRACTOR			Station:
DRILLER			Offset:
GEI REP.		**INSTALL DATE**	

Survey Datum NAVD 88

Ground Surface Elevation

General Soil Conditions (Not to Scale)



Type and size of protective cover ____________

Type of Backfill Above Betonite Seal ____________

Depth to Betonite Seal ____________ ft

Depth to Top of Sand Filter ____________ ft

Piezometer Model # ____________

Piezometer Designation ____________

Depth of Piezometer Tip ____________

Elevation of Piezometer Tip ____________

Piezometer Serial No. ____________

Type of Sand Filter Around Instrument ____________

Depth to Bottom of Sand Filter ____________ ft

Type of Backfill Below Sand Filter ____________

Diameter of Borehole ____________

Bottom of Borehole ____________ ft

NOTES:

____ feet = Length of cable and instrument

____ Calibration Factor

____ in HG = initial barometric pressure

____ Digits = Zero reading

____ Temperature / deg C = Zero reading

1. Based on the Vibrating Wire Piezometer Installation SOP:
   Created for the CT River Levee Projects, GEI Consultants October 2008.

STANDARD OPERATING PROCEDURE
GW-014 Dense Non-Aqueous Phase Liquid (DNAPL) Measurement and Recovery

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1. Objective

Provide procedural guidance for routine gauging and recovery of dense non-aqueous phase liquids (DNAPL) related to former manufactured gas plant (MGP) operations.

2. Execution

2.1 Equipment and materials

The following materials and equipment are necessary for this procedure:

- Oil/water interface probe
- Appropriate pump and required tubing/piping
- Double check valve bailers and string
- Drums or buckets for NAPL collection
- Proper PPE including gloves and protective eyewear
- Drum labels
- Field data sheets or logbooks
- Decontamination supplies and plastic sheeting
- Additional equipment identified by site-specific work plan and HASP
- Example specifications of DNAPL management equipment is included as Attachment A.

2.2 General Measurement Procedures

Using an oil/water interface probe will provide a depth to water and a depth to product in each monitoring well. Refer to probe manual to determine changes between liquid type. To achieve accurate depth measurements, ensure the oil/water interface probe is decontaminated (GEI SOP QA-001 prior to and between each measurement taken at each well.

To calculate the volume of product in monitoring wells with these specifications, take the following measurements:

- Total well length
- Depth to water
- Depth to product (s) – c1 and c2

Using the following equations, determine the length of the water column and the length of the product column:

[1] (a) – (b) = Water column length (d)
[2] (a) – (c1) = Product column length (e) dense non-aqueous phase liquid (DNAPL)

Calculate the volume of DNAPL product in the well using the following equation:

DNAPL for a 2" diameter well
[4] (e) x 0.1632 = Volume (gallons) of product in well
(e) x 0.6178 = Volume (liters) of product in well

DNAPL for a 4" diameter well
[4] (e) x 0.6528 = Volume (gallons) of product in well
(e) x 2.4711 = Volume (liters) of product in well

DNAPL for a 6" diameter well
[4] (e) x 1.469 = Volume (gallons) of product in well
(e) x 5.561 = Volume (liters) of product in well

Once measurements have been taken and calculations have been made, collection of dense non-aqueous phase liquid (DNAPL) may commence.

2.3 DNAPL Collection Procedures

Collection of DNAPL shall be accomplished using common recovery techniques or technologies as follows:

- Peristaltic pumps
- Bailers
- Positive displacement down hole pumps (e.g. Hammerhead, Blackhawk pumps, etc)

Special care shall be taken to prevent any purged DNAPL causing a spill and coming into contact with the ground and sampling personnel. This includes the use of proper personal protective equipment (PPE), including gloves and protective eyewear (Tyvek® if necessary), along with plastic sheeting set beneath the pump, tubing, and collection container (sealed top 55-gallon drum or 5-gallon bucket with lid), and the surrounding work area. A site-specific work plan, HASP and job specific job safety analysis need to be developed prior to the start of work. Examples of DNAPL specific management equipment and tools are included as Attachment A. The specific operating procedures for common recovery methods are discussed in the following sections.

2.3.1 Sampling and recovery via peristaltic pump with dedicated tubing:

- Take and record the required measurements prior to commencing pumping.
- Connect the dedicated tubing to the peristaltic pump with the long end of the silicon tubing set to discharge water and product directly into either a 5-gallon bucket or a 55-gallon closed-top drum, ensuring that the entire set-up is underlain by plastic sheeting.
- Begin purging the well, occasionally checking the depth to water and depth to product.
- Once the DNAPL has been purged from the well, a sample will be collected and preserved if required, in accordance with laboratory standards.

- Following completion of NAPL recovery, disconnect the tubing from the pump, secure the well and road box, and clean/decontaminate the pump and oil/water interface probe, prior to moving to the next location.
- Impacted tubing will either be containerized for proper disposal or left in well for reuse.

2.3.2 Sampling and recovery via double check valve bailer:

- Take and record the required measurements prior to commencing bailing.
- Ensure the entire work area is covered in plastic sheeting to avoid potential spills of water and/or product.
- Tie the bailer to a piece of string that will allow the bailer to reach the bottom of the well.
- Using slow and controlled motions while lowering (and raising) the bailer to the bottom of the well, commence bailing product out of the well and draining the bailer directly into either a 5-gallon bucket or a 55-gallon closed-top drum.
- Once the NAPL has been purged from the well, collect and preserve the analytical sample, if required, in accordance with laboratory standards.

2.3.3 Sampling via piston-style pumps (HammerHead, Blackhawk etc)

For significant accumulations of DNAPL a variety of dedicated pumping technologies exist. Refer to manufacturer-specific operating procedures and site specific means and methods.

2.4 Waste Management and Disposal

Investigation derived waste should be managed in accordance with GEI SOP SC-003. Additional care should be taken with DNAPL while infrequent the potential for hazardous waste characteristics does exist. DNAPL waste management and disposal should be evaluated on a site by site basis as discussed in Section 3.

2.5 Troubleshooting Information

If there are any performance problems with the oil/water interface probe which result in inability to achieve the proper measurements presented in Section 5.1, or if there are any problems with the peristaltic pump, consult the appropriate section of the probe instruction manual for the checkout and self-test procedures. If the problem persists, consult the manufacturer's customer service department immediately for further instructions.

Lower temperatures can affect the ability to pump and/or bail NAPL. Weather should be taken into consideration when scheduling gauging and recovery sampling events.

2.6 Data and records management

All information pertaining to maintenance of the oil/water interface probe and the peristaltic pump shall be maintained in the project file. Field measurements (depth to water, product, *etc.*) and all calculations (product column length, volume of product, *etc.*) shall be recorded on the appropriate field data sheets or in the logbook consistent with GEI SOP Section 5.

2.7 Health and safety considerations

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the site specific Health and Safety Plan (HASP). The collection and accumulation of NAPL presents the potential for significant hazards that need to be managed. A detailed job safety analysis (JSA) should be completed prior to the start of work.

3. Limitations

- DNAPL gauging and recovery can be problematic and requires adaptive thinking. A variety of measurement and collection techniques may be necessary to properly execute the work.
- Exposure to DNAPL can accelerate the required maintenance/replacement intervals for tools and equipment.
- A site specific work plan, HASP and JSA needs to be developed prior to commencing work. The documents should address: safety, recovery technologies, waste containment and waste management.

4. References

U.S. EPA. Ground Water Issue: Dense Non-aqueous Phase Liquids, EPA/540/4-91-002, March 1991.

5. Attachments

Attachment A – Example specifications of DNAPL recovery and management tools and equipment.

6. Contact

Jerry Zak

nationalgrid

Tracey Bell
Manager
Environmental Asset Management

April 13, 2009

Mr. Amen M. Omorogbe, P.E.
Project Manager
New York State Department of Environmental Conservation
MGP Remedial Section, Division of Environmental Remediation
Bureau of Western Remedial Action, 11th Floor
625 Broadway
Albany, New York 12233-7017

Re: DNAPL Recovery Wells Pilot Test Work Plan
Carroll Gardens/Public Place
Former Citizens Gas Works Manufactured Gas Plant Site
Brooklyn, New York
Site No.: C224012

Dear Mr. Omorogbe:

The DNAPL Recovery Wells Pilot Test Work Plan (Work Plan) program is intended to characterize and assess the mobility and potential for recovery of dense non-aqueous phase liquid (DNAPL) at the Former Citizens Gas Works Manufactured Gas Plant (MGP) site (Site) located in the Carroll Gardens/Public Place neighborhood of Brooklyn, New York (Figure 1). The pilot test program will generate data required to develop a final DNAPL recovery approach for the Site, which will be presented as part of the Remedial Design Work Plan (RDWP).

The Final Remedial Investigation Report (RI), dated October 2005, and the Remedial Design Work Plan, dated September 12, 2007, included the recommendation that an on-site DNAPL recovery system be evaluated as one mechanism to control potential DNAPL migration on Parcels I, II, and III. The DNAPL recovery test wells will be installed at boring locations where DNAPL (tar) saturated soils, considered to have the potential for DNAPL recovery, were observed during boring installations. The intended recovery test well locations were selected based on the following investigations:

- During the RI field effort, a number of locations were identified as meeting the criteria for potential DNAPL recovery wells and were noted for consideration in the RDWP. These locations were further evaluated by additional borings at each location during the RDWP pre-design field investigation.

- During the RDWP pre-design field activities, additional locations were identified and investigated as potential DNAPL recovery well locations.

The final proposed wells are listed in Table 1 with locations shown on Figure 2. A brief summary of RDWP findings, pertinent to the activities proposed in this Work Plan, is provided below. The complete RDWP findings will be presented and submitted to the New York State Department of Environmental Conservation (NYSDEC) in a Data Report to follow the pre-design investigation as outlined in the RDWP. The soil boring and test pit logs utilized to develop this Work Plan are attached.

The pertinent findings from the RI and RDWP pre-design investigation used to locate potential recovery well stratigraphic zones are as follows:

- **Parcel I**: DNAPL saturated soils were observed at a number of locations within the intermediate zone soils to approximately El.-51 ft (the zone is defined as being approximately El -20 ft to -90 ft NAVD 88). No DNAPL saturated soils, considered to have the potential for DNAPL recovery, were observed in the shallow zone soils (above approximately El. -20 ft) and the deep zone soils (below El. -90 ft).

- **Parcel II**: DNAPL saturated soils were observed beneath a clay layer bordering the Gowanus Canal in the shallow and intermediate zone soils from approximately El.-15 ft to El.-57 ft (CGSB-127). No DNAPL saturated soils, considered to have the potential for DNAPL recovery, were observed in the deep zone soils (below El. -90 ft).

- **Parcel III:** DNAPL saturated soils were observed in shallow zone soils in test pit CGTP-103B located adjacent to the bulkhead of the Gowanus Canal at approximately El. 1.5 ft. A clay layer was observed along the bulkhead of the Gowanus Canal between approximately El.-4 ft and El.-17 ft between borings CGSB-120 and CGSB-123. DNAPL saturated soils were observed above the clay layer in the shallow zone soils in the vicinity of CGSB-121, CGSB-122 and CGSB-125. DNAPL saturated soils were observed within the intermediate zone soils and slightly into the deep zone soils. Specifically, DNAPL saturated soils were observed between approximately El.-69 ft and El.-91 ft at CGSB-121, and at CGSB-122 between El.-74 ft and El.-81 ft. These observations are consistent with the findings for the adjacent RI monitoring well CGRW-08D (boring log indicated tar saturated soil and tar veins from El.-76 ft to El.-86 ft).

The activities proposed in this Work Plan will address each of the following primary objectives.

- **Assess DNAPL mobility and recovery rates.**
  DNAPL recovery evaluation activities will include monitoring the wells for DNAPL accumulation, performing periodic recovery pumping and disposal events, and assessing the DNAPL recharge rates.

- **Evaluate the location of productive DNAPL recovery zones.**
  The results of the investigations will be used to evaluate which recovery wells have the potential to effectively and efficiently collect DNAPL.

- **Evaluate DNAPL recovery methods and equipment.**
  A number of different recovery methods and equipment will be evaluated as well as options for stand alone or manifolded well collection systems.

The remainder of this Work Plan has been organized into the follow sections: Scope of Work, Pilot Test Report, and Proposed Schedule. The scope of work includes details on recovery well construction, DNAPL monitoring and pumping frequency, and data analysis.

1.0 Scope of Work

1.1 Recovery Well Construction

As detailed above, potential DNAPL recovery zones exist in the intermediate zone soils in Parcel I, the shallow and intermediate zone soils in Parcel II, and the shallow, intermediate and deep zone soils in Parcel III. Well screens for the proposed DNAPL recovery pilot test wells will be placed within these zones and terminate above lower permeability soils (i.e. clay, till), if present. In general, the proposed screen interval was selected to intercept soil layers containing DNAPL saturated soils within a grain matrix conducive to potential DNAPL migration (i.e. sand, silty sand, gravel, etc.). The screen interval was also extended to include adjacent soil layers containing DNAPL saturated soil lenses. The supporting boring and test pit logs from the RDWP pre-design investigation used to site the recovery wells are attached. Table 1 summarizes the construction details of each proposed recovery well, and lists each well with the corresponding soil boring that was installed during RDWP pre-design investigation. The selected locations of the recovery wells are depicted on Figure 2. Parcel I and II recovery wells will be installed at their corresponding RDWP pre-design investigation soil boring locations. Since these were logged and soil samples were collected during the RDWP pre-design investigation, no additional samples or logs will be taken upon installation of these recovery wells.

For Parcel III, at proposed recovery pilot test well locations CGRW-05, CGRW-06 and CGRW-07, multiple recovery wells will be installed in a cluster formation within the vicinity of the corresponding RDWP pre-design investigation soil boring. Each cluster will contain a shallow, intermediate, and deep recovery well as described below. Each recovery well within a cluster will be installed within approximately 5 feet of the other wells in the cluster. For wells in the cluster that are not located at an existing boring location, drilling will advance to the proposed top of screen depth with continuous sampling thereafter to confirm the screen and sump location. When installation requires extension beyond the previous terminal depth due to the boring not terminating in a clean zone, the well boring will be continuously sampled below the former termination depth until approximately 10 feet of soil with minimal DNAPL impact is observed.

Due to the DNAPL chemistry at the Site, the PVC monitoring wells installed during the RI degraded and were subsequently abandoned. Therefore, as detailed below, the pilot test wells will be constructed using 6-inch diameter stainless steel. Based on the volume of DNAPL that was delineated during RI activities and coupled with the observations made during the RDWP pre-design field program, a 5-foot sump is proposed below the screen interval to facilitate DNAPL accumulation and collection. This is an increase from the 2-foot sump recommendation made in the RDWP.

Table 1 summarizes the proposed screen depth intervals and sump locations. These depths are approximate, and may be adjusted accordingly in the field based on subsurface conditions identified at the time to maximize potential DNAPL recovery. The recovery wells will be installed using hollow stem auger drilling techniques (or other appropriate methods) to the targeted depth of the recovery well, and will create a bore hole of approximately 10 inches in diameter. The recovery wells will be constructed of 6-inch inside diameter (ID), flush-threaded stainless steel continuous-slot well screen and solid casing with a 5-foot sump. The screen slot size and filter pack gradation will be developed as a function of the related soil formation. A 5-foot bentonite seal will be placed surrounding the sump. The annular space between the well screen and the borehole will be backfilled with filter sand to approximately 2-feet above the top of the screen interval. A 2-foot bentonite seal will be placed at the top of the sand pack. The remaining annular space will be filled with a cement/bentonite grout to the ground surface by tremie method. Each well will be protected with a lockable traffic rated well vault (Parcel II) or steel surface casing (Parcels I and III) secured with cement. Figure 3 depicts typical recovery well construction.

Final proposed recovery well locations vary from those initially proposed in the RDWP as follows:

- **Parcel I:** CGRW-01 has been added south of former Holder 3 due to the presence of potentially recoverable DNAPL; CGRW-02 has been moved about 50-feet north of its original location (CGMW-02) due to the limited recoverable DNAPL observed at the original location; and CGMW-03 has been deleted as a location due to the poor recharge rate noted during RI testing (2.5% DNAPL recovery after 6 months of recharge).

- **Parcel II:** The CGMW-07 location was deleted due to limited recoverable DNAPL observed at the original location; and CGRW-03 and CGRW-04 have been added due to the presence of potentially recoverable DNAPL.

- **Parcel III:** Clustered recovery wells (shallow (S), intermediate (I), and deep (D)) are proposed for each location. Specifically, recovery wells CGRW-05 S/I/D, -06 S/I/D and -07 S/I/D are proposed. The recovery well 06-cluster is located adjacent to the former CGMW-08 location. The remaining proposed wells (05- and 07-clusters) are at new locations farther north due to the presence of potentially recoverable DNAPL.

- Original well location CGMW-06 is located off site across Huntington Street along the southeast boundary of Parcel III. Due to its off-site location and permitting difficulties, the potential recovery well location is proposed on site across the street from the original well, designated as CGRW-08. This location is presently within the warehouse on the parcel. However, the warehouse and slab are presently being demolished and the approved Parcel III Pre-Design Investigation Work Plan will be implemented following the demolition. Under the Parcel III pre-design program a boring (CGSB-77) will be installed at the potential well location. Following the pre-design plan, this boring will be continuously sampled to a minimum depth of 95-feet bgs (El.-85 ft) or until approximately 10 feet of soil with minimal DNAPL impact is observed. Appropriateness as a recovery well location will be based on this boring.

- Other recovery well locations will be evaluated based on the finding of the Parcel III Pre-Design Investigation.

1.2 DNAPL Monitoring, Recovery and Disposal

Development of the recovery wells will be delayed for 3 to 5 days to distinguish between initial or stagnant DNAPL flow into the well versus DNAPL flow into the well that was influenced by well development procedures. Development procedures will follow the GEI standard operating procedures for well development included in the approved Field Sampling Plan of the Parcel III Pre-Design Investigation Work Plan. Recovery wells may be developed using a high flow pump and will be monitored for drawdown and recovery. Well development fluids will be pumped into 55-gallon drums, a large volume tank, or mobile tanker truck. All groundwater and DNAPL generated during development activities will be disposed off site at an appropriate facility. For the first month after a recovery well has been installed, the recovery well will be gauged and monitored weekly for depth to water, depth to DNAPL, and accumulated DNAPL thickness in the well sump.

If DNAPL is observed in a recovery well after 1 month, DNAPL recovery and monitoring activities will begin at the well and continue for 4 to 5 months in accordance with the following:

- After the DNAPL is recovered or pumped from the recovery well, the well will be gauged at a minimum of every 15 minutes for a period of up to 3 hours.

- If less than 10 percent recovery of the pre-pumping DNAPL level is measured during the initial 3-hour period, then the well will be gauged daily for 1 week and then weekly for up to 3 months or until 85 percent recovery is achieved. If 85 percent recovery is achieved within 1 month following the pumping event, then a second recovery event will proceed and be monitored according to the recharge rate observed after the initial pumping event.

- If greater than 10 percent recovery of the pre-pumping DNAPL level is measured during the initial 3-hour period, then hourly gauging would continue for a period of up to 8 hours or until the DNAPL level recovers to within 20 percent of its original level prior to pumping. After the 8 hours or 20 percent of the pre-pumping DNAPL level is recovered, gauging will proceed daily for 1 week and then weekly until 85 percent recovery is achieved. If 85 percent recovery is achieved within 1 month following the pumping event, then a second recovery event will proceed and be monitored according to the recharge rate observed after the initial pumping event.

- The general parameters may be modified based on observations made in the field.

Different methods of DNAPL recovery will be evaluated throughout the pilot test. These methods may include, as appropriate, pneumatic pumping, belt skimmer, periodic manual removal (bailers), peristaltic pumps, etc. If a bailer is used to recover the DNAPL, then time will be allotted (i.e. 1 to 2 hours) to allow for settlement of any DNAPL that may have been agitated by the bailer. Recovered DNAPL will be temporarily stored onsite in 55-gallon drums or other appropriate storage vessels pending off-site disposal.

Fieldwork will be performed under the approved Health and Safety Plan (HASP) of the RDWP.

2.0 Pilot Test Report

After the field recovery and monitoring program, a Pilot Test Report will be prepared and submitted to the NYSDEC. This report will summarize the recovery well installation and DNAPL recovery activities. The summary will include a calculation of DNAPL recovery rates, and an evaluation of the productivity of each recovery well and the recovery methods. Based on the estimated DNAPL recovery rates and evaluations provided in this report, a determination will be made on the viability of each well for an active DNAPL recovery system, a passive DNAPL recovery program, or abandonment of the well due to limited recovery potential.

3.0 Proposed Schedule

Work is anticipated to begin following NYSDEC approval of this Work Plan. It is anticipated that the field work detailed in this Work Plan can be completed within 6 months of NYSDEC approval of the plan.

If you have any questions or require additional information, please feel free to contact me at (718) 963-5645 or via e-mail at tracey.bell@us.ngrid.com.

Sincerely,

Tracey Bell
Manager

Enclosure

ec: G. Cross (NYSDEC)
C. Doroski (NYSDOH)

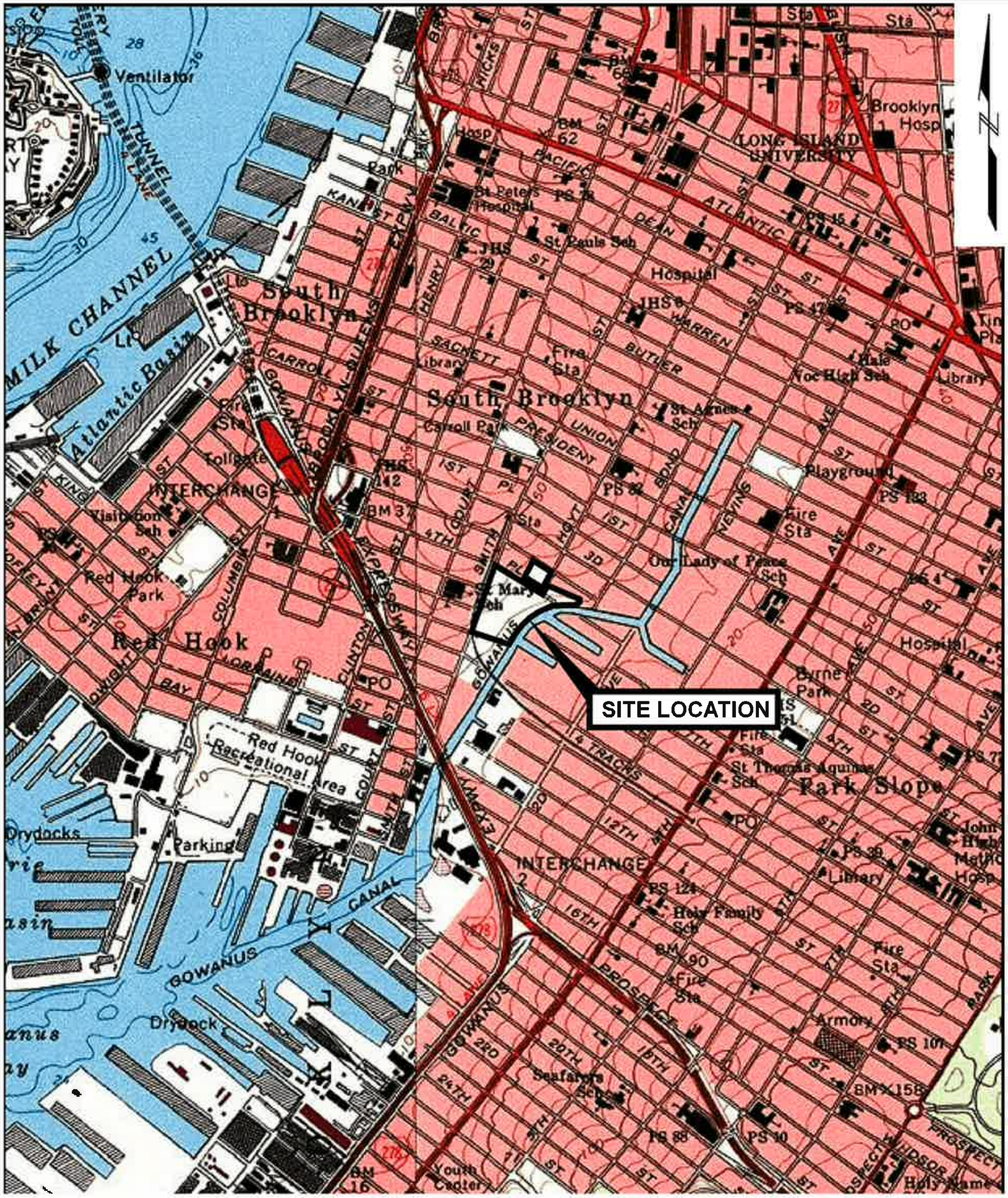
MZ/at H:\WPROC\Project\KEYSPAN\Citizen's Gas\Remedial Design\Remedial Design Investigation\DNAPL Recovery\Pilot Test\Work Plan\DNAPL Recovery WP Final to DEC (4-13-09).docx

Table 1
Proposed Pilot Test Recovery Well Construction
Carroll Gardens/Public Place Former MGP Site
Brooklyn, New York

Pilot Test Recovery Well (at/near RDWP pre-design investigation boring location noted)	Total Depth[1] (ft bgs)[2]	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Screen Interval Length (ft)/ Elevation (ft NAVD 88)	Adjacent RI/RDWP pre-design investigation Boring/Test Pit/Monitoring Well
Parcel I					
CGRW-01(at CGSB-117)	70	30	65	35 (-3 to -38)	CGSB-04
CGRW-02(at CGSB-119)	50	30	45	15 (-16 to -31)	CGSB-10/CGMW-02
Parcel II					
CGRW-03 (at CGSB-128)	57	22	52	30 (-10 to -40)	CGSB-23
CGRW-04 (at CGSB-127)	72	27	67	40 (-15 to -55)	CGSB-8 & 23/CGMW-07
Parcel III					
Shallow Recovery Wells					
CGRW-05S (near CGSB-121)	25	10	20	10 (0 to -10)	CGSB-28/CGMW-08
CGRW-06S (near CGSB-125)	25	10	20	10 (0 to -10)	CGSB-28/CGMW-08
CGRW-07S (near CGSB-122)	30	15	25	10 (-5 to -16)	CGSB-27/CGTP-15
CGRW-08S (at CGSB-77)	TBD	TBD	TBD	TBD	CGMW-06
Intermediate Recovery Wells					
CGRW-05I (near CGSB-121)	74	39	69	30 (-29 to -59)	CGSB-28/CGMW-08
CGRW-06I (near CGSB-125)	67	32	62	30 (-22 to -52)	CGSB-28/CGMW-08
CGRW-07I (near CGSB-122)	62	47	57	10 (-37 to -47)	CGSB-27/CGTP-15
CGRW-08I (at CGSB-77)	TBD	TBD	TBD	TBD	CGMW-06
Deep Recovery Wells					
CGRW-05D (at CGSB-121)	106	81	101	20 (-71 to -91)	CGSB-28/CGMW-08
CGRW-06D (at CGSB-125)	101	86	96	10 (-76 to -86)	CGSB-28/CGMW-08
CGRW-07D (at CGSB-122)	96	81	91	10 (-71 to -81)	CGSB-27/CGTP-15
CGRW-08D (at CGSB-77)	TBD	TBD	TBD	TBD	CGMW-06

1 - Includes a 5 foot sump at depth. Recovery wells in Parcel II will be completed with a flush-mounted lockable steel and/or concrete vault. All other well will be completed with a steel riser pipe with locking cap.

2 - Feet below current ground surface.



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SCALE, FEET

SOURCE: Map created with TOPO! ® ©2001 National Geographic (www.nationalgeographic.com/topo)

DNAPL RECOVERY PILOT PROGRAM
CARROLL GARDENS/PUBLIC PLACE
BOROUGH OF BROOKLYN, NEW YORK

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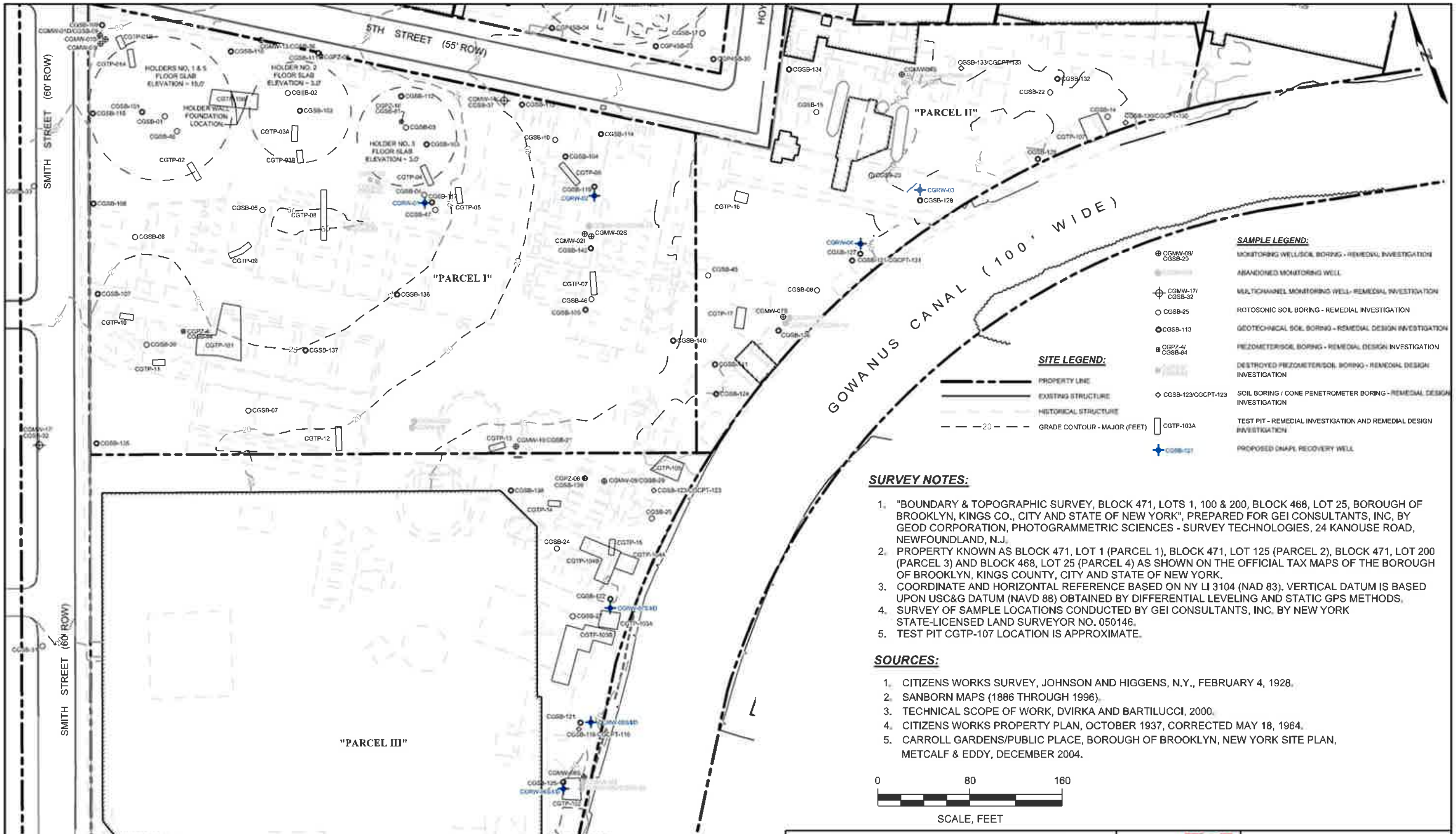
Project 061140-19-2807

SITE LOCATION MAP

April 2009

Figure 1

NATIONAL GRID\CITIZENS\19-2817\CITIZENS-LOCATION MAP.CDR



SURVEY NOTES:

1. "BOUNDARY & TOPOGRAPHIC SURVEY, BLOCK 471, LOTS 1, 100 & 200, BLOCK 468, LOT 25, BOROUGH OF BROOKLYN, KINGS CO., CITY AND STATE OF NEW YORK", PREPARED FOR GEI CONSULTANTS, INC, BY GEOD CORPORATION, PHOTOGRAMMETRIC SCIENCES - SURVEY TECHNOLOGIES, 24 KANOUSE ROAD, NEWFOUNDLAND, N.J.
2. PROPERTY KNOWN AS BLOCK 471, LOT 1 (PARCEL 1), BLOCK 471, LOT 125 (PARCEL 2), BLOCK 471, LOT 200 (PARCEL 3) AND BLOCK 468, LOT 25 (PARCEL 4) AS SHOWN ON THE OFFICIAL TAX MAPS OF THE BOROUGH OF BROOKLYN, KINGS COUNTY, CITY AND STATE OF NEW YORK.
3. COORDINATE AND HORIZONTAL REFERENCE BASED ON NY LI 3104 (NAD 83). VERTICAL DATUM IS BASED UPON USC&G DATUM (NAVD 88) OBTAINED BY DIFFERENTIAL LEVELING AND STATIC GPS METHODS.
4. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. BY NEW YORK STATE-LICENSED LAND SURVEYOR NO. 050146.
5. TEST PIT CGTP-107 LOCATION IS APPROXIMATE.

SOURCES:

1. CITIZENS WORKS SURVEY, JOHNSON AND HIGGENS, N.Y., FEBRUARY 4, 1928.
2. SANBORN MAPS (1886 THROUGH 1996).
3. TECHNICAL SCOPE OF WORK, DVIRKA AND BARTILUCCI, 2000.
4. CITIZENS WORKS PROPERTY PLAN, OCTOBER 1937, CORRECTED MAY 18, 1964.
5. CAROLL GARDENS/PUBLIC PLACE, BOROUGH OF BROOKLYN, NEW YORK SITE PLAN, METCALF & EDDY, DECEMBER 2004.

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SCALE, FEET

DNAPL RECOVERY PILOT PROGRAM
CARROLL GARDENS/PUBLIC PLACE
BOROUGH OF BROOKLYN, NEW YORK

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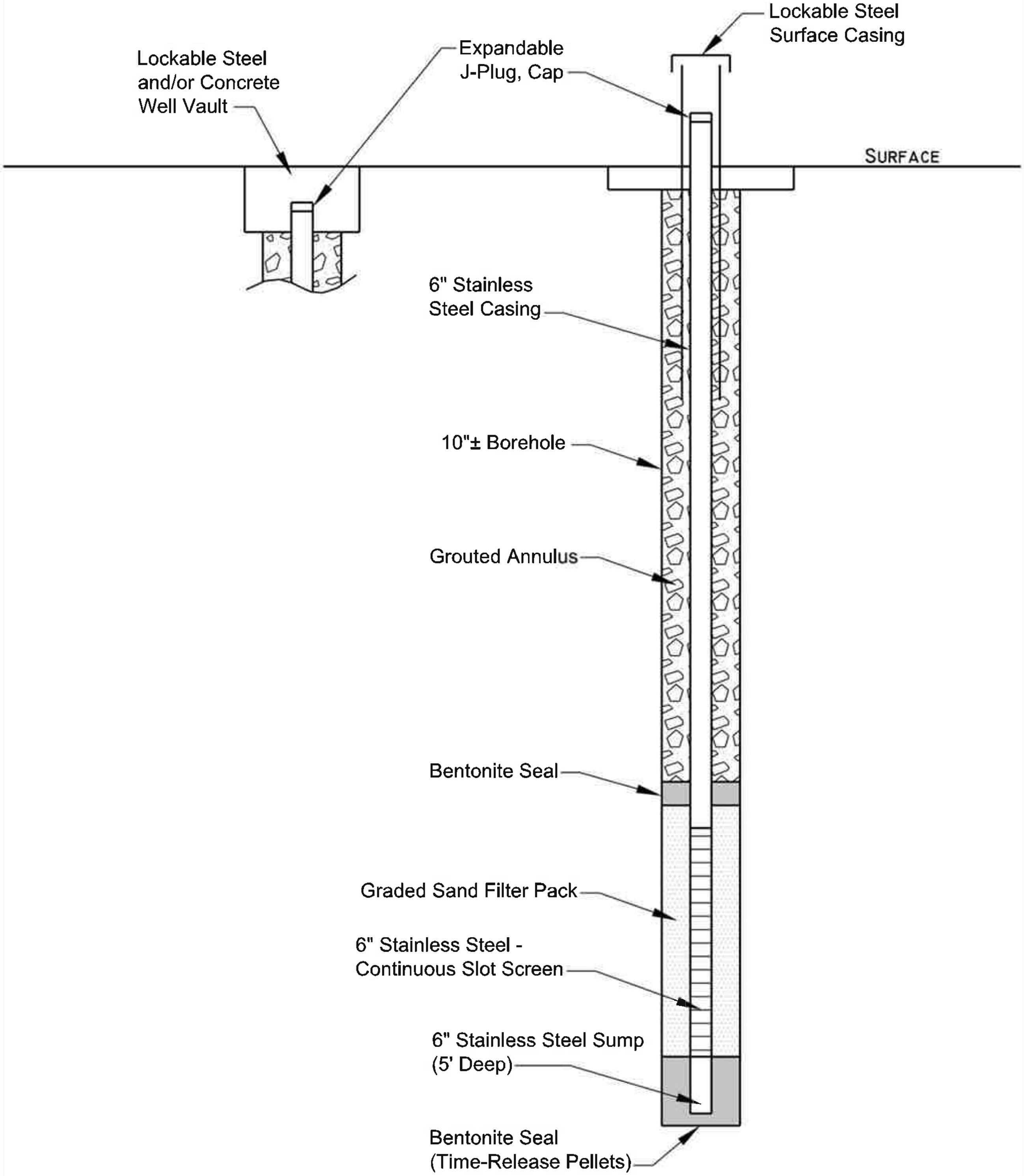
PROPOSED RECOVERY WELLS

Project 061140-19 | April 2009 | Figure 2

I:\GEI\National Grid\CITIZENS\19-2817\ Figure 2 Proposed Recovery Wells.dwg \Apr 13, 2009



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TYPICAL RECOVERY WELL CONSTRUCTION DETAILS

Project 061140-19-2817 | April 2009 | Figure 3

I:\GEI\National Grid\CITIZENS\19-2817\ Figure 3 Citizens-Well Detail.dwg \Apr 13, 2009

Section 8

Surface Water Sampling (SW)

STANDARD OPERATING PROCEDURE

SW-001 Surface Water Sampling

1. Objective

Describe methods used to collect surface water samples.

This SOP is applicable to the collection of representative surface water samples from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth as well as samples collected from the surface. Location, equipment, and sampling situations will dictate the applicable method of sample collection for each point. Four recommended techniques for collecting representative surface water samples are:

- Kemmerer bottle
- Van Doran sampler
- Direct method
- Peristaltic pump

Materials

Depending on the sampling method, the following is a list of equipment that may be used for collection of surface water samples:

- Kemmerer bottles
- Van Doran sampler
- Line and messengers
- Peristaltic pump
- Teflon™/polyethylene tubing
- Laboratory provided sample bottles
- Resealable plastic bags Ice
- Coolers, packing material
- Chain of custody records, custody seals
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Tape measure
- Survey stakes, flags, or buoys and anchors
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent marker
- Sample bottle labels
- Paper towels
- Secchi Disk – Illustration provided as Figure 1
- Personal Protection Equipment (PPE)

- Global Positioning System (GPS) survey equipment or another appropriate method to document the location of surface water sampling locations.

2. Execution

2.1. Pre-Sampling Procedures

2.1.1. Sample Location

Ideally, a GPS navigation system should be used to identify and record the sample location coordinates. Taped measurements from easily identifiable existing permanent features are also acceptable. If necessary, the proposed locations may be adjusted if there are issues with sample location access and/or obstructions.

2.1.2. Water Quality Data

Water quality data should be collected during sampling from the sample depth interval, if appropriate, using an appropriate instrument to measure pH, specific conductance, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential. In addition, water clarity may be measured at each sample location using a secchi disk (Figure 1). The water quality meter should be calibrated daily in accordance with manufacturer's specifications.

2.2. Sample Collection Methods

2.2.1. Kemmerer Bottle

A Kemmerer bottle can be used in most situations to collect representative samples from specific depths. A picture of the Kemmerer bottle is provided as Figure 2. Sampling procedures are as follows:

- Prior to sample collection, properly decontaminate the Kemmerer (see SOP QA-001 Equipment Decontamination). The sampling device should be set so that the upper and lower stoppers pull away from the body of the sampler, allowing the surface water to enter tube.
- Lower the pre-set sampling device to the predetermined depth while avoiding disturbance of the bottom sediments.
- When the Kemmerer bottle is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.
- Retrieve the sampler and discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve.
- This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited (except for samples analyzed for volatiles) or transferred directly to appropriate sample containers.

2.2.2. Van Doran Sampler

A Van Doran sampler can be used to collect surface water from very specific sampling depths or from a shallow water body. A picture of the Van Doran sampler is provided as Figure 3. Since the sampler is suspended horizontally, the depth interval sampled is equal to the diameter of the sampling tube. The sampling procedure is as follows:

- Prior to sample collection, properly decontaminate the Van Doran Sampler (see SOP QA-001 Equipment Decontamination). The sampling device should be set so that the end stoppers are pulled away from the body allowing surface water to enter the tube.
- Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom sediments.
- When the Van Doran is at the selected depth, send the weighted messenger down the suspension line, closing the sampling device.
- Retrieve the sampler and discharge the first 10-20 mL from the drain to clear potential contamination from the valve.
- This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited (except for samples analyzed for volatiles) or transferred directly to appropriate sample containers.

2.2.3. Direct Method

For surface water samples collected within the top 6-inches of the water column, or in waters shallow enough that wading is feasible and safe. The direct method should only be used to collect water samples in unpreserved the sample container(s).

- Analytical samples that require field preservation will be transferred from the unpreserved container to a laboratory pre-preserved sampling container. Samples analyzed for volatiles should be filled directly in laboratory pre-preserved sampling container.
- Samples should be collected in a downstream to upstream direction.
- Avoid disturbing the sediment surface during collection.
- In shallow locations, collect the sample under the water surface while pointing the sample container upstream; the container must be upstream of the collector.
- Hold the sample container below the surface to avoid the collection of floating debris.

2.2.4. Peristaltic Pump

A peristaltic pump can be used to collect surface water from very specific sampling depths or at a remote location that cannot be accessed with other sampling methods. Since the tubing can be weighted and suspended horizontally, the depth interval sampled is equal to the opening of the sampling tubing. The sampling procedure is as follows:

- Prior to sample collection, the tubing weights will be thoroughly decontaminated. Cut a length of the clean, Teflon™ or polyethylene tubing to match the predetermined sampling depth. Lower the tubing and water quality meter to the predetermined sample depth. Avoid disturbance of the bottom sediments.

- When the tubing is at the required depth, attach it to a multi-parameter water quality meter to gather information on water quality at the sample collection interval.
- Turn on the peristaltic pump.
- Discharge approximately two volumes of water from the submerged tubing to collect a representative sample from the predetermined depth interval.

2.2.5. Precautions

Proper sampling procedures should be used to collect samples in accordance with this SOP to prevent cross contamination and improper sample collection. Common problems are listed below to ensure that the samplers can avoid potential sample collection problems.

- Cross Contamination: Eliminated or minimized through the use of dedicated or disposable sampling equipment where appropriate. Where the use of dedicated or disposable sampling equipment is not possible or practical, the equipment will be decontaminated in accordance with the SOP QA-001 Equipment Decontamination.

- Improper Sample Collection: Typical improper sample collection techniques include:
    - Use of sampling equipment or sample containers that are not compatible with the contaminants of concern or the laboratory analytical method
    - Excess sediment in the sample due to disturbance of the sediments by sampling equipment
    - Sample collection in an obviously disturbed or non-representative area
    - Sample collection during a period of increased surface water velocity that causes significant re-suspension of sediments (i.e. tidal influences, storm surge)

3. References

Wilde, F.D., D.B. Radtke, J. Gibs and R.T. Iwatsubo. 1998. National Field Manual for the Collection of Water-Quality Data - Selection of Equipment for Water Sampling. U.S. Geological Survey Techniques of Water - Resources Investigations, Book 9, Chap. A2, variously paged. http://water.usgs.gov/owq/FieldManual/index.html and http://water.usgs.gov/owq/FieldManual/mastererrat.html

U.S. Environmental Protection Agency. 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA/600/4-84-076.

U.S. Environmental Protection Agency. 2002. U.S. EPA Environmental Response Team, Standard Operating Procedures #2013, Surface Water Sampling. EPA, 12/17/02.

4. Attachments

Figures 1, 2, and 3 (included on following pages)
Attachment A – USEPA Surface Water Sampling SOP

5. Contacts

Steven Canton
Bill Simons

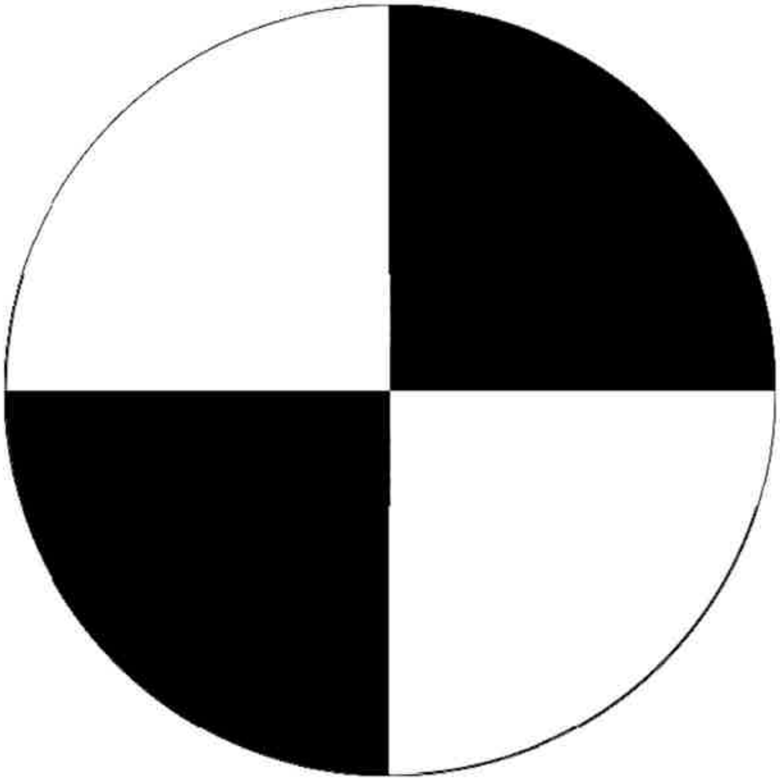


Figure 1 - Secchi Disk

Figure 2 – Kemmerer Bottle

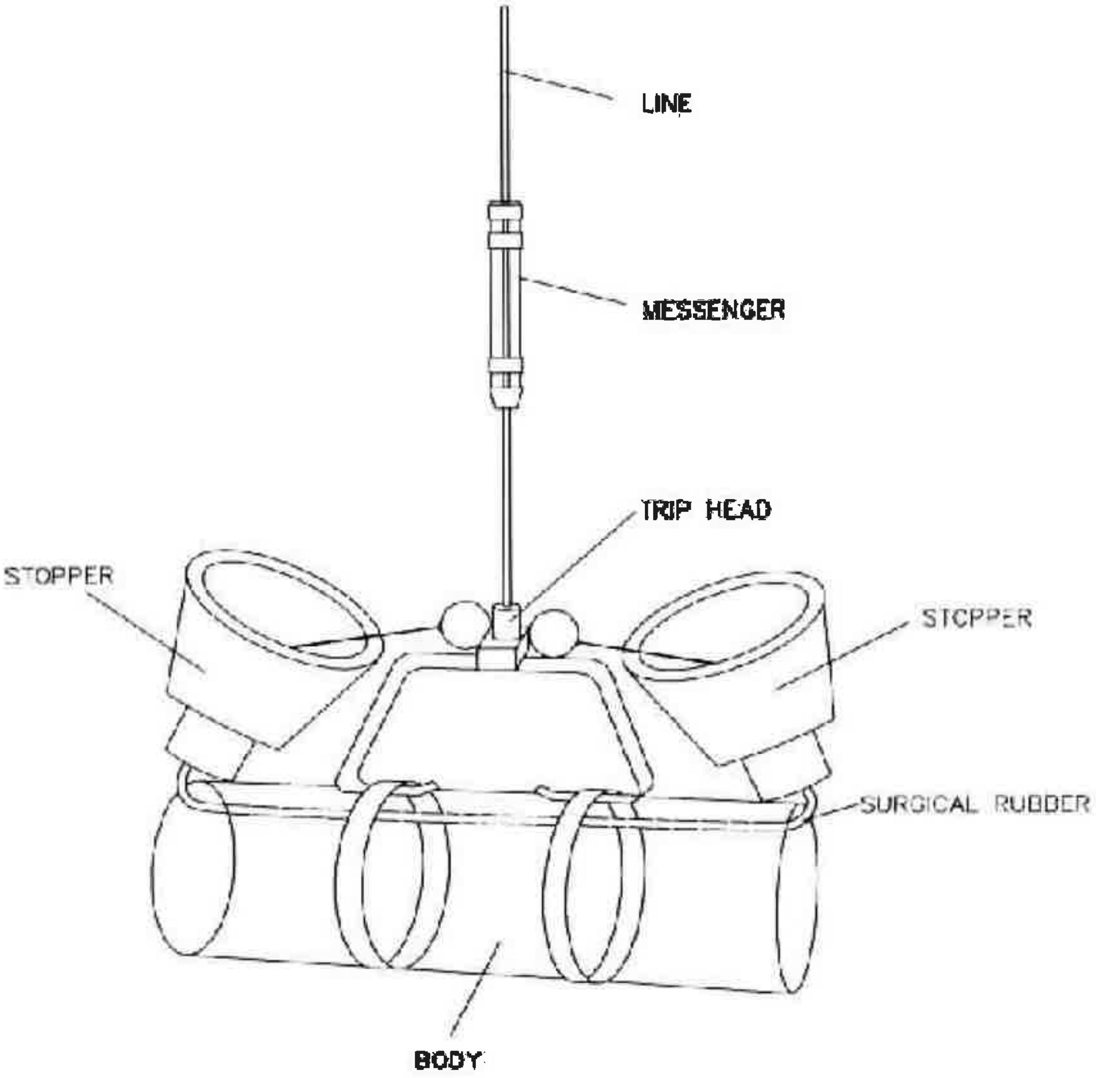


Figure 3 - Van Doran Sampler

U. S. EPA ENVIRONMENTAL RESPONSE TEAM

STANDARD OPERATING PROCEDURES

SOP: 2013
PAGE: 1 of 15
REV: 1.0
DATE: 12/17/02

SURFACE WATER SAMPLING

CONTENTS

CONTENTS (Cont'd)

* These sections affected by Revision 0.0.

SUPERSEDES: SOP #2013; Revision 0.0; 11/17/94; U.S. EPA Contract 68-C4-0022.

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) is applicable to the collection of representative surface water samples from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling situations vary widely; therefore, no universal sampling procedure can be recommended. However, surface water sampling is generally accomplished through the use of one of the following samplers or techniques:

- Kemmerer bottle
- Van Doren sampler
- Bacon bomb sampler
- Dip sampler
- Direct method

These samplers and sampling techniques will result in the collection of representative samples from the majority of surface waters and impoundments encountered.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Once samples have been collected, the following procedures should be followed:

1. Transfer the sample(s) into suitable, labeled sample containers specific for the analyses to be performed.

2. Preserve the sample, if appropriate, or use pre-preserved sample bottles. Do not overfill bottles if they are pre-preserved.

3. Cap the container securely, place in a resealable plastic bag, and cool to 4°C.

4. Record all pertinent data in the site logbook and/or on field data sheets.

5. Complete the Chain of Custody record.

6. Attach custody seals to cooler prior to shipment.

7. Decontaminate all non-dedicated sampling equipment prior to the collection of additional samples.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems associated with surface water sampling. These include cross contamination of samples and improper sample collection.

1. Cross contamination problems can be eliminated or minimized through the use of dedicated or disposable sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to ERT/REAC SOP #2006, *Sampling Equipment Decontamination*.

2. Improper sample collection can involve using contaminated equipment, equipment that is potentially not compatible with the contaminants of concern, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed or non-representative area. Be sure to use sampling equipment of an appropriate composition based upon the suspected contaminants and analyses to be performed.

Following proper decontamination procedures, minimizing disturbance of the sample site, and careful selection of sampling locations will eliminate these problems. Proper timing for the collection of samples must be taken into consideration due to tidal influences and low or fast-flowing streams or rivers.

5.0 EQUIPMENT/APPARATUS

Equipment needed for collection of surface water samples may include (depending on technique chosen):

- Kemmerer bottles
- Van Doren sampler
- Bacon bomb sampler
- Dip sampler
- Line and messengers
- Peristalic pump
- Tygon tubing
- 0.45 micron (• m) filters
- Sample bottles/preservatives
- pH paper
- Resealable plastic bags
- Ice

- Coolers, packing material
- Chain of Custody records, custody seals
- Field data sheets
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Compass
- Tape measure
- Survey stakes, flags, or buoys and anchors
- Camera and film
- Logbook/waterproof pen
- Sample bottle labels
- Paper towels
- Disposable pipets
- Hydrolab
- Personal protection equipment (PPE)*
- Global positioning system (GPS)

* Be sure to use types appropriate for analytes to be measured to avoid contamination of samples. Powdered gloves may contain contaminants of concern.

6.0 REAGENTS

Reagents will be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed and are summarized in ERT/REAC SOP #2003, *Sample Storage, Preservation and Handling*. Decontamination solutions are specified in ERT/REAC SOP #2006, *Sampling Equipment Decontamination.*

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

2. Obtain the necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry, in accordance with the site specific Health

and Safety Plan (HASP).

6. Use stakes, flags, or buoys to identify and mark all sampling locations. Alternatively, a GPS radio-navigation system may be used to identify and record sample location coordinates. If required, the proposed locations may be adjusted based on site access, property boundaries, and obstructions.

7.2 Representative Sampling Considerations

In order to collect a representative sample, the hydrology and morphometrics of a stream, river, pond, lake or impoundment should be determined prior to sampling. This will aid in determining the presence of phases or layers in lagoons or impoundments, flow patterns in streams, and appropriate sample locations and depths.

Water quality data should be collected in ponds, lakes and impoundments to determine if stratification is present. Measurements of dissolved oxygen, pH, conductivity, oxidation-potential, temperature and turbidity can indicate if strata exist that would affect analytical results. Measurements should be collected at one-meter intervals from the surface to the bottom using the appropriate instrument (i.e., a Hydrolab or equivalent). These water quality measurements can assist in the interpretation of analytical data, and the selection of sampling sites and depths when surface water samples are collected.

Factors that contribute to the selection of a sampling device used for sampling surface waters in streams, rivers, lakes, ponds, lagoons, and surface impoundments are:

- Width, depth, flow and accessibility of the location being sampled
- Whether the sample will be collected onshore or offshore

7.2.1 Sampler Composition

The appropriate sampling device must be of a proper composition. Selection of samplers constructed of glass, stainless steel, polyvinyl chloride (PVC) or PFTE (Teflon®) should be based upon the suspected contaminants and the analyses to be performed.

7.3 Sample Collection

7.3.1 Kemmerer Bottle

A Kemmerer bottle (Figure 1, Appendix A) may be used in most situations where site access is from a boat or structure, such as a bridge or pier, and where samples at specific depths are required. Sampling procedures are as follows:

1. Use a properly decontaminated Kemmerer bottle. Set the sampling device so that the upper and lower stoppers are pulled away from the body, allowing the surface water to enter tube.

2. Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.

3. When the Kemmerer bottle is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.

4. Retrieve the sampler and discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

7.3.2 Van Doren Sampler

A Van Doren sampler (Figure 2, Appendix A) is used to collect a surface water from a very specific sampling depth or from a shallow water body. Since the sampler is suspended horizontally, the depth interval sampled is the diameter of the sampling tube. The sampling procedure is as follows:

1. Use a properly decontaminated Van Doren sampler. Set the device so that the end stoppers are pulled away from the body allowing surface water to enter the tube.

2. Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.

3. When the Van Doren is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.

4. Retrieve the sampler and discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

7.3.3 Bacon Bomb Sampler

A bacon bomb sampler (Figure 3, Appendix A) may be used in situations similar to those outlined for the Kemmerer bottle. Sampling procedures are as follows:

1. Lower the bacon bomb sampler carefully to the desired depth, allowing the line for

the trigger to remain slack at all times. When the desired depth is reached, pull the trigger line until taut. This will allow the sampler to fill.

2. Release the trigger line and retrieve the sampler.

3. Discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

7.3.4 Dip Sampler

A dip sampler (Figure 4, Appendix A) is useful in situations where a sample is to be recovered from an outfall pipe or along a lagoon bank where direct access is limited. The long handle on such a device allows access from a discrete location. Sampling procedures are as follows:

1. Assemble the device in accordance with the manufacturer's instructions.

2. Extend the device to the sample location and collect the sample by dipping the sampler into the water.

3. Retrieve the sampler and transfer the sample to the appropriate sample container(s).

7.3.5 Direct Method

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples directly into the sample container(s). Health and safety considerations must be addressed when sampling lagoons or other impoundments where specific conditions may exist that warrant the use of additional safety equipment. These issues must be addressed in the site-specific HASP.

Using adequate protective clothing, access the sampling station by appropriate means. When possible, collect samples in a downstream to upstream direction. For shallow stream stations, collect the sample under the water surface while pointing the sample container upstream; the container must be upstream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface while avoiding surface debris and the boat wake.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.
3. To avoid the incidental inclusion of disturbed sediment in the sample, surface water should be collected from a downstream to upstream direction and upstream of any activity that may disturb the sediment (i.e., wading).
4. While collecting surface water using the direct method, the sample container should be held below the surface to avoid the collection of floating debris.
5. Water quality data should be collected to detect the presence of stratified layers or other site-specific characteristics that would affect the sample.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA and Occupational Health and Safety (OSHA) health and safety procedures.

More specifically, when sampling lagoons or surface impoundments containing known or suspected hazardous substances, adequate health and safety and boating precautions must be taken to ensure the safety of sampling personnel.

12.0 REFERENCES

Wilde, F.D., D.B. Radtke, J. Gibs and R.T. Iwatsubo. 1998. National Field Manual for the Collection of Water-Quality Data - Selection of Equipment for Water Sampling. U.S. Geological Survey Techniques of Water -

Resources Investigations, Book 9, Chap. A2, variously paged.

http://water.usgs.gov/owq/FieldManual/index.html and http://water.usgs.gov/owq/FieldManual/mastererrat.html

U.S. Environmental Protection Agency. 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA/600/4-84-076.

13.0 APPENDICES

A - Figures

APPENDIX A
Figures
SOP #2013
December 2002

FIGURE 1. Kemmerer Bottle

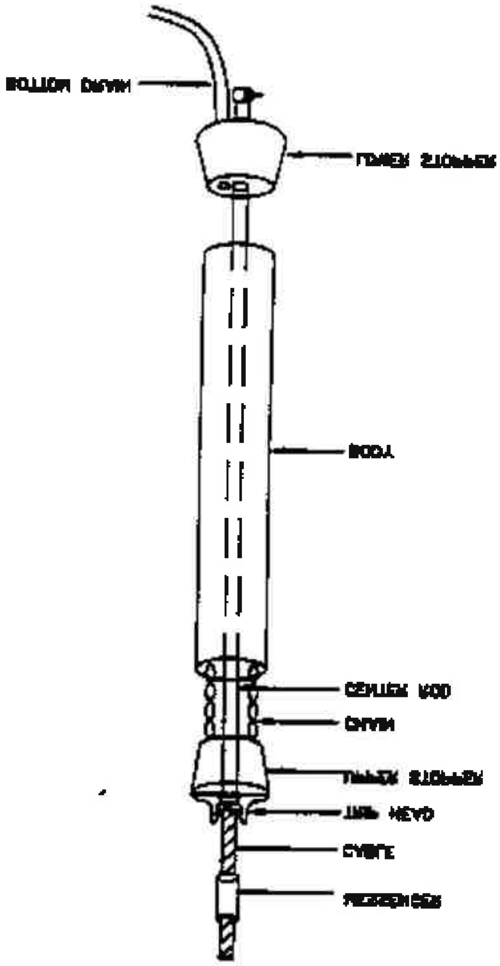


FIGURE 2. Van Doren Sampler

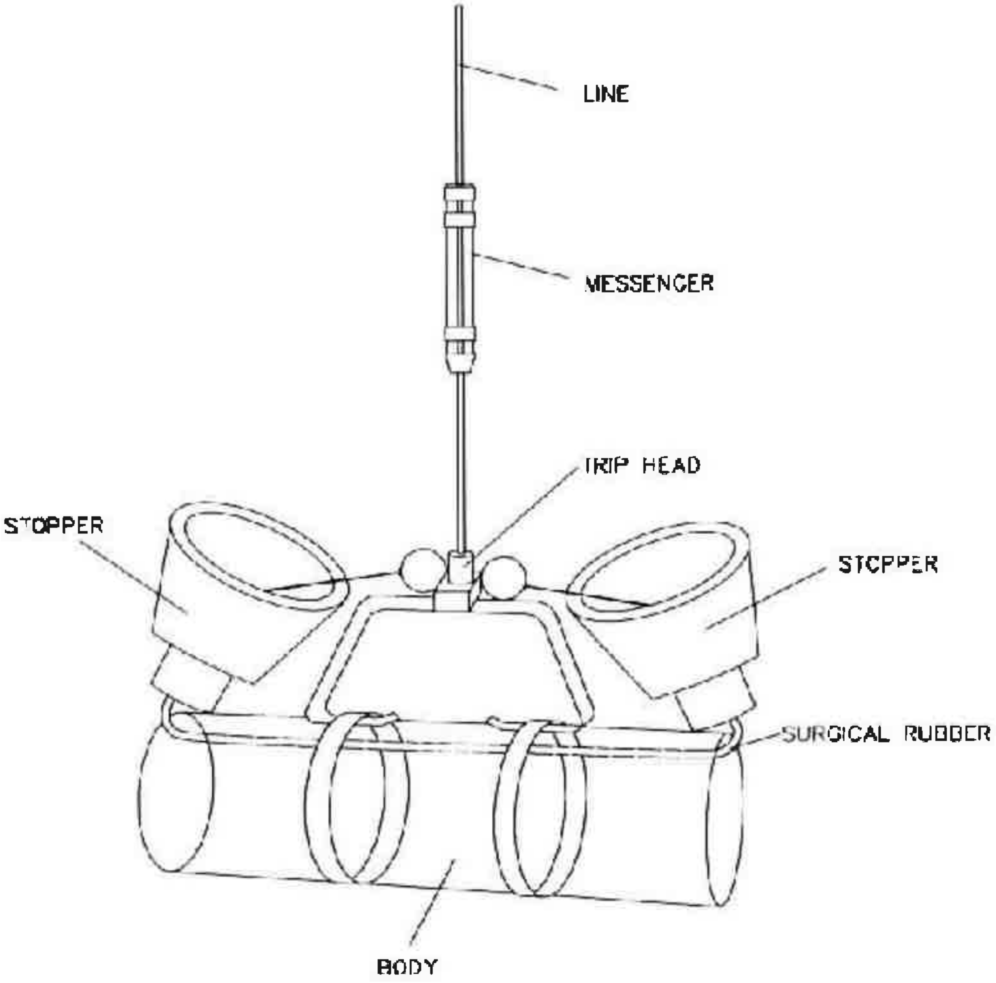


FIGURE 3. Bacon Bomb Sampler

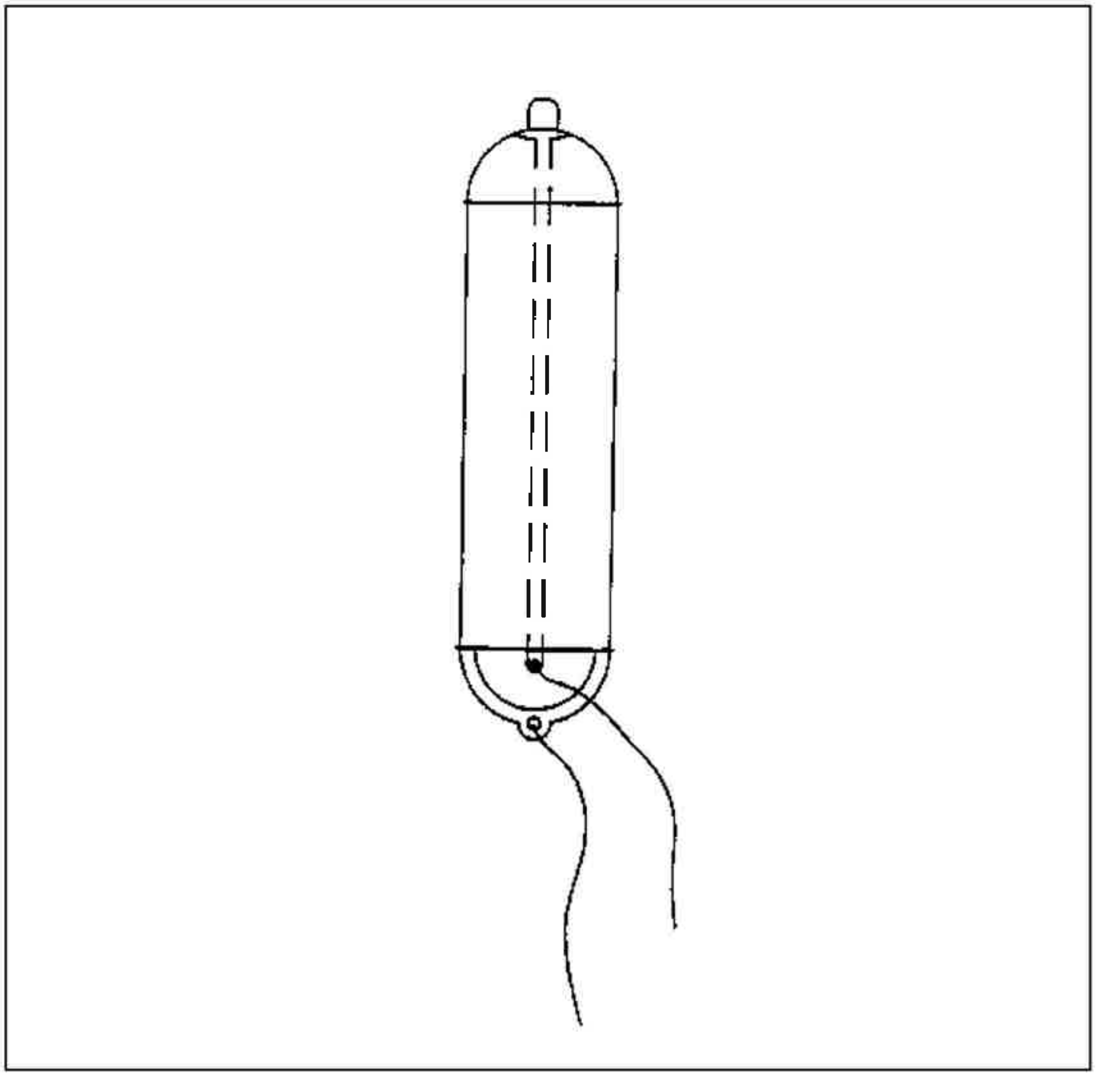
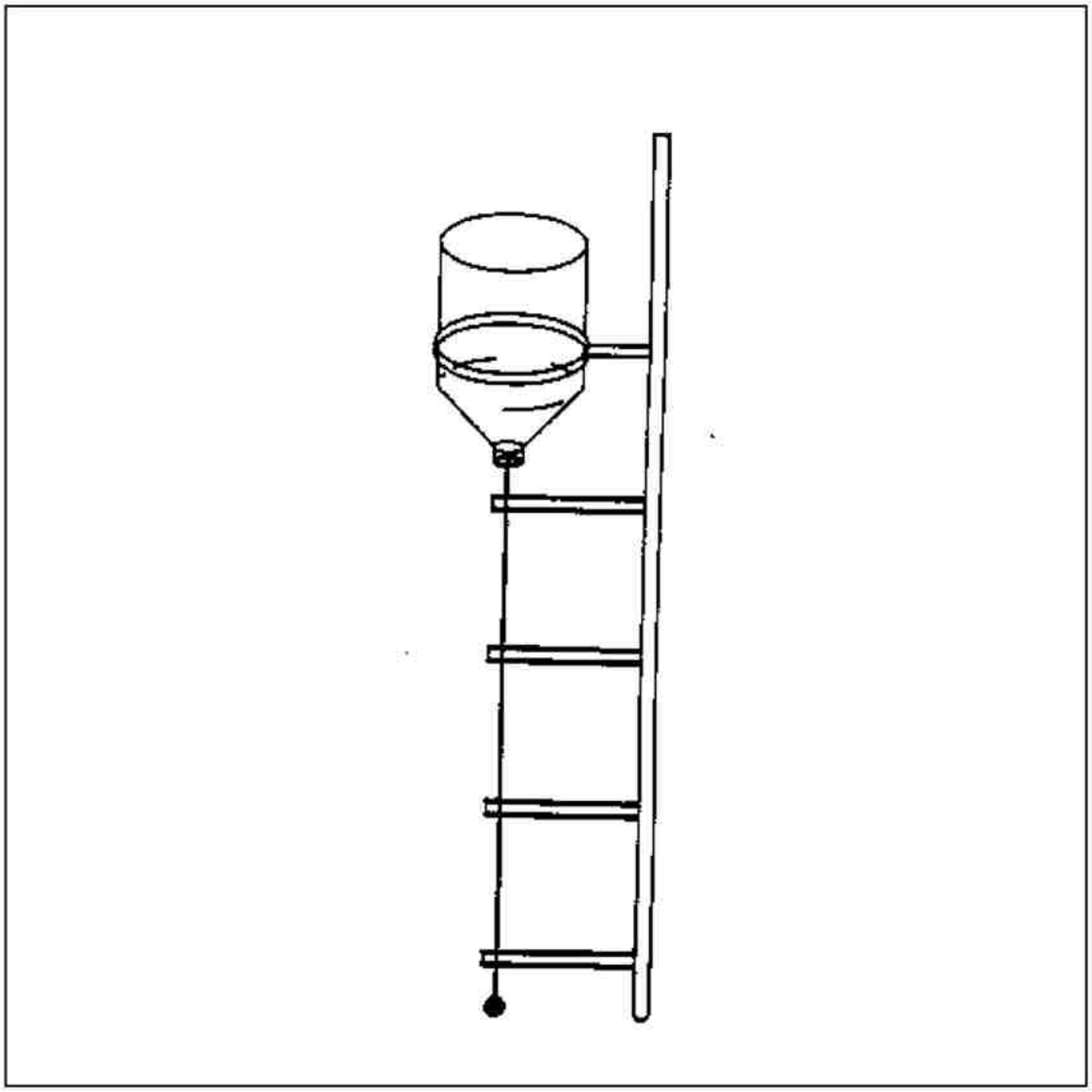


FIGURE 4. Dip Sampler



Section 9

Sediment Sampling (SS)

STANDARD OPERATING PROCEDURE

SS-001 Sediment Sampling Using a Ponar or Shipek Grab Sampler

1. Objective

Describe surficial sediment (approximately upper 6 inches) sample collection using a Ponar or Shipek type grab sampler.

Both devices are relatively easy to handle and operate, readily available, moderately priced, and versatile in terms of the range of substrate types they can effectively sample. Both samplers provide sufficient sample volume (approximately 7.5 or 3 cubic liters, respectively) to support sub-sampling for multiple analytes.

2. Materials

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- Ponar/Shipek Sampler
- Stainless steel sampling tools
- Laboratory provided sample bottles
- Resealable plastic bags
- Ice
- Coolers, packing material
- Chain of custody records, custody seals
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Tape measure
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal Protection Equipment (PPE)
- Global Positioning System (GPS)

3. Execution

- Prior to sample collection, the grab sampler will be decontaminated in accordance with SOP QA-001 – Equipment Decontamination or in accordance with specific project requirements.
- Sample from downstream to upstream locations so that disturbed sediment does not affect subsequent sampling locations.

- When deploying the grab sampler, do not allow it to "free fall". This will prevent kinking of the rope or cable. In deep water, use a winching system to control the rate of descent and ascent.
- The sampler should be carefully lowered the last few feet to minimize dispersal of fine material due to a sampler-induced shock wave.
- After the sample is collected, the sampling device should be lifted slowly off the bottom and raised to the surface at a slow and steady rate.
- Open the jaws of the Ponar slightly and allow the water to drain. If the trapped water is turbid, allow suspended solids to settle before draining.
- Sediments in direct contact with sides or teeth of the grab sampler will be excluded from samples, when possible, to prevent potential contamination from the grab sampling device.
- When it is not possible to collect material directly from the sampler, it should be slowly opened over a clean sample platform, with minimal disturbance.
- If required, photograph the sediments while it is still in the sampler or, if necessary, on the sampling platform. Place a small label with sample field ID number and approximate depth so that it appears in each frame. SOP FD-004 Photodocumentation provides further guidance on photodocumentation.
- Record sediment description in the field notebook based on SOP SM-003, Soil Classification.
- Place sediment samples into pre-cleaned laboratory provided jars for the analyses identified in the work plan.
- The samples should be placed in bubble wrap and then placed in a cooler with ice until transfer to the analytical laboratories.
- At the time of the sample collection, the sample location will be measured from known reference points or may be surveyed with GPS or other survey equipment.

4. Limitations

Careful use of grab samplers is required to avoid problems such as loss of fine-grained surface sediments from the bow wave during descent, mixing of sediment layers upon impact, lack of sediment penetration, and loss of sediment from tilting or washout upon ascent.

Following proper decontamination procedures, minimizing disturbance of the sample site, and careful selection of sampling locations will minimize the potential for cross-contamination.

Larger materials such as twigs and stones may prevent jaw closure. In areas with significant debris or course organic matter, collection of a representative sample may not be possible.

5. References

U.S. Environmental Protection Agency, Office of Water, Office of Science & Technology. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823B-01-002, October 2001.

State of Ohio, Environmental Protection Agency, Division of Surface Water. 2001. Sediment Sampling Guide and Methodologies, Second Edition. November 2001.

ASTM, 2003. D4823-95 (2003) Standard Guide for Core Sampling Submerged, Unconsolidated Sediments. ASTM International, West Conshohocken, PA. August 2003.

Newfield's Environmental Forensics Laboratory, 2005. Geochronologic Sample Handling Procedure.

6. Contacts

Kim Bradley
Ryan Hoffman

STANDARD OPERATING PROCEDURE

SS-002 Sediment Sampling Using Vibracore Equipment

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1. Objective

Describe use of Vibracore methods to collect sediment samples.

Fine-grained sediments, such as sands, silts and clays can be collected using Vibracore (VC) equipment. The VC consists of a metal core barrel with a cutting edge, a sample retaining ring, a replaceable plastic liner, and an air powered piston vibrator to drive the core pipe into the unconsolidated sediments. A new plastic liner is used for each sample.

2. Materials

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- Vibracore sampler
- Stainless steel sampling tools
- Laboratory provided sample bottles
- Resealable plastic bags
- Ice
- Coolers, packing material
- Chain of custody records, custody seals
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Tape measure
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal Protection Equipment (PPE)
- Global Positioning System (GPS)

3. Execution

- Sample from downstream to upstream locations so that disturbed sediment will not affect subsequent sampling locations.
- If sediment samples are being collected for laboratory analysis, the sampling equipment (i.e., cutting shoe, retainer, and sampling barrel) shall be decontaminated prior to the collection of samples at each location. Decontamination shall be conducted in accordance with SOP QA-001 –

Equipment Decontamination or according to any requirements that are outlined in the site-specific work plan(s).

- Moor the VC watercraft in a multi-point fashion.
- Measure and record the depth of the water column (depth to top of sediments).
- If possible, record the latitude, longitude, and elevation of the sample location using Global Positioning System (GPS) equipment.
- If GPS is not available, mark the sampling locations with a labeled stake, buoy, flagging, or other device, and document the locations by measuring from known reference points.
- Vibrate the core barrel into the sediments. Penetration rates will vary depending on the sediment type. When the target depth is attained, retrieve the core.
- If sufficient room is available on the VC watercraft, log the core in accordance with SOP SM-003 Soil Classification and collect analytical samples. Note attributes such as cementation, color and mineralogy (if it can be determined). The presence of iron-staining, or other staining, presence of organic matter, shells, debris or detritus will be recorded. Any odors (i.e., tar-like vs. gasoline-like vs. fuel oil-like, etc.) will be recorded. Any visual impacts will be recorded (i.e., sheens vs. non-aqueous phase liquid (NAPL) vs. staining vs. oil blebs).
- Otherwise, ferry core samples to a field representative on shore as soon as practical for logging and sampling.
- Screen for Volatile Organic Compounds (VOCs) throughout the core and record any instrument response. A photoionization detector will be used for this process. When selecting portions of the core for screening, select undisturbed portions if present. Otherwise, disturbed portions may be screened. Screening should be performed in accordance with SOP SC-004 Head Space Screening.
- Analytical samples will be selected based on criteria stipulated in the associated site-specific work plan. Analytical samples shall be collected with stainless steel spatulas (or similar) that have been decontaminated according to procedures that are outlined in SOP QA-001 Equipment Decontamination or the site-specific work plan(s). The samples shall be contained in laboratory provided jars or glassware and kept cool. The sample identification, date, time, and associated details will be recorded. Pertinent information regarding the samples will be recorded on a chain-of-custody form.

4. Limitations

4.1. When marking locations in navigable waterways, inform the appropriate regulatory agencies and take precautions to prevent navigational hazards before, during, and after sampling.

5. References

Annual Book of ASTM Standards (1993), Section 4, v. 4.08 Soil and Rock; Building Stones; Geosynthetics, D2488-90, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), American Society for Testing and Materials (ASTM).

6. Contacts

Kim Bradley
Ryan Hoffman

STANDARD OPERATING PROCEDURE

SS-003 Sediment Sampling Using a Remote Sampler

1. Objective

Describe use of a remote sampler to collect surficial sediment samples at shallow depths.

The remote sampler is used when Ponar/Shipek and/or vibracore methods are not used.

2. Materials

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- Remote sampler
- Stainless steel sampling tools
- Laboratory provided sample bottles
- Resealable plastic bags
- Ice
- Coolers, packing material
- Chain of custody records, custody seals
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Tape measure
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal Protection Equipment (PPE)
- Global Positioning System (GPS)

3. Execution

- Prior to sample collection, the remote sampler should be decontaminated.
- Sample from downstream to upstream locations so that disturbed sediment will not affect subsequent sampling locations.
- The remote sampler consists of a stainless steel or Teflon scoop attached to a telescoping pole or similar device.
- The remote sampler is extended to the location of the sediment sample targeted for collection.
- Once sediment is collected in the scoop, the sampler should be retrieved slowly to avoid the loss of fine material as the sampler passes through the water column.

- If necessary, photograph the sample with a camera. Place a small label with sample field ID number and approximate depth so that it appears in each frame. SOP FD-004 Photodocumentation provides further guidance.
- This process may be repeated if additional sample volume is necessary.
- Describe and record the sediment in the field notebook in accordance with SOP SM-003 Soil Classification.
- Place sediment samples into pre-cleaned laboratory provided jars for the analyses identified in the work plan. Label each jar with a unique sample identification number and depth of the sample.
- The samples should be placed in bubble wrap and then placed in a cooler with ice until transfer to the analytical laboratories.
- At the time of the sample collection, the sample location will be measured from known reference points or may be surveyed with GPS or other survey equipment.

4. References

U.S. Environmental Protection Agency, Office of Water, Office of Science & Technology. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823B-01-002, October 2001.

State of Ohio, Environmental Protection Agency, Division of Surface Water. 2001. Sediment Sampling Guide and Methodologies, Second Edition. November 2001.

ASTM, 2003. D4823-95 (2003) Standard Guide for Core Sampling Submerged, Unconsolidated Sediments. ASTM International, West Conshohocken, PA. August 2003.

Newfield's Environmental Forensics Laboratory, 2005. Geochronologic Sample Handling Procedure.

5. Contacts

Kim Bradley
Ryan Hoffman

Section 10

Air Sampling and Monitoring (AR)

STANDARD OPERATING PROCEDURES

AR-001 General Guidance on Work Zone Monitoring Methods

1. Objective

Protect human health by measuring air quality at the perimeter of a work area.

2. Execution

Walk-around perimeter and work zone monitoring for Total Volatile Organic Compounds (TVOC), Respirable Particulate matter less than 10 microns (RPM_{10}), and odor will occur along the perimeter of the project site on a regular and as-needed basis. Specific site conditions that will trigger walk-around perimeter or work zone monitoring include:

- visible dust
- odor complaints
- detection of TVOCs and/or RPM_{10} at levels approaching or exceeding action levels
- direction by the site oversight consultant or client

Perimeter air monitoring and work zone monitoring, in the absence of any specific triggering criteria, will be conducted on a regular basis during the normal work day. Particular attention will be given to the direction of any residences or other sensitive receptors.

At the time when a triggering condition is observed, the walk-around perimeter and work zone monitoring will occur continuously until the conditions that triggered the monitoring have subsided. Additional temporary monitoring points may be established due to changing site or meteorological conditions.

TVOC concentrations will be monitored and recorded using a Rae Systems MiniRAE 2000 Portable Ionization Detector (PID) or equivalent. RPM_{10} will be measured and recorded using a MIE personal DataRAM 1200 (PDR-1200) portable real-time aerosol monitor equipped with a PM-10 monitor and Gilian personal air sampling pump. AR-002 Suspended Particulate Matter in Ambient Air using the MIE DataRAM Real-time Aerosol Monitor (Portable) provides guidance on the use of this meter. Odors will be noted based on the n-butanol scale, as adapted from ASTM E544-99.

At each monitoring point, the 15-minute average value of TVOC and RPM_{10}, sample time, and sample location will be collected and recorded. The odor intensity based on the n-butanol scale will be monitored over a 15-minute period and recorded. At each location, air temperature, wind direction, and wind speed may be monitored and recorded using a hand-held wind meter.

Odors as a function of naphthalene concentration will be monitored over a 15-minute period and recorded. To measure naphthalene concentrations, the zNose™ Model 4200 system will be used. The zNose™ is an ultra-fast gas chromatograph (GC) that is capable of analyzing airborne concentrations of VOCs and SVOCs in less than one minute. The zNose™ uses a surface acoustic wave (SAW) detector that changes in vibration frequency as compounds elute from the column and condense onto the surface of the detector.

The zNose™ is a portable instrument and will be positioned downwind of the remedial activities. Up to five samples will be analyzed for naphthalene concentrations over a 15-minute period. The concentrations will be averaged to produce a 15-minute result. The calibration will be checked at the start of the day, at mid-day, and at the end of the day. An air blank will be run every two hours. A blank will also be run if a reading exceeds the calibration range of the instrument.

The zNose™ also has the capability of generating fingerprint images of the chemical constituents in the vapor called VaporPrints™. A VaporPrint™ of an air sample can be collected through a headspace analysis. This VaporPrint™ can be compared to others generated at the perimeter and off-site to see if remedial operations are the source of the odors. VaporPrints™ can allow for identification of odors that may not be affiliated with remedial operations.

To monitor cyanide (as hydrogen cyanide gas), a real-time hand-held meter in conjunction with the Dräger Chip Measuring System (CMS) will be used. Types of continuously monitoring equipment include the V-RAE by Rae Systems and the Mini-Warn by Dräger Safety Systems and are available from rental equipment suppliers. Due to potential interference from sulfur compounds, hydrogen sulfide gas (H_2S) will also be monitored for comparison to the hydrogen cyanide gas levels detected. Hydrogen cyanide gas detections will also be confirmed with CMS Dräger tubes due to this interference. The Dräger CMS can quantify other gases that could potentially provide false positives for hydrogen cyanide gas (including sulfur dioxide, hydrogen sulfide, phosphine gas, chlorine, and nitrogen dioxide) detected by the real-time meter.

At each location, air temperature, wind direction, and wind speed will be monitored and recorded using a hand-held wind meter.

3. References

New York State Department of Environmental Conservation. 2010. DER-10 / Technical Guidance for Site Investigation and Remediation. Division of Environmental Remediation. May 3, 2010. Appendix 1A. pp. 204-206

ASTM E544 - 99(2004) Standard Practices for Referencing Suprathreshold Odor Intensity

4. Attachments

None

5. Contact

Brian Skelly

STANDARD OPERATING PROCEDURE

AR-002 Air Sampling for Dust (Particulate Matter) using the MIE DataRAM™ Real-Time Aerosol Monitor

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1. Objective

Describe standard procedures for the real-time monitoring of airborne particulate matter using a MIE DataRAM™ model DR-2000 real-time aerosol monitor.

The MIE DataRAM™ is a real-time, portable monitor that measures airborne particulate matter. It is capable of monitoring total suspended particulate matter, particulate matter less than 10 microns (PM_{10}), and particulate matter less than 2.5 microns ($PM_{2.5}$) by using an appropriate orifice to control the size of the particles being measured. The DataRAM can be programmed to collect continuous real-time data, or to record time averaged data.

2. Materials

- MIE DataRAM™ model DR-2000
- Shelter/Enclosure - a pre-constructed enclosure capable of protecting the instrumentation from severe weather conditions during sample collection
- Omnidirectional inlet
- Inlet heater
- $PM_{2.5}/PM_{10}$ impactor
- IBM compatible computer loaded with MIE DataRAM™ software
- Field notebook

3. Meter Calibration

- Assemble all necessary DataRAM™ attachments.
- Make sure the power selector switch on the rear panel is in the “on” position. Turn on the power by pressing the “on” button on the front display panel of the DataRAM™. “Main Menu I” will appear on the screen.
- Activate the zero mode by pressing the button indicating zero.
- When the screen indicates the zero mode is complete, activate the span check mode by pressing the button indicated, and follow the prompts that appear on the screen.
- Record the time of the zeroing and the calibration difference percent in the field notebook. If the zeroing procedure takes longer than 5 minutes press “exit” and then “off,” and then put the power switch on the rear panel of the instrument in the “off” position. Wait several minutes, turn on the power and zero the instrument again. If the calibration difference percent is more than ±5% then follow the “Calibr Diff” Resetting Procedure in the DataRAM™ Instruction Manual.
- Set the DataRAM™ to automatically log data. Refer to the Instruction Manual for details on how to set the data logging function.

- Record the instrument flow rate from the parameters menu in the field notebook.

4. Sample Collection

- Set the DataRAM™ at the predetermined sampling location in a rain or weatherproof containment, with only the inlet tubing exposed to ambient air.
- Start the run.
- When sampling is completed, terminate run and download data using the RS-232 cable connector and the MIE DR-COM software.
- Once the data file has been successfully downloaded and saved in an appropriate location, clear the data from the instrument memory.

5. Limitations

Each instrument must be calibrated using the internal reference standard and zeroed at the start of each sampling event and at a frequency of once per day throughout the duration of the sampling event.

The DataRAM™ can be programmed to collect continuous real-time data, or can collect "averaged" real-time data. These various options should be addressed prior to field operations and must be referenced in an approved work plan. This work plan must be available to all field personnel.

Project objectives will usually dictate the sampling location. In general, for air monitoring, meters are usually placed near breathing height and away from objects that can interfere with air motions. Since the DataRAM™ is measuring particulate matter, placement of the instrument directly on the ground should be avoided to prevent the sampling of dust concentrations that may not be representative of the air that is intended to be sampled (e.g. air at breathing height).

6. References

Code of Federal Regulations, 40 CFR 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Washington, D.C. EPA-454/B-08-003 December, 2008.

7. Contacts

Brian Skelly
Mark Ensign

STANDARD OPERATING PROCEDURE

AR-003 Air Sampling for PM_{10} Particulate Matter using the High-Volume Sampler Method

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1. Objective

Describe standard procedures for the collection of air samples for laboratory analysis of PM_{10} particulate matter using the high volume sampler method.

2. Materials

- General Metal Works (GMW) Model IP 10-8000 or equivalent. The GMW sampler can be rented.
- Calibration kit, as specified for the selected sampler.
- PM_{10} sampling filters, to be supplied by the contract laboratory. A Whatman QM-A quartz filter is currently the only commercially available PM_{10} filter that satisfies all criteria specified in 40 CFR 50, Appendix J. .
- Ice chest for sample storage or shipping.

3. Sampling

This method measures the mass concentration of particulate matter with an aerodynamic diameter equal to or less than 10 micrometers (µm). A high volume (HV) sampler draws a known volume of ambient air at a constant flow rate through a size selective inlet and through one or more filters. Particulates of 10 µm or smaller are collected on the filter(s) during the prescribed time period. Each sample filter is weighed before and after sampling to determine the net weight gain of the collected PM_{10} sample.

A HV sampler consists of two basic components: a specially designed inlet that transmits only particles equal to or less than 10 µm in diameter and a flow control system capable of maintaining a constant flow rate within the design specifications of the inlet.

3.1. Sampler Installation

- On receipt of the sampler, inspect all shipping cartons to ensure that all components have been received and verify that the unit is operational.
- On site, assemble the unit according to the manufacturer's instructions. Check all power cords and tubing for crimps, cracks, and breaks. The HV sampler should be placed on a sturdy platform or table, with the air inlet 4 to 6 feet above ground level.
- The sampler should be strategically placed according to the work plan or objectives of the study and located free of any obstructions to ambient air flow.
- The HV sampler requires 110 V AC power. The electrical outlet should be protected by a ground fault interrupter and water proof electrical connectors should be used.

- Operate the sampler for 30 minutes to ensure that the motor is operating at full performance.
- Calibrate the sampler in accordance with the instructions provided with the appropriate calibration kit. Proper calibration of the sampler is critical.
- Field personnel should be familiar with both the sampling unit and the calibration procedure before attempting to record data.

3.2. Sampling Procedure

- Operate sampler as per manufacturer's instructions.
- Filters are received from the laboratory numbered and pre-weighed in their individual envelope or folder within an envelope. Powder free latex gloves, or equivalent, should be worn during the handling of filters. Only touch the edges of the filter.
- Examine the filter support screen to confirm that it is clean. If it appears to be dirty, wipe it clean using lint free wipes such as laboratory wipes or equivalent. Check the gasket to be sure that it is in good condition. The filter is placed on the support screen with the numbered side facing down. Tighten thumb nuts on alternate corners to properly align and seat the gasket. The nuts should be only hand tightened to avoid damaging the gasket.
- Record the sampler serial number, filter ID number, sampler location, sampling date, and the operator's initials in the field notebook, any field data sheets being used, and on the back of a clean chart and install the chart in the flow recorder.
- Turn the sampler on and allow it to equilibrate to operating temperature, about 3 to 5 minutes. Verify that the recorder is operating and that the pen is inking. Allow the sampler to run for the required sampling interval.
- When sampling interval is completed, turn off the sampler and carefully remove the filter as soon as possible. Sample degredation can occur if the filter is left in the sampler for an extended period of time. The filter should be folded in half with the exposed side inward and the folded filter carefully placed in its respective folder and/or envelope. When removing and folding the filter touch only the outer edges. Powder free latex gloves, or equivalent, should be worn when handling filters.
- Record the following parameters in the field notebook and in any field data sheet being used:
    1. Elapsed time of sampling interval in minutes
    2. Average recorder response in arbitrary units
    3. Starting flow rate and ending flow rate
- The average flow rate for GMW Model IP 10-8000 sampler should be close to 1.13 m^3/min.
- Calculate the total flow rate for the sampling interval by time weighted averaging the flow rate readings. Air monitoring results where the flow rates

varied more than +/- 10%, from beginning to end, should be qualified accordingly and discussed with the project manager.

- The exposed filters, folded in half, are placed back into their shipping envelope and forwarded with completed chain of custody forms to the contracted laboratory for analyses. Follow the contracted laboratory's instructions for handling and returning the exposed filters.

4. General Guidance

The total volume of air sampled is determined from the measured volumetric flow rate and the sampling time. The mass concentration of PM_{10} in the ambient air is calculated as the total mass of collected PM_{10} particles divided by the total volume of air sampled. The PM_{10} measurement is expressed as micrograms (µg) per standard cubic meter (µg/std M^3). The sampled volume must be corrected to EPA standard conditions, 25° C, 760 mm Hg or 101 kPa.

A field blank may be collected, which consists of an unexposed filter removed from its envelope, put in place in the HV sampler, immediately removed, folded, replaced in its envelope and sent to the laboratory. Field blanks, if collected, should be taken at a frequency of one per twenty samples. If fewer than twenty samples will be collected during one week, collect one field blank weekly during sampling.

5. References

Code of Federal Regulations, 40 CFR 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods (Interim Edition), Addendum to Section 2.11 Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere (High-Volume Sampler Method), US Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-94/038b April 1994.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Washington, D.C. EPA-454/B-08-003 December, 2008.

6. Contacts

Brian Skelly
Mark Ensign

STANDARD OPERATING PROCEDURE

AR-004 Air Sampling for Polycyclic Aromatic Hydrocarbons (PAHs) using EPA Method TO-13A

1. Objective

Describe standard procedures for the collection of ambient air samples to be analyzed for polycyclic aromatic hydrocarbons (PAHs) using U.S. EPA Method TO-13A.

2. Materials

- Modified High Volume Sampler
- General Metal Works (GMW) Model PS-1 sampler, or equivalent, sample cartridges and filters
- GMW Model GMW-40 calibrator and associated equipment, or equivalent, for calibration of the GMW PS-1 sampler
- Cooler with ice
- Stopwatch
- Data sheets for recording the sampling location, date, duration, starting and stopping times, and calculated sample volume
- Airtight, labeled, screw-capped container (wide mouth, glass with Teflon seal) to hold filter and adsorbent cartridge during transport to analytical laboratory
- Raised platform for the GMW PS-1 sampler

3. Sampling

This section details the sampling methodology and the media preparation by the analytical laboratory.

3.1. Sampling Equipment Overview

- Filters and adsorbent cartridges (containing XAD-2, Polyurethane Foam (PUF), or combination XAD-2 and PUF) are stored in screw-capped containers wrapped in aluminum foil (for protection from light) prior to installation in a modified high volume sampler. The filters and cartridges are supplied by the laboratory ready for use.
- A GMW Model PS-1 or equivalent sampler must be calibrated to draw approximately 325 cubic meters (m^3) of air through the filter and adsorbent sample cartridge.
- The filter and sample cartridge are placed in an appropriately labeled container and shipped to the analytical laboratory for analysis. Since heat, ozone, nitrogen dioxide (NO_2), and ultra violet (UV) light can cause sample degradation, the exposed sampling media must be immediately removed from the sampler using polyester gloves, wrapped in clean aluminum foil, tightly sealed, and packed in ice or refrigerated.

3.2. Sample Collection

- Calibrate each unit weekly and check the calibration daily, before use and at the end of the run, using the calibration kit and calibration curves supplied by the manufacturer.
- The samplers should be located in an unobstructed area, at least six feet from any obstacle to air flow. The exhaust hose should be stretched out in the downwind direction to prevent recycling of air into the sample head. The sampler should be placed off the ground on a sturdy stand, with the air inlet 4 to 6 feet off the ground.
- Remove the empty sample module from the sampler, rinse all sample contact areas using reagent grade hexane from a Teflon bottle. Allow the hexane to evaporate from the module in a well ventilated area before loading the sample cartridge.
- Detach the lower chamber of the rinsed sampling module. While wearing disposable, clean, lint-free nylon or powder-free latex or nitrile gloves, remove a clean glass sample cartridge from its container (wide-mouthed glass jar) and unwrap its aluminum foil covering. Place the foil back into the jar for rewrapping the sample cartridge after use.
- Insert the sample cartridge into the lower chamber and tightly reattach it to the module.
- Using clean Teflon tipped forceps, carefully place a clean fiber filter atop the filter holder and secure in place by clamping the filter holder ring over the filter using the three screw clamps. Ensure that all module connections are tightly assembled. Failure to do so may cause leaks which could affect sample representativeness. Ideally, sample module loading and unloading should be conducted in a controlled environment within a centralized sample processing area so that the sample handling variables can be minimized.
- With the module removed from the sampler and the flow control valve fully open, turn the pump on and allow it to warm up for approximately five minutes.
- Record the required information for the sampling run on the test data sheet. Record location, sampling date, starting and stopping times. Calculate the volume of air sampled.
- Attach the loaded sample module to the sampler.
- Connect the sampler to a 110 volt AC power source. Turn the power switch on. Activate the lapsed time meter and record the start time.
- Record the Magnehelic reading every six hours during the sampling period. Use the calibration curve to calculate the flow rate. Record the temperature, barometric pressure, and the Magnehelic reading at the beginning and end of the sampling period.
- At the end of the sampling period, turn the power off. Carefully remove the sampling head containing the filter and adsorbent cartridge in a clean area. While wearing lint-free nylon or powder-free latex or nitrile gloves, remove the sorbent cartridge from the lower module chamber and lay it on the

retained aluminum foil in which the sample was originally wrapped. Carefully remove the glass fiber filter from the upper chamber using clean Teflon tipped forceps.

- Fold the filter paper in half twice (sample side inward) and place it in the glass cartridge above the sorbent.
- Wrap the combined samples in aluminum foil and place them in their original glass sample container. Complete and fix a sample label to the sample container. Maintain chain-of-custody records for all samples.
- Store the glass container in a cooler with ice and protect the samples from light to prevent photodecomposition of collected analytes. If the time span between sample collection and lab analysis will exceed 24 hours, samples must be kept refrigerated. The sample holding time is less than 20 days.
- Perform a final calculated sample flow check. If flow rate calibration deviated by more than 10 percent from the initial reading, the flow data for that sample must be marked as estimated.
- Store all samples in the field on ice at approximately 0°C until delivered to the laboratory.

4. General Guidance

- This method may be modified for indoor air sampling.
- Field Blank: If necessary, collect a field blank, which consists of an unexposed filter that is removed from its envelope, put into the sampler, immediately removed, folded, replaced in its envelope and sent to the laboratory for analysis. Collect field blanks at a frequency of one per twenty samples. If fewer than twenty samples will be collected during one week, collect one field blank weekly during the sampling.

5. References

Code of Federal Regulations, 40 CFR 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Washington, D.C. EPA-454/B-08-003 December, 2008.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-13A, Determination of PAHs in Ambient Air Using GC/MS, US Environmental Protection Agency, Office of Research and Development, Center for Environmental Research Information, Cincinnati, OH, EPA/625/R-96/010b, January 1999.

6. Contacts

Brian Skelly
Mark Ensign

STANDARD OPERATING PROCEDURE

AR-005 Hydrogen Cyanide Work Zone Air Monitoring Procedures

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1. Objective

Describe real-time monitoring of hydrogen cyanide gas during field activities.

2. Equipment

To monitor cyanide (as hydrogen cyanide gas), the GEI field representative should utilize a real time handheld meter in conjunction with the Dräger Chip Measuring System (CMS) during subsurface activities including subsurface excavations, borings and monitoring well installation, materials handling, and groundwater sampling in areas with confirmed or suspected cyanide impacts.

Continuous monitoring equipment includes the V-RAE by Rae Systems and the Mini-Warn by Dräger Safety Systems, and are available from rental equipment suppliers. Due to potential interference from sulfurs, hydrogen sulfide gas (H_2S) should also be monitored for comparison to the hydrogen cyanide gas levels detected. Hydrogen cyanide gas detections will also be confirmed with CMS Dräger tubes due to this interference. The Dräger CMS can quantify other gases that could potentially provide false positives for hydrogen cyanide gas (including sulfur dioxide, hydrogen sulfide, phosphine gas, chlorine, and nitrogen dioxide) detected by the real time meter.

3. Calibration

Prior to commencing work on-site, the real-time cyanide meter should be calibrated in accordance with the equipment manufacturer's specifications. If the meter is calibrated in the field, the daily calibration results should be recorded in the field notebook.

4. Execution

Cyanide will be monitored around the perimeter of the work zone on a regular basis. Continuous monitoring should be completed every fifteen minutes if sulfur odor or suspected purifier waste material (former MGP sites only) is encountered. Measurements should be monitored in the breathing zone and should be recorded into the field notebook or on an applicable form. In the event that hydrogen cyanide is detected, the GEI field representative should proceed as follows:

4.1. Action Level: HCN ≤1 ppm for 15-minute average using real time meter

- Run CMS Dräger tube.
- Continue monitoring with real time meter.
- Continue work if CMS Dräger tube for hydrogen cyanide reads <2 ppm.

4.2. Action Level: 1 ppm < HCN < 2ppm for 15-minute average using real time meter.

- Run CMS Dräger using hydrogen cyanide gas chip and confirm <2 ppm concentration.
- Continue monitoring with real time meter.
- Run CMS Dräger tube using sulfur dioxide, hydrogen sulfide phosphine chip to evaluate potential interference.
- Recalibrate the real time meter and continue to monitor the work zone.

4.3. Action Level: HCN 2 ppm on CMS Dräger tube

- Stop work and move (with continuous monitoring meter) at least 25 feet upwind from excavation or until continuous monitoring meter registers <1 ppm.
- Run CMS Dräger hydrogen cyanide chip and re-evaluate activities
- Continue monitoring with real time meter.
- Allow area to ventilate and continue to monitor while returning to the work zone.
- Do not move into an area when readings are >1 ppm without confirming with additional CMS Dräger measurement.
- May resume work if Dräger tube for cyanide reads <2 ppm.

5. Limitations

No air purifying respiratory protection is available for hydrogen cyanide gas.

The American Conference of Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) for Hydrogen Cyanide is 4.7 ppm.

6. References

Code of Federal Regulations, 40 CFR 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods (Interim Edition), Addendum to Section 2.11 Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere (High-Volume Sampler Method), US Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-94/038b April 1994.

7. Contacts

Brian Skelly
Ryan Hoffman

STANDARD OPERATING PROCEDURE

AR-006 Air Sampling for Volatile Organic Compounds (VOCs) using Summa Canisters

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1. Objective

Describe standard procedures for the collection of ambient air samples to be analyzed for volatile organic compounds (VOCs) using Summa canisters. Typically, U.S. EPA Method TO-15 is used for laboratory analysis. The site-specific Work Plan should be consulted for proposed sample locations and sampling duration.

2. Materials

- Sampling canister
- Flow controller
- Vacuum gauge
- Wrench for removing fittings and assembling the sample train
- Data sheets for recording the sampling location, date, duration, starting and stopping times, and calculated sample volume
- Camera and measuring tape
- Weather station data
- PID

3. Sampling

This section details the sampling methodology and the media preparation by the analytical laboratory.

3.1. Sampling Equipment Overview

- The laboratory prepares the canister for sampling by cleaning and then evacuating the contents to a vacuum of approximately 29.9 inches of Mercury (in. Hg). Opening the stainless steel bellows valve allows the air sample to enter the canister. When the target volume of sample is collected, close the valve and return the canister to the laboratory.
- A flow controller is used as part of the sample train to control the amount of air allowed to flow into the container over time. Flow controllers are typically set to a flow rate that collects a sample continuously over a 1-hour (hr), 8-hr, or 24-hr interval. The sampling duration needs to be communicated to the laboratory prior to sampling, so that the laboratory can provide the appropriate flow controller.
- Summa canisters are typically used and named after the “Summa” process which describes the electro polishing of the interior surface of the canister to prepare it for sampling.
- The holding time for a standard VOCs list of EPA Method TO-15 is 30 days after sample collection, although some projects may require a shorter hold time.

3.2. Document Field Conditions

Document pertinent field conditions prior to sample collection:

- Record weather information, if available (such as precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for at least the past 12 hours.
- Sketch the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North).
- Record pertinent observations, such as odors and readings from field instrumentation.

3.3. Sample Collection

- Collect samples in a clean Summa canister (or equivalent) using a flow controller calibrated for the anticipated sample duration (e.g. 8-hour, 24-hour, etc.). The flow controller flow rate should not exceed 0.2 liters per minute.
- Verify the initial vacuum of the canister using the vacuum gauge. If the canister vacuum is less than 25 in. Hg, do not use it. The procedure to verify the initial pressure is simple, and a missed step can compromise the validity of the sample media.
  - i. Confirm the canister's bellows valve is closed by turning the knob clockwise to tighten.
  - ii. Remove the brass cap from the canister inlet.
  - iii. Attach the vacuum gauge.
  - iv. Open and close the bellows valve quickly (a few seconds).
  - v. Read and record the vacuum on the gauge as 'Initial vacuum' on the chain-of-custody (COC).
  - vi. Confirm the bellows valve is closed by turning the knob clockwise to tighten.
  - vii. Remove the vacuum gauge and replace the brass cap.
- <u>Begin Sampling</u>
  - i. Confirm the bellows valve is open by turning the knob counter-clockwise to loosen.
  - ii. Remove the brass cap.
  - iii. Attach the flow controller.
  - iv. Attach a "J"-shaped sampling cane to prevent precipitation from entering the canister.
  - v. Place the canister at the sampling location open the bellows valve. If the sample is collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet should be at the proper height.

    vi. Record the start date and time on the COC.
    vii. Record the identification numbers for the canister and flow controller and the vacuum gage.

- Begin Sampling (with a field duplicate)
    i. Confirm the bellows valve is closed by turning the knob clockwise to loosen on both canisters.
    ii. Remove the brass cap from both canisters.
    iii. Attach a flow controller on both canisters.
    iv. Attached a “T”-shaped sample train designed for field duplicates to both canisters.
    v. Attach a “J”-shaped sampling cane to the common end of the sampling “T” to limit precipitation entering the canisters.
    vi. Place the attached primary and duplicate canisters at the sampling location open the bellows valve. If the sample is collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet should be at the proper height.
    vii. Record the start date and time on the COC.
- Monitoring Sample progress
    i. At regular intervals, record the vacuum on the flow controller to confirm that the vacuum is decreasing in the canister. If the vacuum reads 5 in. Hg or less the bellows valve should be closed and the sample interval ended.
    ii. Some residual vacuum is important to maintaining sample integrity. If there is no vacuum remaining, call the laboratory and discuss the sample viability with them. Evaluate whether another sample will be taken after sharing the laboratory’s opinion with your project manager.
- End Sampling
    i. Sampling will end when the time interval (e.g., 8-hr period) is completed, or when the canister vacuum reads 5 in. Hg or less.
    ii. Close the bellow valve by turning the knob clockwise to tighten.
    iii. Remove the “J”-shaped sampling cane.
    iv. Remove the flow controller.
    v. Attach the vacuum gauge.
    vi. Open and close the bellows valve quickly (a few seconds).
    vii. Read and record the vacuum on the gauge as ‘Final vacuum’ on the chain-of-custody (COC).
    viii. Confirm the bellows valve is closed by turning the knob clockwise to tighten.
    ix. Remove the vacuum gauge and replace the brass cap.
- Sample Transport
    i. Return the canister, flow controller, and sampling cane to the laboratory in the boxes provided.
    ii. Fill out the COC and relinquish samples properly with flow controller and canister numbers on the COC.

iii. Place the COC in the box and retain a copy of the COC for your records.
iv. Tape the box shut.
v. Deliver or ship the samples to the laboratory as soon as practical to adequately meet the holding time of the sample.

4. General Guidance

- This method may be modified for indoor air sampling.
- Field Blank: Do not collect a field blank.
- Trip Blank: Do not collect a trip blank. The canister is prepared for sampling by evacuating the contents to a vacuum of, so no air exists for a trip blank to provide meaningful information.

5. References

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS), US Environmental Protection Agency, Office of Research and Development, Center for Environmental Research Information, Cincinnati, OH, EPA/625/R-96/010b, January 1999.

Guide To Air Sampling & Analysis, Air Toxics, Ltd., Folsom, CA.

6. Contacts

Brian Skelly
Mark C. Ensign

Section 11

Soil Gas Sampling (SG)

STANDARD OPERATING PROCEDURE

SG-001 General Guidance on Soil Vapor Intrusion Evaluations

1. Objective

The goal of a soil vapor intrusion evaluation is to assess whether complete exposure pathways of soil vapor to indoor air exist. A complete exposure pathway exists if vapors from constituents are migrating through various pathways into residential or commercial buildings at concentrations that may result in an unacceptable human health risk. If a complete exposure pathway does not exist, then further assessment of soil vapor intrusion is not required.

Depending on the status of investigation performed at the site it may be appropriate to approach an evaluation of soil vapor intrusion at different tiers. If little work has been performed relative to the potential for contaminants to affect soil vapor near a structure, then a screening level assessment is an appropriate first step. However, if a plume is well delineated and the potential for groundwater impacts, or nearby source material, to affect soil vapor near a potential receptor structure is well understood, then it may be more appropriate to directly develop and implement a soil vapor and/or indoor air sampling plan. To accommodate the potential varied states of knowledge when a vapor intrusion evaluation is required, a flexible approach is needed that incorporates the following elements.

- SOP SG-002 Soil Vapor Sample Collection
- SOP SG-003 Sub-Slab Soil Vapor Collection
- Indoor Air Sampling
- SOP SG-004 Ambient Air Sample Collection

Soil vapor intrusion evaluations should be approached on a site-specific basis and depending on the site-specific setting and proximity to impacted groundwater or source material, it may be appropriate to proceed in a hierarchical fashion through each tier of evaluation or a variety of tiers may be combined and implemented simultaneously. The SOPs presented in this SOP address each of these sampling procedures.

2. Execution

2.1. Implementation Triggers

Soil vapor intrusion evaluations may be implemented at various times based on event triggers throughout the Site Characterization (SC), Remedial Investigation (RI), and site remedial action plan. The following event triggers would require the implementation of this soil vapor intrusion investigation.

- Identification of a potential complete exposure pathway
- Private property owner request for sampling

- State or Federal administrative order

2.2. Factors Affecting Soil Vapor Intrusion

Prior to conducting a soil vapor intrusion assessment at a private property, an analysis of the factors contributing to the migration of soil vapor to indoor air should be conducted. The completion of this analysis should take into account the two types of factors: environmental and building factors.

2.2.1. Environmental Factors

Environmental factors include site specific conditions in the subsurface and above the ground surface that may affect the rate and direction at which soil vapor may migrate.

The soil and groundwater conditions between the contamination and the residential/commercial building should be evaluated and recorded in any soil vapor intrusion investigation. If the SC/RI has been completed, then the data are available for this review. If the SC/RI has not been completed, then at a minimum the nature and extent of impacted soil and/or groundwater between the site and the residential/commercial building should be defined.

After compiling the necessary site-specific data, that information should be reviewed to determine groundwater conditions at the site. The potential for man-made or natural preferential pathways for vapor migration in the vadose zone and/or for groundwater migration in the saturated zone should also be determined at this time.

- The depth to groundwater below the residential or commercial building will be determined. For example, in cases where groundwater intersects the foundation there is no vadose zone to collect a sub-slab sample. In cases where the groundwater is close to the foundation, there is a risk of causing/exacerbating groundwater intrusion through the foundation during periods of high groundwater.

Additional Site Observations

- Direction of groundwater flow from the contaminant source to the residential or commercial building;
- The location, depth, extent, and concentration of potential constituents in unsaturated soil and groundwater on the property; and,
- Presence of an overlying water bearing zone that does not have impacts beneath the residential or commercial building. An un-impacted shallow water zone will significantly retard or completely prohibit the potential for deeper impacted groundwater to affect soil vapor.
- Potential “smear zones” (residual non-aqueous phase liquid (NAPL) present at depths over which the water table fluctuates) should also be identified as they may also affect the rate of soil vapor migration.
- Location, depth, extent of NAPL, if present.

Soils which are highly organic, wet, and/or of low permeability should be identified. If these soils are present beneath a structure and above impacted groundwater or soil, they may effectively shield the building from potential vapor intrusion. Conversely, dry and porous soils underlying a building may provide a less inhibited soil vapor intrusion pathway. The limits of backfill surrounding residential or commercial building should be also noted.

2.2.2. Building Factors

Building Factors include the physical characteristics, such as structure, floor layout, air flow, and physical conditions. These conditions will be documented during the evaluation. The New York State Department of Health (NYSDOH) Center for Environmental Health's Indoor Air Quality Questionnaire and Building Inventory form is presented in Attachment A. At a minimum, the following information should be recorded.

- Building foundation construction characteristics (basement, footers, crawl spaces, etc), including potential preferential vapor intrusion pathways such as foundations cracks and utility penetrations.
- Basement wall materials (hollow block, stone, or poured concrete, etc.)
- Presence of an attached garage.
- Recent renovations to the building such as new paint or new carpet.
- Mechanical heating/cooling equipment that may affect air flow.
- Use and storage of petroleum products such as home heating oil storage tanks, underground storage tanks (USTs), or kerosene heaters.
- Recent use of petroleum-based finish or other products containing volatile organic compounds (VOCs).
- Areas of pavement on the property should also be identified in the event sub slab vapor sampling is not feasible or appropriate due to a high groundwater table. Paved areas could serve as surrogate locations in lieu of sub slab soil vapor sampling if high water table conditions exist.

The construction materials and integrity of the floor of the structure closest to the potential point of entry for soil vapor (basement level or first floor for slab-on-grade constructions) should be identified. In addition to the foundation type and integrity, this survey should note any preferential pathways (utility lines/pipes, sumps, etc.) that may exist within the bottom-most level of the structure.

The operation and presence of heating systems, including fireplaces and clothes dryers, may create a pressure differential between the structure and the outside environment, causing an increase of migration of soil vapor into the building. The NYSDOH guidance document suggests limiting indoor air sampling to the heating season (with the exception of immediate inhalation hazard situations), which is roughly defined as November 15th to March 31st. However, sampling may be completed at any time during the year for any sampling completed in response to a request by a community member. In situations where non-heating season sampling has taken place, consideration should be given to re-sampling the property within the heating season. The operation of HVAC systems should be noted on the building inventory form (Attachment A).

During the initial building assessment and visit, and again when sub-slab soil vapor and/or indoor air sampling are performed, differential pressure measurements between indoor air, ambient air, and soil vapor should be collected and recorded to document the potential effect building conditions have on soil vapor migration.

2.2.3. Property Visit

A property visit will be conducted prior to sampling. During the site visit, technical representatives will complete site visit observations, inventories and occupant questionnaire forms (Appendix A). During the course of the interview, observations will be made to identify any potential areas or issues of concern or the presence of any odors, and if sampling appears necessary, identify potential sampling points and general building characteristics. The questionnaire is also used to identify potential sources and activities that may interfere with sampling results. The questionnaire will specifically address the activities of the occupant's (e.g., smoking, work place activities) that may contribute to indoor air concentrations of volatile chemicals.

The responses to the questionnaire will be evaluated and a determination will be made as to whether additional investigation is required.

2.2.4. Chemical Inventory

The chemical inventory complements the identification of the building factors affecting soil vapor intrusion. The chemical inventory will identify the occurrence and use of chemicals and products throughout the building. These products can be used to develop an indoor environmental profile. A separate inventory should be prepared for each room on the floor being tested as well as any other indoor areas physically connected to the areas being tested. Inventories will include product names, chemical ingredients, or both. If possible, photographs of the products should be taken of the location and condition of the inventoried products and the photographic records should be indexed with the inventory records. The products inventory can also be used to document odors and if possible portable vapor monitoring equipment measurements should be taken and recorded. A product inventory will be repeated prior to each round of testing at the building. If available, the volatile ingredients should be recorded for each product. If the ingredients are not listed on the label, record the manufacturer's name and address or phone number if available. The product inventory form is presented in Attachment A.

2.2.5. Water Table Conditions and Vapor Intrusion Assessment Approach

Sub-slab soil vapor sampling is intended to evaluate the potential for vapor intrusion. However, there are circumstances where collection of sub-slab soil vapor samples may not be feasible if the water table is near, at, or above the elevation of a buildings foundation slab. An evaluation of the water table elevation relative to the building slab should be made before attempting to install a sub-slab vapor sampling point.

If the water table is found to be sufficiently below the building slab and sub-slab vapor sampling can be performed, then the following Low Water Table Scenario should be followed.

2.2.5.1. Low Water Table Scenario

If the water table elevation is lower than the basement slab, then the following samples should be collected.

- Sub-slab soil vapor samples
- Indoor air samples from basement level
- Indoor air samples from main living space (First floor)
- Outdoor ambient air sample

If the water table is deemed to be at too high of an elevation to allow sub-slab vapor sampling, then alternate means of evaluating the potential for vapor intrusion must be employed. If a building has a groundwater sump, the sump should be evaluated to determine if there is water present in the sump and if that water is representative of groundwater or if the water is stagnant. If water in the sump represents groundwater, then a sample from the sump should be collected. The High Water Scenario below summarizes the methods to evaluate potential vapor intrusion if sub-slab vapor sampling cannot be conducted due to high groundwater conditions.

2.2.5.2. High Water Table Scenario

If the water table elevation is higher than the basement slab, then the following tasks should be performed.

- Determine if a sump pump is present and actively pumping water.
- If sump is actively pumping, collect a sample of groundwater from the sump.
- Collect an indoor air sample from basement level.
- Collect an indoor air sample from main living space (first floor).
- Identify exterior soil vapor sample location near foundation (outside of foundation backfill) and preferably beneath a surrogate vapor cap (e.g. paved driveway, patio).
- Collect soil vapor samples from exterior soil vapor location
- Collect an outdoor ambient air sample.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

4. Attachments

Attachment A - NYSDOH Center for Environmental Health's Indoor Air Quality Questionnaire and Building Inventory Form

5. Contact

Chris Berotti

ATTACHMENT A

Off-Site Property Sampling Documentation Form

Property Location/Address: ______________________________

Property: _____________________________

Sampling Date: _____________________________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Preparer's Name: _______________________________ Date/Time Prepared: ______________
Preparer's Affiliation: _______________________________ Phone No.: __________________
Purpose of Investigation:____

1. OCCUPANT Interviewed: Yes ☐ No ☐
Last Name: _____________________________ First Name: ____________________________
Address: ____
County: _______________________
Home Phone: ___________________________ Office Phone: __________________________
Number of Occupants/persons at this location _______ Age of Occupants__________________

2. OWNER OR LANDLORD (Check if same as occupant __) Interviewed: Yes ☐ No ☐
Last Name: _____________________________ First Name: ____________________________
Address: ____
County: _______________________
Home Phone: ___________________________ Office Phone: __________________________

3. CONTACT NAME (Check if same as Occupant ____, Owner ____)
Last Name: _____________________________ First Name: ____________________________
Address: ____
County: _______________________
Home Phone: ___________________________ Office Phone: __________________________

4. PROPERTY LOCATION: ____
Relative to Site:
Direction ________ Direction to Nearest Cross Street: _________
Distance ________ Distance to Nearest Cross Street: _________
Surrounding Land Use:
North: ________________ East: ________________
South: ________________ West: ________________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

5. PROPERTY BOUNDARIES

Delineate the boundaries of the property (on a separate project map, outline property location, private well location, septic/leachfield location, groundwater flow, compass direction, windrose.)

6. BUILDING CONSTRUCTION

Type of Building (Circle appropriate response)

Residential School Commercial/Multi-use

Industrial Church Other: _________________

If the property is residential, type? (Circle appropriate response)

Ranch 2-Family 3-Family

Raised Ranch Split Level Colonial

Cape Cod Contemporary Mobile Home

Duplex Apartment House Townhouses/Condos

Modular Log Home Other:_______________

If multiple units, how many? ________

If the property is commercial, type?

Business Type(s) _____________________________________

Does it include residences (i.e., multi-use)? Yes ☐ No ☐

If yes, how many? ______

Other characteristics:

Number of floors______ Building age______

Is the building insulated? Yes ☐ No ☐ How air tight? Tight / Average / Not Tight

Construction Material ___________________________________

7. BASEMENT AND CONSTRUCTION CHARACTERISTICS

Does the building have a basement and/or crawl space, or is it slab-on-grade construction?

____

Describe the construction of the basement/crawl space (Circle all that apply)

a. Above grade construction: wood frame concrete stone brick

b. Basement type: full crawlspace slab other ________

Property Location/Address: _______________________________
Property: ______________________________
Sampling Date: ______________________________

c. Basement floor:	concrete	dirt	stone	other ________
d. Basement floor surface:	uncovered	covered	covered with ____________	
e. Concrete floor:	unsealed	sealed	sealed with _____________	
	unpainted	painted	painted with ____________	
f. Foundation walls:	poured	block	stone	other ________
g. Foundation walls:	unsealed	sealed	sealed with _____________	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	

Does your basement have a sump? Yes ☐ No ☐

Is, is there water in the sump? Yes ☐ No ☐

Describe sump conditions:____

____

Have you observed standing water in your basement? Yes ☐ No ☐

If so, what is the frequency of this observation? _____________During rain events? ☐

Have you observed sheen atop the standing water? Yes ☐ No ☐

Basement/Lowest level depth below grade: ________(feet)

Are there any cracks in the floor of your basement? Yes ☐ No ☐

Description: ____

____

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

Description: ____

____

What activities occur in the finished basement?

Description: ____

____

Approximately how many hours per day (or week) do you spend in your basement? __________

8. HEATING, VENTING AND AIR CONDITIONING

Type of heating system(s) used in building: (Circle all that apply – note primary)

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Hot Air Circulation   Hot Water Baseboard   Steam Radiation
Electric Baseboard   Heat Pump   Wood Stove
Space Heaters   Radiant Floor   Outdoor wood boiler
Unvented Kerosene Heater   Other _____________________________

The primary type of fuel used is:

Fuel Oil   Natural Gas   Electric
Kerosene   Propane   Solar
Wood   Coal   Other? ___________________

Time of use of each type of heating? ____

Domestic hot water tank fueled by: ____

Boiler/furnace located in: Basement   Outdoors   Main Floor   Other_______________

Air conditioning: Central Air   Window units   Open Windows   None

Are there air distribution ducts present?   Yes ☐   No ☐

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

____
____
____
____

Type of insulation (e.g. blown, fiber, etc.)? ____

Does building have energy efficient windows (e.g. double paned)   Yes ☐   No ☐

Was weather-stripping recently added/upgraded?   Yes ☐   No ☐

Particleboard used in construction?   Yes ☐   No ☐

9. OCCUPANCY

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

Level General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage)

Basement ____

1st Floor ____

2nd Floor ____

3rd Floor ____

4th Floor ____

10. BULK PETROLEUM STORAGE

Aboveground storage tank on the property Yes ☐ No ☐

If yes, how old is tank? _______________ Condition? __________________

Last inspected? _______________ Location: ____________________

Describe conduits to building (type, location, and entry portal condition): _________________

____

Underground storage tank on the property. Yes ☐ No ☐

If yes, how old is tank? _______________ Condition? __________________

Last inspected? _______________ Location: ____________________

Describe conduits to building (type, location, and entry portal condition): _________________

____

11. WATER AND SEWAGE

Water Supply:

Public Water Drilled Well Driven Well Dug Well Other ______________

Is there use of groundwater water for irrigation purposes? Yes ☐ No ☐

Sewage Disposal:

Public Sewer Septic Tank Leach Field Dry Well Other ______________

12. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Yes ☐ No ☐

If not, is there a separate garage or carport? Yes ☐ No ☐

b. Does the garage have a separate heating unit? Yes ☐ No ☐ NA ☐

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, ATV, car)

Yes ☐ No ☐ NA ☐ Please specify__________________

Is gasoline stored in the garage? Yes ☐ No ☐

Quantity? ________________

d. Has the building ever had a fire? Yes ☐ No ☐

When?_________________

e. Is a kerosene or unvented gas space heater present? Yes ☐ No ☐

Where? ________________

f. Is there a workshop or hobby/craft area? Yes ☐ No ☐

Where & Type? ________________

g. Is there smoking in the building? Yes ☐ No ☐

How frequently? _______________

h. Have cleaning products been used recently? Yes ☐ No ☐

When & Type? ________________

i. Have cosmetic products been used recently? Yes ☐ No ☐

When & Type? ________________

j. Has painting/staining been done in the last 6 months? Yes ☐ No ☐

Where & When? _______________

Is house paint stored inside? Yes ☐ No ☐

Where? _______________

k. Is there new carpet, drapes or other textiles? Yes ☐ No ☐

Where & When? _______________

l. Have air fresheners been used recently? Yes ☐ No ☐

When & Type? ________________

m. Is there a kitchen exhaust fan? Yes ☐ No ☐

If yes, where vented?____________

n. Is there a bathroom exhaust fan? Yes ☐ No ☐

If yes, where vented?____________

o. Is there a clothes dryer? Yes ☐ No ☐

If yes, is it vented outside? Yes ☐ No ☐

p. Has there been a pesticide/chemical fertilizer application? Yes ☐ No ☐

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

When & Type?____

Conducted by Owner or Private Yard Service ___________________________

Is yard waste/trash burned on-site? Yes ☐ No ☐

Do any of the building occupants use solvents at work? Yes ☐ No ☐

(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? ____

If yes, are their clothes washed at work? Yes ☐ No ☐

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, Use dry-cleaning regularly (weekly)
Use dry-cleaning infrequently (monthly or less)
Yes, work at a dry-cleaning service

No
Unknown

Is there a radon mitigation system for the building/structure? Yes ☐ No ☐

Date of Installation: ____________

Is the system active or passive? Active ☐ Passive ☐

Are there any recent/past improvements to building? Yes ☐ No ☐

Interior painting? ____

Any landscaping improvements that involved bringing fill on site? Yes ☐ No ☐

Other ____

Approximately when (how long ago) did these improvements occur? ______________

Does anyone living here engage in any of the following activities or hobbies?

a. Art projects (e.g. oil painting, ceramics, pottery, stained glass, metal sculpture)

Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

b. Furniture refinishing Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

c. Model building(e.g. planes,boats,cars) Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

d. Gardening Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

e. Automotive work Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

f. Ammunition reloading Yes ☐ No ☐

Name: ____________________________ Age: _________ Sex: _____________

Name: ____________________________ Age: _________ Sex: _____________

Is there a wood burning stove? Yes ☐ No ☐

If so, how frequently is it used?

____

____

Is there a barbeque grill? Yes ☐ No ☐

If so, how frequently is it used? What is the type of fuel?

____

____

Has the building ever had fumigation? Yes ☐ No ☐

Property Location/Address: ______________________________
Property: _____________________________
Sampling Date: _____________________________

If so, when and how frequently? Type?

____

____

13. ODOR SUMMARY

Have the occupants observed any unusual odors? _______________________________________

____

____

____

____

History of odor observation – date of onset, duration, severity, etc.

____

____

____

____

____

____

____

14. PRODUCT INVENTORY

Record the specific products found in building that have the potential to affect indoor air quality on the attached product inventory form.

15. INDOOR SKETCH

Draw a plan view sketch (on grid paper) of the basement, first floor, and any other floor where sampling was conducted in the building as well as any outdoor sample locations. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Property Location/Address: ____________________________
Property: ___________________________
Sampling Date: ___________________________

Product Inventory
Off-Site Property Sampling Documentation
Soil Vapor Intrusion Investigation

Property Address:	**Performed by:**
Date of Inventory:	**Field Instrument Make & Model:**

Location	**Product Description**	**Size (units)**	**Condition ***	**Chemical Ingredients**	**Field Instrument Reading (units)**	**Photo ** Y/N**

Notes

* Describe the condition of the product containers as Unopened (UO), Used (U), or Deteriorated (D)

** Photographs of the front and back of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

STANDARD OPERATING PROCEDURE

SG-002 Soil Vapor Sample Collection

1. Objective

This procedure outlines the general steps to collect soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary soil vapor probes should be installed using the procedures outlined below. All soil vapor probes should be installed using a direct-push drill rig (e.g., Geoprobe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

Document pertinent field conditions prior to installation of any probe points.

- Record weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North);
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Soil Vapor Point Installation Specifications

Each soil vapor point should be constructed as follows:

- Six-inch stainless steel Geoprobe® AT86 series Permanent Implants (soil vapor screens) or equivalent and threaded to an (expendable) stainless steel anchor point.
- The implants should be fitted with inert Teflon or stainless steel tubing of laboratory or food grade quality.
- The annular space surrounding the vapor screen interval and a minimum of 6-inches above the top of the screen should be filled with a porous backfill

material (e.g., glass beads or coarse silica sand) to create a sampling zone 1 foot in length.

For temporary points, a hydrated bentonite surface seal should be created at the surface to minimize infiltration. For permanent points, the additional measures described below should be included.

- The soil vapor points should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet (or to grade, whichever is smaller) to prevent ambient air infiltration.
- If needed, the remainder of the borehole should be backfilled with clean material.
- A protective casing should be set around the top of the point tubing and grouted in place to the top of the bentonite to minimize infiltration of water or ambient air, as well as to prevent accidental damage to the soil vapor point.
- The tubing top should be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

2.3. Soil Vapor Sample Collection

Soil vapor samples should be collected as indicated in the work plan and in accordance with applicable state or federal guidance documents. Specifically, samples from the points should be collected as follows:

- Permanent soil vapor points should not be sampled or purged for a minimum of 24 hours after installation. Temporary points may be purged and sampled immediately following installation.
- Document pertinent field conditions prior to sampling as described above.
- A suction pump should be used to remove a minimum of three implant volumes from the soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute.
- Samples should be collected for volatile organic compounds (VOCs) in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate should not exceed 0.2 liters per minute.
- A helium tracer gas should be used to identify any potential migration or short circuiting of ambient air during sampling as described below.
- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing

laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.

- Connect the tubing from the soil vapor probe to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample should be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- All laboratory analytical data should be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

2.4. Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the soil vapor probe seal and assess the potential for introduction of ambient air into the soil vapor sample.

A tracer gas evaluation should be conducted on the each temporary soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent soil vapor probe during the initial sampling event and a minimum of 10% of the soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

Retain the tracer gas around the sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.

- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber should have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >10%.
- The chamber should have a gas-tight fitting or sealable penetration to allow the soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that should be pre-calibrated to extract soil vapor at a rate of no more than 0.2 liters per minute. Purge the tubing using the pump. Calculate the volume of air in the tubing and probe and purge one to three tubing/probe volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary.

If the evaluation on a probe indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement subsequent sample collection.

A non-detectable level of tracer gas is preferred, however, if the evaluation on a probe indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, *dated October 2006.*

4. Contact

Chris Berotti

STANDARD OPERATING PROCEDURE

SG-003 Sub-slab Soil Vapor Collection

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1. Objective

This procedure outlines the general steps to collect sub-slab soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary sub-slab soil vapor probes will be installed using the procedures outlined below. All sub-slab soil vapor probes will be installed using a direct-push drill rig (e.g., Geoprobe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

Document pertinent field conditions prior to installation of any probe locations.

- Record weather information (precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours. Record the indoor conditions (temperature, heating/cooling system active, windows open/closed, etc.).
- Measure the differential pressure at the building. Measure the indoor and outdoor barometric pressure using a high resolution device. Where possible, measure the sub-slab barometric pressure at the sampling point.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Indoor floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, heating, ventilating and air conditioning (HVAC) system air supply and return registers, compass orientation (North), footings that create separate foundation sections, and any other pertinent information should be completed;
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sub-Slab Soil Vapor Point Installation Specifications

Each sub-slab soil vapor point will be constructed as follows:

- Drill an approximately 3/8-inch hole through the slab. If necessary, advance the drill bit 2-3 inches into the sub-slab material to create an open cavity.
- Using dedicated inert Teflon or stainless steel tubing of laboratory or food grade quality, insert the inlet of the tubing to the specified depth below the slab. For permanent installation, only stainless steel tubing and fittings will be used.
- For permanent point installations, the annular space surrounding the vapor probe tip will be filled with a porous backfill material (e.g., glass beads or coarse silica sand) to cover 1-inch of the above the tip of the probe.
- Seal the annular space between the hole and the tubing using an inert non-shrinking sealant such as melted 100% beeswax, permagum grout, putty, etc. For permanent installations, cement may be used.
- For permanent points, a protective casing will be set around the top of the point tubing and grouted in place minimize infiltration of water or ambient air, as well as to prevent accidental damage to he permanent point.
- The tubing top will be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

In cases where sub-slab sampling is impractical or infeasible, a surrogate location (attached garage, concrete patio, asphalt driveway, etc.) may be used if it is representative of sub-slab conditions. In surrogate locations, the vapor sampling point may be installed in accordance with SOP SG-002 Soil Vapor Collection.

2.3. Sub-Slab Soil Vapor Sample Collection

Sub-slab soil vapor samples will be collected as indicated in the site-specific Sampling and Analysis Work Plan and in accordance with state or Federal guidance documents. Specifically, sub-slab samples from the points will be collected as follows:

- Document pertinent field conditions prior to sampling as described above.
- A suction pump will be used to remove one to three implant volumes from the sub-slab soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute.
- Samples will be collected in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate will not exceed 0.2 liters per minute.
- A helium tracer gas will be used to identify any potential migration or short circuiting of ambient air during sampling as described below.

- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.
- Connect the tubing from the sub-slab soil vapor probe to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Samples will be analyzed for volatile organic compounds (VOCs) and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

2.4. Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the sub-slab soil vapor probe seal and assess the potential for introduction of indoor air into the sub-slab soil vapor sample. A tracer gas evaluation should be conducted on the each temporary sub-slab soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent sub-slab soil vapor probe during the initial sampling event and a minimum of 10% of the sub-slab soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

- Retain the tracer gas around the sub-slab sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >10%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the sub-slab soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract sub-slab soil vapor at a rate of no more than 0.2 lpm. Purge the tubing using the pump. Calculate the volume of air in the tubing and purge one to three tubing volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation will be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary:

If the evaluation on a probe indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement subsequent sample collection.

A non-detectable level of tracer gas is preferred; however, if the evaluation on a probe indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

4. Contact

Chris Berotti

STANDARD OPERATING PROCEDURE

SG-004 Ambient Air Sample Collection

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1. Objective

Describe procedures to collect ambient air samples. The site-specific Work Plan should be consulted for proposed sample locations and sampling duration.

2. Execution

2.1. Document Field Conditions

Document pertinent field conditions prior to sample collection:

- Record weather information, if available (such as precipitation, temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for at least the past 12 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North).
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sample Collection

- Samples should be collected in laboratory-certified clean SUMMA® canister (or equivalent) using a flow controller calibrated for the anticipated sample duration (1-hour, 8-hour, etc.). The regulator flow rate should not exceed 0.2 liters per minute.
- Place the canister at the sampling location. If the sample is collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet should be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller.
- Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.

- Connect the tubing to the flow controller.
- Open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- If possible, monitor the vacuum pressure in the canister routinely during sampling. During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, call the laboratory and discuss the sample viability with them. Determine whether another sample will be taken after sharing the laboratory's opinion with your project manager.
- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

4. Contacts

Chris Berotti
Bill Simons

Section 12

Quality Control – Quality Assurance (QA)

STANDARD OPERATING PROCEDURE

QA-001 Equipment Decontamination

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1. Objective

This SOP describes methods used to decontaminate reusable sampling equipment for projects that require collection of organic and inorganic analytical samples. The goal is to minimize cross-contamination between samples. This maximizes confidence that field samples will be representative of specific locations and conditions.

Refer to the work plan or project manager to determine if different decontamination methods are acceptable.

2. Execution

- All contractor-provided equipment (augers, rods, spoons, backhoe buckets) should be decontaminated by steam cleaning or pressure washing prior to coming on site. If there is doubt about cleanliness of drilling tools, they should be decontaminated before use at the site.
- Sampling equipment decontamination is a sequential procedure consisting of the following steps:
    - Alconox-solution wash (or equivalent non-phosphate detergent)
    - Potable water rinse
    - A ten percent reagent grade nitric acid wash should be used to strip potential inorganic contaminants from sampling devices.
    - Laboratory grade 100 percent methanol, should be used to strip potential organic contaminants from sampling devices.
    - Three distilled/deionized water rinses.
- Alconox solution is a mixture of approximately 1 cup of Alconox per 1 gallon of potable water. Alconox solution wash requires scrubbing the equipment with a brush soaked in Alconox solution to remove visible contamination or dirt from sampling devices.
- Split-spoon samplers must be decontaminated prior to collecting each sample. The procedure follows:
    - Overall wash and scrub in a bucket of Alconox solution
    - Potable water rinse.
    - 10% nitric rinse
    - 100% laboratory grade methanol rinse
    - Three distilled-water rinses.

The same procedure is applied to all devices that may contact soil or groundwater slated for analytical samples - spoons and knifes used to inspect or sample soils; water level indicators; oil/water interface probes.

Equipment used for well development of multiple wells must be decontaminated between wells.

Pumps and tubing should be flushed using a minimum of one gallon of Alconox-solution followed by a gallon of potable water. Some projects may require methanol (in much lower quantities) and distilled water instead of or in addition to the Alconox-solution and potable water.

For pumps and tubing, a final rinse of the sampling equipment may be performed with the water being sampled.

Equipment blanks measure the effectiveness of the decontamination procedures. Blanks should be collected per guidance provided in QA-002, Field Quality Control Samples.

3. Limitations

- Do not store the deionized/distilled water in polyethylene bottles, use Nalgene, glass, or Teflon. Polyethylene may leach phthalates.
- Do not attempt to decontaminate string or rope - replace it.
- Due to eye and skin absorption hazards, safety glasses and gloves must be worn when handling decontamination solvents.
- Decontamination procedures may also require modification based on state or federal requirements.
- Steam cleaning or pressure washing with potable water is generally an acceptable decontamination method for drilling equipment (i.e., augers). Check with the work plan.
- Dedicated equipment need not be decontaminated beyond initial decontamination prior to field use.

4. References

Environmental Response Team (ERT), US EPA. Sampling Equipment Decontamination, SOP No. 2006, Revision 0.0. August 11, 1994.

US EPA Region 9. Sampling Equipment Decontamination, SOP No. 1230, Revision 1.September 1999.

5. Contacts

Brian Conte
Bill Simons

STANDARD OPERATING PROCEDURE

QA-002 Field Quality Control Samples

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1. Objective

Field Quality Control (QC) samples are used to monitor the reproducibility and representativeness of field sampling. The QC samples are handled, transported, and analyzed in the same manner as the associated field samples. QC samples may include trip blanks, equipment blanks, and field duplicates.

2. Execution

2.1. Trip blanks

- Used to monitor possible sources of contamination from transport, storage, inadequate bottle cleaning, or laboratory methodologies.
- Sample containers filled at the laboratory with analyte-free water are transported to and from the site, and are not opened until time of analysis.
- Trip blanks are stored with the sample containers prior to and after field activities and remain with the collected samples until analyzed.
- Generally, one trip blank per volatiles analysis (e.g. volatile organic compounds) shipment.
- Consider submitting a trip blank when sample shipment is by Fed Ex or other large carrier, or laboratory courier.
- Trip blanks should be recorded in the field notebook and on the chain-of-custody that same as all other samples.

2.2. Equipment blanks

- Equipment blanks (also known as equipment rinsate blanks) are used to monitor possible sources of contamination associated with sample collection. Monitors on-site sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions
- Equipment blanks are collected by pouring laboratory supplied or distilled or deionized water over sampling tools that have been decontaminated per the work plan, into sample containers.
- Equipment blanks are stored with the associated field samples until submitted for analysis.
- Generally collected when site conditions indicate site related contamination is a concern. Check project-specific work plan and/or quality assurance project plan for required frequency.
- Prepare equipment blanks immediately after the equipment is cleaned in the field and before leaving the sampling site.
- Prepare equipment blanks by rinsing the decontaminated sampling equipment set with the appropriate type of analyte-free water and collecting the rinse water in appropriate sample containers.

- If a potable water rinse is the typical final step, collect the equipment blank with analyte-free water after the potable water rinse.
- Equipment blanks should be recorded in the field notebook and on the chain-of-custody that same as all other samples.

2.3. Field Duplicates

- Used to evaluate the precision and representativeness of the sampling procedures.
- Field duplicates are two samples collected from the same location using the same procedures. Both samples are submitted to the laboratory as individual samples with different sample identification.
- Field duplicates from groundwater sampling for all analyses except volatiles analysis are collected by alternating filling sample containers from the same sampling device. Field duplicates for volatiles analysis are filled sequentially.
- Soil or sediment field duplicates are collected by homogenizing the sample for all analyses except volatiles. The homogenized sample is then divided into two equal portions and placed in separate sample containers. Field duplicates for volatile analysis are collected at two adjacent sampling locations.
- Each sample is assigned different sample identifications.
- Field duplicates are generally collected at frequency of 1/20 samples. Check project-specific work plan and/or quality assurance project plan for required frequency.
- All field QC samples should be labeled in the field and submitted “blind” to the laboratory – as if they are separate, primary samples.
- Field duplicates should be recorded in the field notebook and on the chain-of-custody that same as all other samples.
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2.4. Matrix-Spike samples (MS/MSD)

- Matrix spike and matrix spike duplicate samples (MS/MSDs) are environmental samples that are spiked in the laboratory or in the field with a known concentration of a target analyte(s) to verify percent recoveries.
- Matrix spike and matrix spike duplicate samples are primarily used to check sample matrix interferences. They can also be used to monitor error due to laboratory bias and poor precision. However, a data set of at least three or more results is necessary to statistically distinguish between laboratory performance and matrix interference.
- Generally, the laboratory is required to extract and analyze MS or MS / MSDs at a minimum frequency of 5% of samples being analyzed for the target analyte(s). If the project or client criteria require an MS or MS/MSD, collect sufficient volume in the appropriate containers, and designate the sample to be used as the MS or MS/MSD on the chain of custody.
- Calculate the percent recovery for all spiked analytes for both the MS and MSD. For MS/MSDs also calculate the relative percent difference (RPD). The

RPD for each spiked analyte is calculated using the amount detected not percent recovery. If your data will be subjected to validation, the % recovery and the RPD will generally be determined by the validator.

2.5. Typical QA/QC Frequency

- QA/QC frequency is determined by project, client or regulatory criteria and should be verified prior to sample collection. Generally, QA/QC samples are collected according to the frequency described below:

Duplicate Samples	One per sampling event, one per 10 samples collected, or one every two weeks, whichever comes first.
Equipment Blanks	For each equipment type that is not dedicated or disposable - one per sampling event, one per 20 samples collected, or one every two weeks, whichever comes first.
Trip Blanks	One per sample delivery group, or in each cooler containing VOC soil or aqueous samples, depending on project.
MS or MS / MSDs	One MS or MS/MSD per sampling event, one per 20 samples collected, or one every two weeks, whichever comes first.

3. Limitations

- Trip blanks must never be opened in the field.
- Trip blanks are usually for VOCs only because less volatile compounds are not likely to cross-contaminate other samples by simply being in close proximity.
- Laboratory-grade water must be used during the collection of equipment blanks.
- Field duplicates must have different sample identifications.

4. References

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (November 1986), U.S. Environmental Protection Agency Department of Solid Waste, Washington, D.C.

U.S. Environmental Protection Agency Office of Emergency and Remedial Response, 1990, Quality assurance/quality control guidance for removal activities: EPA/540/G-90/004, Sampling QA/QC Plan and Data Validation Procedures Interim Final, April, 1990.

5. Contact

Brian Conte
Pat King

Section 13

Technical Report Production (RP)

STANDARD OPERATING PROCEDURE

RP-001 Technical Project Delivery

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1. Objective

Describe the technical project delivery process.

The technical project delivery process outlined below begins at the start of a project and is intended to help focus the goals and objectives and the approach for completion of the project. The technical project delivery process involves numerous staff and resources, and a systematic approach should improve technical quality and streamline the entire process. This technical project delivery process should begin after the contract has been signed and scope of work has been confirmed with client and/or regulatory agency.

Much of the material covered in this standard operating procedure (SOP) is referenced to GEI's Project Delivery Model (PDM) Revised August 2009. This manual should be consulted in concert with this SOP.

2. Plan

2.1. Project Team Alignment

Identify, align and commit the full range of individuals who will be responsible for executing the project tasks and activities.

- Project Manager (PM)
- Lead Author (LA) / Assistant Project Manager / Project Engineer / Project Scientist
- Senior Review Team (SRT) / In-House Consultant (IHC) / Technical Reviewer (TR)
- Task/Phase/Discipline Leads
- Project Technical and Support Staff

2.2. Plan Checklist

The Plan Checklist identifies the project planning elements of a complete and comprehensive Project Delivery Plan.

- Read and understand contract with terms and conditions
- Read and understand Scope of Work
- Clarify project deadlines, responsibilities, and deliverables
- Compare proposed level of effort to individual effort
- Establish individual team responsibilities
- Identify Project Subcontractors
    - Identify key subcontractor contact information
    - Discuss scheduling field work

    - Provide with signed approved subcontractor purchase order
- Review prior client and project correspondence (e.g. notes from meetings) - critical to understanding client needs
- Identify client contact and preferred means of communication
- Identify similar projects/reports prepared by GEI or others
- Identify key guidance documents used for project

2.3. Project Delivery Plan

The Project Delivery Plan describes and documents the resources, tools, and processes that the project team will use to successfully deliver the project to achieve the project goals and objectives. A complete and comprehensive project plan should consider the following elements:

- Goals/Objectives
- Definition/Scope
- Deliverables
- Team/Resources
- Budget
- Schedule/Milestones
- Quality
- Risk
- Health and Safety
- Document Management
- Change Management
- Communication

3. Execute

3.1. Project Kick-off and Goal Setting Meeting

Prior to getting underway with Project Execution, the Project Kick-off activity is focused on understanding the Project Delivery Plan (scope, schedule, budget, etc.).

- Highlight project scope details including:
    - Goals and objectives
    - Deliverables
    - Schedule
    - Roles and responsibilities of team members
    - Similar project deliverables
- Provide location of background information (e.g. contracts and scopes of study)
- Discuss team's workloads and other project commitments
- Identify hard-to-meet goals or project deadlines

- Discuss site and project Health and Safety Issues
- Discuss presentation of tables and figures

3.2. Evaluate Project Performance / Quality Management

Regularly review project performance, measured against the Project Delivery Plan and identified project goals and objectives. Evaluate performance at least monthly. Review project processes, procedures, controls, and documentation per GEI Quality Assurance Program, Client and contract requirements, and industry standards. At a minimum, assess:

- Scope completion vs. cost-to-date (e.g. percent complete vs. percent spent).
- Actual schedule vs. planned schedule.
- Status of deliverables.
- Status of Accounts Receivable and Accounts Payable.
- Under- or over-estimates of required task efforts.
- Out-of-scope work and scope creep.
- Real-time review and feedback to project team.

3.2.1. Project Execution / Data Collection

- Monitor data collection activities
- Document all field deviations and subsequent corrections from scope of work for inclusion into report
- Document any discussions with regulators, client, or site personnel that may affect the conclusions or interpretation of data
- Notify client of any deviations or unexpected findings
- Monitor collection of sub-contractor data (e.g. survey data)

3.2.2. Data Quality Objectives

- Provide laboratory contacts and preferred method of communication
- Establish approximate dates of data collection
- Discuss analytical reporting (e.g. should electronic version be submitted directly to laboratory)
- Provide locations and copies of quality assurance documents prepared for the project (e.g. quality assurance project plan (QAPP))
- Discuss amount and type of data to be generated (e.g. number of samples and matrices)
- Determine if outside validation of data is required or necessary
- Define laboratory reporting requirements. Are they sufficient to meet data quality objectives
- Identify analytical parameters with expedited hold times
- Identify all applicable regulatory standards
- Need to generate interim data reports to update client

3.2.3. Data Presentation – Reports and Figures

- Provide drafting with materials for creation of figures and plates
- Confirm the presentation of exceedances (e.g. bold and shade)
- Confirm the presentation of qualified data (e.g. "J" flags)
- Discuss legend and notes section to be provided in tables and figures
- Provide timetable for completion of tables and figures
- Provide tables and figures to participants prior to conceptual model presentation

3.3. Deliverables

During this phase the Lead Author(s) prepare the document in consultation with the PM. Project team should consult with the IHC as needed prior to submittal of draft review.

- Discuss salient points of investigation - "what is the story" to be told in the report
- Provide any perceived data gaps and how they will be addressed in report
- Provide deviations from original work plan and why they were made
- Highlight any inconsistencies with data (e.g. lack of spatial trend in data)
- Everyone involved should agree to the conceptual model

3.3.1. Technical Review

- The Lead Author provides a complete report (tables, figures, text, appendices – all in final form) to the PM for a detailed review.
- After review by the PM, the Lead Author incorporates the PM's input and provides the complete report to the TR / IHC, if necessary, for a technical review.
- Once the changes suggested by the TR / IHC have been agreed upon by the PM and the TR/ IHC, the changes are made and a complete revised draft is provided to the PM
- The PM reviews the final document prior to submittal to the client to ensure that their objectives for documents have been met. These objectives include:
  - Re-review contract and scope of work
  - Consistency of analysis and writing
  - No overstatement of conclusions

4. Limitations

- Deadline dates should be provided to the Word Processing (WP) staff and any changes to the date (pushed back or forward) should be communicated.
- Report checklist or an e-mail with precise instructions should be provided to WP as early as possible (See Attachment A - Report Checklist – for various examples). A report checklist facilitates a thorough understanding of what is needed by the WP staff. Providing more detail up front will make it easier for the WP staff to complete their part of the process.

- Tables should be given to WP staff well in advance (this enables the lead author, or delegate to review the tables one last time before final printing and creating a PDF version). They need to have enough time to format them (which can be very time consuming), and if needed, convert the table to PDF and bookmark them correctly.
- Don't forget to notify CADD of any CADD-related project needs.
- Reports that have many copies/or CDs will take time to produce. WP must be given ample enough time to produce. PM's should take the time to discuss timing with the WP staff. Let them know how detailed a review of the text is required (i.e. just a spell check, quick format check or a thorough proofread including a thorough check on the acronyms and grammar). The creation of a PDF does not necessarily take very long, but in lengthy reports, pulling in the tables, figures and appendices can take some time, especially if the whole PDF needs extensive bookmarking.
- Inform WP by providing the file path to where your documents are located. IN order to be sure your documents are saved in the proper location in the WPROC directory, it is beneficial if you can provide the WP staff with the location of where you want your files saved in the WPROC directory. Only one copy should be held on the network; do not request to keep a copy elsewhere on the network, and with multiple drafts please confer with WP as to what drafts (electronically) can be deleted, if any.

5. Reference

GEI's Project Delivery Model (PDM) Revised August 2009

6. Attachment

Attachment A - Report Checklist Example

7. Contact

Andrea Hippler
Pat King

REPORT CHECKLIST

Project Manager and Key Staff:					
Project Info:	Client:	Name of Report:			
	Project:	Phase:	Task:		
Date/Time Due to Client:		**Primary Mailing Address:**			
No. of Copies:	File:	Original	Client	Personal:	Total:
Document Version:	"Draft" on ☐ off ☐	"Privileged & Confidential" on ☐ off ☐			
Tables:	Yes ☐	No ☐	Comment:		
Figures:	Yes ☐	No ☐	Comment:		
Plates:	Yes ☐	No ☐	Comment:		
Appendices:	Yes ☐	No ☐	Comment:		
CAD Status	Date Submitted:	Completed	Yes ☐	No ☐	
Blue Separator Pages Within Appendix and/or Tables:	Yes ☐	No ☐			
Appendices:	Will be supplied ☐	Use From a Previous Version of Report ☐			
	Electronic Only ☐	Specify Report:			
Scan/PDF:	Text:	Yes ☐	No ☐		
	Tables:	Yes ☐	No ☐		
	Figures:	Yes ☐	No ☐		
	Plates:	Yes ☐	No ☐		
	Data for Appendices:	Yes ☐	No ☐		
PDF Links	Yes ☐	No ☐			
Transmittal:	Cover Letter:	Transmittal Form:	E-Mail:		
GBC or Binder:	GBC ☐	3-Ring Binder ☐	Binder Clip ☐	Staple ☐	
Any Color Printing? (Text, Tables, Figures) Specify:	Yes ☐	No ☐	Text ☐	Tables ☐	Figures ☐ Plates ☐
Mail Delivery Type:	Regular Mail ☐		Overnight ☐	AM Delivery ☐	
	Fax ☐	Ground ☐	Email ☐	Saturday Delivery ? ☐	
Specify Level of Editorial Review:					
Additional Staff Review and Comments					
REQUIRED SIGNATURES	**INITIAL**	**Additional Address (cc and/or bcc list)**			
Technical Review					
In-House Consultant Review[1]					
Editor					
Production					
Final Review					

STANDARD OPERATING PROCEDURE

RP-002 Laboratory Data Review Procedures

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1. Objective

Reviewing laboratory data before they are used for analysis is an important step in quality assurance. GEI defines four levels of data review based on the needs of the project. Attachment A outlines the four levels of data review and indicates the data package requirements for each level.

Analytical data for all projects should undergo a Level 1 review in order to verify that the analytical results provided by the laboratory are of a consistent minimal level of data completeness. Most projects will benefit from a Level 2 review and is encouraged for all project work.

A Level 1 data review can be performed by most staff by following the guidelines below in Section 2.2. A higher level of data review may be required for your project and you should check with the project manager to define these requirements. Each level of data review requires certain laboratory deliverables that need to be defined before samples are sent to the laboratory so the reviewer has the tools they need to complete the review.

Laboratories utilize quality assurance and quality control (QA/QC) results to document the quality of the analytical data they submit. Although the laboratories strive to meet all QC requirements, due to complex sample matrices and other laboratory limitations, it is not unusual for laboratory reports to contain QC non-conformances. The chances of every analyte passing all of the QC criteria are remote and not expected. The Level 2 review will reveal the QC non-conformances, which in many cases, do not affect the usability of the analytical data for the intended use. In these cases, the end user of the data can have the confidence that the quality of the data is appropriate for the intended purpose.

In a small percentage of cases, the review will reveal QC non-conformance that will affect the usability of the data. In these cases, the end-user can avoid making decisions that are not technically supported and may not be fully protective of human health and the environment.

2. Execution

2.1. Quality Assurance

Quality Assurance (QA) is an important component for all projects. A formal Quality Assurance Project Plan (QAPP) may or may not be required for your project and you should check with the project manager if you do not already have the below information in a QAPP or in the work plan. In general, these QA components are important for all projects:

- Project team (including QA/QC manager)
- Samples summary table (including QA samples)
- Required analyte tables to include the Project Quantitation Limits (PQLs) and Project Action Limits (ALs) for all project matrices

- Analytical parameters summary table
- Data review level requirements
- Laboratory data quality objectives
- Laboratory deliverable level description.

2.2. Level 1 (Completeness Check)

The laboratory data package is reviewed for the compliance of sample receipt conditions and analytical results using the Level 1 review sheet (Attachment B).

- Review the reported analytical results in comparison to those requested on the chain-of-custody (COC) to ensure that all analyses were performed. Verify that analysis dates are present and appropriate units are reported. Notify the Project Manager if there were discrepancies between the requested analyses and those reported by the laboratory.
- Compare the required analyte lists to those reported in the data package. Notify the Project Manager if the analyte reporting requirements were not met.
- If dilutions were performed and analyses were not combined by the laboratory, the over calibration range (E) results are to be replaced with the dilution (D) results in order to report all results within the calibration range while reporting the lowest quantitation limits.

2.3. Level 2 (Reduced Data Deliverable Review)

This review builds on the completeness check conducted in Level 1. The Level 2 review of the data package consists of the Level 1 review plus the verification and validation checks for the compliance of the sample-related QC using the appropriate Level 2 review sheets (Attachment C).

- Items listed in the Level 1 review.
- The holding times, laboratory and field blanks, surrogate recoveries, MS/MSD and/or laboratory duplicate results, laboratory control samples, and field duplicates are reviewed according to GEI’s Level 2 Data Review Procedures dated June 2013 (or more current revision) and findings are summarized in a data review memo and results table.

2.4. Level 3 and 4 Level (Data Validation)

Full data deliverable packages are reviewed according to validation requirements specified in the project QAPP or appropriate USEPA Region or State guidelines.

Level 3 and Level 4 review require the expertise of a chemist with combined laboratory and data validation experience. State agencies often determine the years of experience required.

An “external party” or “third-party” data validator may be required for your project and you should check with your state agency to assign a GEI staff or subcontractor to meet these requirements.

EPA defines “external party(ies)” as “*organizations that are not part of the immediate laboratory that generates the analytical data*.” (EPA, 2009)

NYSDEC DER-10 Appendix 2B section 2.0(a)2 defines personnel requirements as a person pre-approved by DER. It also defines third party data validation as potentially necessary (e.g. pending litigation), (NYSDEC, 2010). GEI data validators have been members of project teams in many NYSDEC-approved work plan documents in the past 10+ years.

3. State-specific Levels of Data Review

Each state agency overseeing your project may have specific requirements. The following link includes links to forms and procedures for how to conduct data review for specific states, if required.

http://geiconnections/operations/Operations/JUNE 2011 - Atlantic and New England Standard Operating Procedures (Environmental)/Section_14 - Technical Report Production (RP)/

4. References

New York Department of Environmental Conservation Analytical Service Protocol, Exhibit A, Summary of Requirements (July 2005).

State of Connecticut Department of Environmental Protection, Laboratory Quality Assurance and Quality Control, Data Quality Assessment and Data Usability Evaluation Guidance Document (December 2010).

U.S. Environmental Protection Agency [USEPA] Office of Emergency and Remedial Response, 1990, Quality assurance/quality control guidance for removal activities: EPA/540/G-90/004, Sampling QA/QC Plan and Data Validation Procedures Interim Final (April 1990).

USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (December 1996).

USEPA Region 2 Guidelines for Evaluating Inorganic Analyses (December 2012).

USEPA Region 2 Guidelines for Evaluating Organic Analyses (December 2013).

USEPA National Functional Guidelines for Organic Methods Review (June 2008).

USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (November 2008).

U.S. Environmental Protection Agency, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, EPA 540-R-08-005 (January 2009).

USEPA National Functional Guidelines for Inorganic Methods Review (January 2010).

New York State Department of Environmental Conservation. 2010. DER-10 / Technical Guidance for Site Investigation and Remediation. Division of Environmental Remediation. (May 2010).

5. Attachments

Attachment A – Levels of Data Review (defined by GEI)
Attachment B – Level 1 Data Review Cover Sheet
Attachment C – Level 2 Data Review SOP and checklists

6. Contact

Lorie Mackinnon

SOP RP-002 - Attachment A
Data Review Matrix

Level of Data Review	What/How is done?	What quality assurance components are needed if a QAPP is required?	What laboratory deliverables are required?	Who can perform the review?	How long does it take per sample?
Level 1	• Results requested on the COC are reported in the package. • All analytical parameters are reported (Data Completeness).	• Project team • Samples summary table (including QA samples • Project Quantitation Limits and Action level criteria table • Analytical parameters summary table • Data review level requirements • Laboratory deliverable level description	• Analytical results, SDG narrative, chains-of-custody	• Most staff	• 5 minutes per sample for large packages
Level 2	• Review includes the following: Data Completeness, Holding times, Method/Field/Trip Blanks, Surrogate recoveries, MS/MSD and/or laboratory duplicate results, Laboratory control sample (LCS), and Field duplicate review.	• Same as Level 1	• Analytical results, SDG narrative, chains-of-custody, method blank results, surrogate recoveries, MS/MSD and/or laboratory duplicate results, and LCS results.	• Staff trained with data review SOP	• 5-10 minutes per test/per sample for large data packages. This depends on the number of tests per sample.
Level 3	• Review is done according to validation guidelines as specified in QAPP. Review includes the following (if applicable): Data Completeness, Sample preservation/Holding times, GC/MS or ICP Tunes, Initial and continuing calibrations, Interference check samples (ICP), Surrogate recoveries, Method/Instrument/Field/Trip Blanks, MS/MSD and/or laboratory duplicate results, Laboratory control samples (LCS), Internal standards, Serial dilutions (ICP), Moisture content, Dual column precision (GC), Quantitation limit requirements, Target compound identification, Sample Quantitation, Field duplicates, and data assessment if multiple analyses (re-analyses or dilutions) are reported for a sample.	• Same as Level 1	• Same as Level 2, and additionally all QC results and raw data.	• Chemist with combined laboratory and data validation experience • Staff with data validation experience • Data validators identified in a state-approved QAPP • Check with your state's "external party" or "third-party" reviewer requirements. In most cases, GEI data validators meet these requirements if they are not affiliated with the laboratory and do not have project-level cost performance responsibilities.	• 30 minutes per analytical group (VOCs, SVOCs, Pesticides, PCBs, Herbicides, Metals, or general chemistry) per sample for large packages.
Level 4	• Level 3 review performed. • In addition, laboratory raw data is verified with calculations performed in all subsets of review (ex. Surrogate recovery, calibration results, MS/MSD, etc.).	• Same as Level 1	• Same as Level 2, and additionally all QC results and raw data, all laboratory logbook pages (standards prep, refrigeration logs, etc.) are required.	• Same as Level 3	• 60 minutes per analytical group (VOCs, SVOCs, Pesticides, PCBs, Herbicides, Metals, or general chemistry) per sample for large packages.

SOP RP-002 - Attachment B

Level 1 Data Review Cover Sheet

Data Reviewed By:	Date:
Project Title:	Project Number:
Laboratory:	Laboratory Job Number:
Project Manager:	

Chain of Custody (COC) Present and complete (Y/N): ______________________

Case Narrative Present (Y/N): _______________________

All requested Analyses Performed (Y/N): _____________________

If all required analyses were not performed, does the narrative or COC explain the discrepancies between the requested and reported analyses? (Example: Bottle broken in shipment, etc.)

If all required analyses were not performed, has the project manager been notified (Y/N): _____

Did the laboratory report multiple dilution analyses for any samples (Y/N)? _________________

If yes, list the affected samples/analytes: ____

Replace the over calibration range (E) results with those from the dilution (D) for the affected samples when possible.

Does a Quality Assurance Project Plan (QAPP) exist for this project (Y/N)? ________________

If yes, have the required analytes been reported (Y/N):

Have the required quantitation limits been met (Y/N):

List any QAPP analyte list or project quantitation limit (PQL) criteria which were not met:

If required analytes were not reported or PQLs were exceeded, has the project manager been notified (Y/N): ____

SOP RP-002 - Attachment C

Level 2 Reduced Data Deliverable Review

1. Objective

The overall objective of reviewing analytical data is to provide a quality control (QC) check on the data and the laboratory. A review of the laboratory narrative and analytical data package is performed in an effort to summarize the QC nonconformances and their effect on the quality and its usability for project objectives.

Review forms have been developed for each group of analyses, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and inorganics (metals/cyanide).

2. Execution

1. Fill out all of the information listed on the cover sheet and select one data review form for each analysis.

2. Record the method used for analysis on the appropriate form.

3. Review the data package chain-of-custody (COC) and laboratory narrative to answer the following questions:

    i. Were all requested analyses performed? If no, does the narrative or COC explain the discrepancies between the reported and requested analyses? If all of the required analyses were not performed, the project manager should be contacted.

    ii. Was the cooler temperature upon receipt at the laboratory acceptable? If no, was ice present? If ice was present and the time of transit was minimal, the cooler was not able to reach the acceptable temperature before receipt at the laboratory and the samples were not impacted.

4. Review the sample reporting forms for the extraction (if applicable) and analysis dates. Determine if the holding time criteria were met for each analysis/matrix by calculating the days between the sample collection date and extraction or analysis date. Mark the "Exceedance" box with the appropriate response. If the criteria have not been met for any sample, record the sample ID in the "affected samples" box and the exceedance (in days). The bias will be low (-) for this QC exceedance.

5. Review the associated method blanks and any field or trip blanks submitted with the samples. If analytes are detected in any of the associated laboratory method blanks, field, or trip blanks:

    i. List the blank ID, associated samples, analytes, and contaminant levels detected.
    ii. Calculate the blank action level for each contaminant. For uncommon contaminants, the action level (AL) is determined by multiplying the detected contamination by 5. For common contaminants, the action level is determined by multiplying the detected contamination by 10. Common contaminants are listed on the review checklist for each method.
    iii. Review the associated samples for possible contamination and qualifications. For example, if chromium was detected in the method blank at 5 ug/L, the action level would be calculated to be 25ug/L. Reviewing the associated samples, detected chromium results which were less than 25ug/L would be attributed to laboratory contamination. If the sample chromium result is less than the reporting limit, the result is reported as non-detect (U) at the reporting limit. If the sample chromium result is greater than the reporting limit but less than the AL of 25, the chromium result is reported as non-detect (U) at the value at which it was detected.
    iv. Record those sample IDs in the “Affected Samples” column on the data review checklist.

6. If present, review the reported matrix spike/matrix spike duplicate (MS/MSD) results. If the MS/MSD is not performed on a project sample review is not necessary, as the QC results would only apply to the specific sample (organics) or a specific matrix, type, etc. (inorganics).

    i. For an organic project-specific MS/MSD, compare the reported recoveries and relative percent differences (RPDs) to the limits specified by the laboratory. The affected sample is the sample which the MS/MSD was performed on, only. Record this sample ID on the review checklist. List the compounds and recoveries/RPDs outside of the control limits on the checklist form.

        - If a compound recovery is below the control limits, the positive or non-detect result for this compound would be affected and biased low.
        - If a compound recovery is above the control limits, the result would only be affected if detected in the sample and would be biased high.

- If the MS/MSD RPD is above the control limits, the result would only be affected if detected in the sample, and the direction of the bias is indeterminate.
- If any recovery is less than 10, and the sample compound result is not detected in the sample, this result is rejected (R) and cannot be considered usable for data objectives. If detected, the result would be usable for project objectives and biased low.

ii. For an inorganic project-specific MS/MSD, compare the reported recoveries and RPDs to those limits specified in the review checklist. The affected samples are all those of a similar matrix in the laboratory job or sample batch. Note the matrix and job number of the associated samples on the review checklist. List the analytes and recoveries/RPDs outside of the control limits on the checklist form.

- If an analyte recovery is below the control limits, all the positive or non-detect results for this analyte in the sample batch would be affected and biased low.
- If an analyte recovery is above the control limits, only associated positive results would be affected and biased high.
- If the MS/MSD RPD is above the control limits, only associated positive results would be affected, and the direction of the bias is indeterminate.
- If any recovery is less than 10, all associated non-detect results for this analyte would be rejected (R) and cannot be considered usable for data objectives. Any detected results for this analyte in the batch would be usable for project objectives and biased low.

Note the bias (low/- for recoveries less than the control limits, high/+ for recoveries greater than the control windows) on the review sheet. Bias cannot be determined for the MS/MSD RPD exceedance.

7. Review the reported laboratory control samples (LCS) or blank spikes (BS) recoveries. Compare the recoveries to the limits specified on the method review checklist. If the criteria were not met, record the LCS ID, associated samples, analytes, and recoveries which did not meet the specified criteria.

  i. If an analyte recovery is below the control limits, all associated positive and non-detect analyte results are affected.

  ii. If an analyte recovery is above the control limits, only associated positive results are affected. Non-detect results are not affected.
  iii. If an analyte recovery is less than 10, associated non-detect analyte results are rejected (R) and cannot be considered usable for data objectives. Associated positive results are usable for project objectives and biased low.

  Note the bias (low/- for recoveries less than the control limits, high/+ for recoveries greater than the control windows) on the review sheet.

8. Review any project specific laboratory duplicate (if performed) analysis RPDs. If the duplicate is not performed on a project sample review is not necessary, as the QC results would only apply to the specific sample (organics) or a specific matrix, type, etc. (inorganics). Compare the RPDs to the limits specified on the method review checklist. If the criteria were not met, record the duplicate sample ID, associated samples, analytes, and RPDs which did not meet the specified criteria. Bias cannot be determined for the duplicate RPD exceedance.

  i. For an organic project-specific duplicate, compare the reported RPDs to the limits specified by the laboratory. The affected sample is the sample on which the duplicate analysis is performed. Record this sample ID on the review checklist. List the compounds RPDs outside of the control limits on the checklist form.
  ii. For an inorganic project-specific duplicate, compare the reported RPDs to those limits specified in the review checklist. The affected samples are all those of a similar matrix in the laboratory job or batch. Note the matrix and job number of the associated samples on the review checklist. List the analytes RPDs outside of the control limits on the checklist form.

9. Review the surrogate recoveries for the appropriate analyses. Compare the surrogate recoveries to the limits listed in the review checklist criteria box. If the criteria were not met, record the affected sample, surrogate, recovery, and associated qualifier (if required see below).

  i. For SVOC analyses, action is required only if more than one surrogate is recovered outside of control limits in each fraction (acid or base/neutral). If one SVOC surrogate recovery criteria is not met, record the sample, surrogate, recovery, and no action required.

ii. For pesticide or PCB analyses, action is required only if a surrogate is recovered outside of control limits on both columns. If a pesticide/PCB surrogate recovery criteria is not met on one column only, record the sample, surrogate, recovery, and no action required.

iii. If any VOC surrogate recovery, two or more SVOC surrogate recoveries, or dual-column pesticide or PCB surrogate recovery criteria are not met, evaluation is performed as follows.

- For surrogate recoveries less than the control limits, positive and non-detect samples results are affected and may be biased low.
- For surrogate recoveries greater than the control limits, positive compound results, only, are affected and biased high.
- If any surrogate recovery is less than 10, associated non-detect analyte results are rejected (R) and cannot be considered usable for data objectives. Associated positive are usable for project objectives and are biased low.

Note the bias (low/- for recoveries less than the control limits, high/+ for recoveries greater than the control windows) on the review sheet.

10. Identify field duplicate pairs (if collected) and calculate the detected analyte RPDs. Identify the field duplicate pair on the method review checklist. Compare the RPDs to the limits specified on the method review checklist. If the criteria were not met, record the affected analytes and RPDs. The affected samples are the sample and field duplicate only. Bias cannot be determined for the field duplicate RPD exceedance.

11. Review the reporting limits for each sample. Determine if the reporting limits have been elevated due to sample dilutions, reduced sample preparation weights, increased extract volumes, or high level analyses because of matrix interference, the presence of non-target analytes, or the high concentrations of target analytes. If the reporting limits have been elevated for any samples, note the sample ID, dilution factor, and reason.

12. Verify that all solid (soil/sediments) samples were reported on a dry weight basis. Review sample moisture content. If moisture content is greater than 70, sample results should be considered estimates with indeterminate bias. If samples were not reported on a dry weight basis, the laboratory should be contacted for a data package resubmittal.

13. If issues related to the laboratory arise during review of the data, the reviewer must contact the laboratory and resolve the issues. The issues, resolution, and laboratory contact must be noted on the bottom of the cover sheet. The issues may include resubmittal of data sheets or QC data, explanations for sample dilutions or laboratory footnotes, inquires with regard to compounds detected or not detected.

3. References

USEPA National Functional Guidelines for Organic Methods Review (June 2008), U.S. Environmental Protection Agency.

USEPA National Functional Guidelines for Inorganic Methods Review (January 2010), U.S. Environmental Protection Agency.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (November 1986), U.S. Environmental Protection Agency Department of Solid Waste, Washington, D.C.

SOP RP-002 - Attachment C

Level 2 Data Review Cover Sheet

Data Reviewed By:

Date:

Project Title:

Project Number:

Laboratory:

Laboratory Job Number:

Chain of Custody - Present and complete (Y/N): ____________________

All Requested Analyses Performed (Y/N): _____________________

Case narrative Present (Y/N): ______________________

Data have been reviewed in consideration of the criteria specified in the USEPA National Functional Guidelines for Superfund Organic Methods Data Review, USEPA-540-R-08-01, June 2008 and the USEPA National Functional Guidelines for Superfund Inorganic Methods Data Review, USEPA-540-R-10-011 (January 2010).

The following footnotes were used to qualify the project data (Circle footnote letters):

A	The result is estimated due to exceedance of holding time criteria.
B	The reported result is attributed to sampling or laboratory contamination.
C+ / C-	The result has a high bias / low bias due to surrogate recovery above upper / below lower control limits.
F+ / F-	The result has a high bias / low bias due to matrix spike recovery above upper / below lower control limits.
G	The result is estimated due to duplicate precision outside control limits.
J	The reported result is below the laboratory reporting limit and is estimated.
K+ / K-	The result has a high bias / low bias due to blank spike or laboratory control sample recovery above upper / below lower control limits.
R	The result is **Rejected**.

There were no qualifications (Circle if applicable).

Sample Number(s)	Affected Compounds/Analyte(s)	Quality Control Nonconformance (Footnote letter)	High/Low Bias

SOP RP-002 - Attachment C

Level 2 VOC Data Review Checklist

Data Reviewed By:

Date:

Project Title:

Project Number:

Laboratory:

Laboratory Job Number:

Parameter	**Criteria**	**Exceedance (Y/N)**		**Affected Samples**
Cooler Temperature	4° Celsius +/- 2°			
Sample Receipt Condition or Laboratory Noted Nonconformances	Notes:			
Holding Time	Aqueous, 14 days Soil/Sediment, 14 days if preserved. Soil Encore/ Unpreserved, 48 hours[2]			
Method Blanks/ID	Associated Samples	Analyte/Level Detected	Action Level[1]	Validated Sample Results (result value and qualifier)
Field/Trip Blanks/ID	Associated Samples	Analyte/Level Detected	Action Level [1]	
MS/MSD Results (list those performed on project samples only)	Recoveries/RPDs within laboratory control windows <10% recovery; associated nondetects (NDs) rejected			
Surrogates	Recoveries within laboratory control windows <10% recovery; associated NDs rejected			
Laboratory Control Samples	Recoveries within laboratory control windows <10% recovery; associated NDs rejected			
Field Duplicates Pair ID:	Aqueous RPDs <30 Soil RPDs <50	See separate worksheet for detected compounds/RPDs. Compound RPD Exceedances		

[1] The action level is calculated as 10x the maximum blank concentration detected for common contaminants (acetone, methylene chloride, and 2-butanone) or 5x the maximum blank concentration detected for each non-common contaminant.

[2] For unpreserved solid VOC samples must be analyzed or frozen within 48 hours. If frozen, samples must be analyzed within 14 days of collection. Encore samples must be prepared within 48 hours and analyzed within 14 days of collection.

SOP RP-002 - Attachment C

Level 2 SVOC Data Review Checklist

Data Reviewed By:

Date:

Project Title:

Project Number:

Laboratory:

Laboratory Job Number:

Parameter	Criteria	Exceedance (Y/N)		Affected Samples
Cooler Temperature	4° Celsius +/- 2°			
Sample Receipt Condition or Laboratory Noted Non-conformances	Notes:			
Holding Time	7 days (aqueous) or 14 days (solid) to extraction; 40 days extraction to analysis.			
Method Blanks/ID	Associated Samples	Analyte/Level Detected	Action level [1]	
Field Blanks/ID	Associated Samples	Analyte/Level Detected	Action level [1]	
MS/MSD Results (list those performed on project samples only)	Recoveries/RPDs within laboratory control windows <10% recovery; associated nondetects (NDs) rejected			
Surrogates (Action required only if more than one surrogate is outside of control limits)	Recoveries within laboratory control windows <10% recovery; associated NDs rejected			
Laboratory Control Samples	Recoveries within laboratory control windows <10% recovery; associated NDs rejected			
Field Duplicates Pair ID:	Aqueous RPDs <30 Soil RPDs <50	See separate worksheet for detected compounds/RPDs. Compound RPD Exceedances:		

[1] The action level is calculated as 10x the maximum blank concentration detected for common contaminants (phthalates) or 5x the maximum blank concentration detected for each non-common contaminant.

SOP RP-002 - Attachment C

Level 2 Pesticide and PCB Data Review Checklist

Data Reviewed By:

Date:

Project Title:

Project Number:

Laboratory:

Laboratory Job Number:

Parameter	**Criteria**	**Exceedance (Y/N)**		**Affected Samples**
Cooler Temperature	4o Celsius +/- 2o			
Sample Receipt Condition or Laboratory Noted Nonconformances	Notes:			
Holding Time	7 days (aqueous) or 14 days (solid) to extraction; 40 days extraction to analysis.			
Method Blanks/ID	Associated Samples	Analyte/Level Detected	Action level [1]	
Field Blanks/ID	Associated Samples	Analyte/Level Detected	Action level [1]	
MS/MSD Results (list those performed on project samples only)	Recoveries/RPDs within laboratory control windows <10% recovery; associated nondetects (NDs) rejected			
Surrogates	Recoveries within laboratory control windows <10% recovery; associated NDs rejected			
Laboratory Control Samples	Recoveries within laboratory control windows <10% recovery; associated NDs rejected			
Dual Column Analysis	RPDs <40%			
Field Duplicates Pair ID:	Aqueous RPDs <30 Soil RPDs <50	See separate worksheet for detected compounds/RPDs. Compound RPD Exceedances:		

[1] The action level is calculated as 5x the maximum blank concentration detected for each contaminant.

SOP RP-002 - Attachment C

Level 2 Inorganic Data Review Checklist

Data Reviewed By:

Date:

Project Title:

Project Number:

Laboratory:

Laboratory Job Number:

Parameter	**Criteria**	**Exceedance (Y/N)**		**Affected Samples**
Cooler Temperature	4° Celsius +/- 2°			
Sample Receipt Condition or Laboratory Noted Nonconformances	Notes:			
Holding Time	Metals 180 days Mercury 28 days Cyanide 14 days			
Method Blanks/ID	Associated Samples	Analyte/Level Detected	Action level [1]	
Field Blanks/ID	Associated Samples	Analyte/Level Detected	Action level [1]	
MS/MSD Results	Recoveries 75-125% Aqueous RPDs <20 Soil RPDs <35 <10% recovery; nondetect results (NDs) rejected			
Duplicates (if applicable)	Aqueous RPDs <20 [2] Soil RPDs <35 [3]			
Laboratory Control Samples	AQ: 80-120 Soil: Within Vendors Limits <10%; NDs rejected			
Field Duplicates Pair ID:	Aqueous RPDs <30 Soil RPDs <50	See separate worksheet for detected analytes and RPDs. Analyte RPD Exceedances:		

[1] The action level is calculated as 5x the maximum blank concentration detected for each contaminant.

[2] For aqueous samples, if concentration of both samples >5x RL, RPD<20; if one or both samples <5x RL; difference ± RL.

[3] For soil samples, if concentration of both samples >5x RL, RPD<35; if one or both samples <5x RL; difference ± 2xRL.

Section 13

Biosolve

BIOSOLVE®
Hydrocarbon Mitigation Technology

...Is Making A Difference!

VAPOR SUPPRESSION / ODOR CONTROL

BioSolve® offers a relatively simple and cost effective method of suppressing Odors and VOC release from soils, during excavation, loading, stockpiling, etc. The following guidelines will apply to the most common situations encountered on site.

In most cases a 3% BSW solution (1 part **BioSolve®** concentrate to 33 parts water) will be adequate to keep vapor emissions within acceptable limits and control fugitive odor problems on contact. Although, some sites may only require a 2% solution, up to a 6% solution may be recommended on sites with elevated levels or particularly difficult/ mixed stream contaminants are present.

The **BioSolve®** solution should be applied evenly to the soil surface in sufficient quantity to saturate the surface area. As a general rule, use 1-3 litres of **BioSolve®** solution to 1 square metre of surface area. (1 gallon of **BioSolve®** per solution will cover approximately 4-sq. yd. of soil surface area) **BioSolve®** is a water-based surfactant that will apply like water.

BioSolve®, in its concentrated form, is a viscous liquid material that must be diluted with water. A fluorescent red tracing dye is present in the formula allowing **BioSolve®** to be detected during application. Once diluted, **BioSolve®** can be applied with virtually any equipment that can spray water. **BioSolve®** will not harm equipment or clog pipes. For large sites, applicators such as water truck, portable agricultural sprayers, foam inductors & pressure sprayers can be used. For smaller jobs, garden sprayers, water extinguishers or a garden hose with a fertiliser attachment on the nozzle can be used effectively. This characteristic makes **BioSolve®** very adaptable and much most convenient to use in almost any situation. **BioSolve®** is equally effective when used with all types of water (soft, hard, salt or potable).

On stockpiled soil or other soil that will be left undisturbed, a single application of **BioSolve®** to the exposed surfaces may last up to 10 to 14 days or more (depending on environmental conditions). **BioSolve®,** when applied, will form a "cap" of clean soil. If the soil is not disturbed, via weather, movement, etc. this "cap" will remain functional. During excavation, loading or other movement of the soil, it may be required to spray an additional amount of **BioSolve®** to the freshly exposed surface area to keep emissions at an acceptable level.

In case of an extremely high level of emissions, or if the soil is heavily contaminated, it may be necessary to increase the strength of the **BioSolve®** solution or apply more solution per square metre to reduce emissions adequately. It is important that the site be monitored regularly and that the **BioSolve®** solution be reapplied if and when necessary to insure that VOC emissions and odors remain under control.

BioSolve® is packaged and readily available in 55 gallon (208 liter) drums, 5 gallon (19 liter) pails and in 4X1 gallon (3.8 liter X 4) cases. Contact The Westford Chemical Corporation® Toll Free @ 1-800-225-3909, via e-mail at info@biosolve.com or your Local BioSolve distributor for pricing.

BioSolve® should only be used in accordance with all regulatory rules and regulations.

This material is made available or use by professionals or persons having technical skill to be used at the own discretion and risk. These protocols are guidelines only and may need to be modified to site specific conditions. Nothing included herein is a warrantee or to be taken as a license to use **BioSolve** without the proper permits, approvals, etc. of the appropriate regulatory agencies, nor are the protocols provided as instructions for any specific application of **BioSolve**.

SOIL VAPOR SUPPRESSION UTILIZING BIOSOLVE

BioSolve is being utilized by numerous environmental consultants, response contractors, and fire departments to suppress VOC’s & LEL’s as well as problem odors. BioSolve encapsulates the source of the vapor rather than temporarily blanketing it like a foam or other physical barrier. Vapor reduction is so fast and effective that BioSolve is used to comply with the tough emission standards regulated by each State.

BioSolve offers a relatively simple and cost effective method of suppressing VOC vapor release from soils during excavation, loading, stockpiling… The following guidelines will apply to the most common situations encountered on site.

In most cases a 3% solution of BioSolve will be adequate to keep vapor emissions within acceptable limits. Dilute BioSolve concentrate with water at a ratio of 1 part BioSolve to 33 parts water to make a 3% solution.

The BioSolve solution should be applied evenly to the soil surface in sufficient quantity to dampen the surface well, (as a general rule, 1 gallon of BioSolve solution will cover approximately 4 sq. yd. of soil surface area). BioSolve is not a foam, it is a surfactant based product that will apply like water. The solution may be applied with a hand sprayer, high pressure power sprayer, water truck, etc., whichever method best suits the site and/or conditions.

NOTE: In the case of extremely high emission levels and/or very porous soil it may be necessary to increase the strength of the BioSolve solution (6%) or apply more per sq. yd. to reduce emissions adequately. On stockpiled soil or other soil that will be undisturbed, a single application of BioSolve to the exposed surfaces may last 10-14 days or more. During excavation, loading, or other movement of soil it may be necessary or required to spray each freshly exposed surface to keep emissions below acceptable levels.It is important that the site be monitored regularly and the BioSolve solution be reapplied if/when necessary to insure that vapor emissions remain at or below acceptable standards.

MATERIAL SAFETY DATA SHEET

THE WESTFORD CHEMICAL CORPORATION®
P.O. Box 798
Westford, Massachusetts 01886 USA

Ref. No.: 2001
Date: 1/1/2002

Phone: (978) 392-0689
Phone: (508) 878-5895
Emergency Phone-24 Hours: 1-800-225-3909

Fax: (978) 692-3487
Web Site: http://www.BioSolve.com
E-Mail: info@BioSolve.com

SECTION I - IDENTITY

Name:	**BioSolve®**
CAS #:	138757-63-8
Formula:	Proprietary
Chemical Family:	Water Based, Biodegradable, Wetting Agents & Surfactants
HMIS Code:	Health 1, Fire 0, Reactivity 0
HMIS Key:	4 = Extreme, 3 = High, 2 = Moderate, 1 = Slight, 0 = Insignificant

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SECTION II - HAZARDOUS INGREDIENTS

Massachusetts Right to Know Law or 29 C.F.R. (Code of Federal Regulations) 1910.1000 require listing of hazardous ingredients.

This product does not contain any hazardous ingredients as defined by CERCLA, Massachusetts Right to Know Law and California's Prop. 65.

SECTION III - PHYSICAL - CHEMICAL CHARACTERISTICS

Boiling Point	: 265°F	Specific Gravity	: 1.00 +/-.01
Melting Point	: 32°F	Vapor Pressure mm/Hg	: Not Applicable
Surface Tension- 6% Solution	: 29.1 Dyne/cm at 25°C	Vapor Density Air = 1	: Not Applicable
Reactivity with Water	: No	Viscosity - Concentrate	: 490 Centipoise
Evaporation Rate	: >1 as compared to Water	Viscosity - 6% Solution	: 15 Centipoise
Appearance	: Clear Liquid unless Dyed	Solubility in Water	: Complete
Odor	: Pleasant Fragrance	pH	: 9.1+/-.3
Pounds per Gallon	: 8.38		

SECTION IV - FIRE AND EXPLOSION DATA

Special Fire Fighting Procedures	: None	Flammable Limit	: None
Unusual Fire and Explosion Hazards	: None	Auto Ignite Temperature	: None
Solvent for Clean-Up	: Water	Fire Extinguisher Media	: Not Applicable
Flash Point	: None		

SECTION V - SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

Precautions to be taken in Handling and Storage: Use good normal hygiene.
Precautions to be taken in case of Spill or Leak -
Small spills, in an undiluted form, contain. Soak up with absorbent materials.
Large spills, in an undiluted form, dike and contain. Remove with vacuum truck or pump to storage/salvage vessel. Soak up residue with absorbent materials.
Waste Disposal Procedures -
Dispose in an approved disposal area or in a manner which complies with all local, state, and federal regulations.

SECTION VI - HEALTH HAZARDS

Threshold Limit Values: Not applicable
Signs and Symptoms of Over Exposure-
Acute : Moderate eye irritation. Skin: Causes redness, edema, drying of skin.
Chronic: Pre-existing skin and eye disorders may be aggravated by contact with this product.
Medical Conditions Generally Aggravated by Exposure: Unknown
Carcinogen: No
Emergency First Aid Procedures -
Eyes: Flush thoroughly with water for 15 minutes. Get medical attention.
Skin: Remove contaminated clothing. Wash exposed areas with soap and water. Wash clothing before reuse. Get medical attention if irritation develops.
Ingestion: Get medical attention.
Inhalation: None considered necessary.

SECTION VII - SPECIAL PROTECTION INFORMATION

Respiratory Protection	: Not necessary	Local Exhaust Required	: No
Ventilation Required	: Normal	Protective Clothing	: Gloves, safety glasses Wash clothing before reuse.

SECTION VIII - PHYSICAL HAZARDS

Stability	: Stable	Incompatible Substances	: None Known
Polymerization	: No	Hazardous Decomposition Products	: None Known

SECTION IX - TRANSPORT & STORAGE

DOT Class	: Not Regulated/Non Hazardous		
Freeze Temperature	: 28°F	Storage	: 35°F-120°F
Freeze Harm	: None (thaw & stir)	Shelf Life	: Unlimited Unopened

SECTION X - REGULATORY INFORMATION

The Information on this Material Safety Data Sheet reflects the latest information and data that we have on hazards, properties, and handling of this product under the recommended conditions of use. Any use of this product or method of application, which is not described on the Product label or in this Material Safety Data Sheet, is the sole responsibility of the user. This Material Safety Data Sheet was prepared to comply with the OSHA Hazardous Communication Regulation and Massachusetts Right to Know Law.

APPENDIX H. SITE MANAGEMENT FORMS

Monitoring Well Sample Data Form

Project: National Grid - Sag Harbor

Well ID: ____________________

Sample Date: ____________________

Total Well Depth (from top of casing): ____________________

Depth to Water (from top of casing): ____________________

Well Diameter: 3/4" 1" 2" 4"

Pump Intake Depth (Mid-Point of Screen Zone): ____________________

Sampling Crew: Rich Crockett

Purge Time: *Start:* ____________________ *Finish:* ____________________

Purging Method: Peristaltic Pump

Sampling Method: Low Flow

Sample Time: *Start:* ____________________ *Finish:* ____________________

Sample Analysis: BTEX+MTBE (8260C)/PAHs+2MN (8270D)

Purge Data

Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**
										Well Headspace PID =

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Request to Import/Reuse Fill or Soil

This form is based on the information required by DER-10, Section 5.4(e). Use of this form is not a substitute for reading the applicable Technical Guidance document.

SECTION 1 – SITE BACKGROUND

The allowable site use is: Choose an item

Have Ecological Resources been identified? Choose an item

Is this soil originating from the site? Choose an item

How many cubic yards of soil will be imported/reused? Choose an item

If greater than 1000 cubic yards will be imported, enter volume to be imported:

SECTION 2 – MATERIAL OTHER THAN SOIL

Is the material to be imported gravel, rock or stone? Choose an item

Does it contain less than 10%, by weight, material that would pass a size 80 sieve? Choose an item

Is this virgin material from a permitted mine or quarry? Choose an item

Is this material recycled concrete or brick from a DEC registered processing facility? Choose an item

SECTION 3 - SAMPLING

Provide a brief description of the number and type of samples collected in the space below:

Example Text: 5 discrete samples were collected and analyzed for VOCs. 2 composite samples were collected and analyzed for SVOCs, Inorganics & PCBs/Pesticides.

If the material meets requirements of DER-10 section 5.5 (other material), no chemical testing needed.

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SECTION 3 CONT'D - SAMPLING

Provide a brief written summary of the sampling results or attach evaluation tables (compare to DER-10, Appendix 5):

Example Text: Arsenic was detected up to 17 ppm in 1 (of 5) samples; the allowable level is 16 ppm.

If Ecological Resources have been identified use the "If Ecological Resources are Present" column in Appendix 5.

SECTION 4 – SOURCE OF FILL

Name of person providing fill and relationship to the source:

Location where fill was obtained:

Identification of any state or local approvals as a fill source:

If no approvals are available, provide a brief history of the use of the property that is the fill source:

Provide a list of supporting documentation included with this request:

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The information provided on this form is accurate and complete.

______________________________ ______________
Signature Date

____
Print Name

____
Firm

Revised August 2014

Annual Inspection Checklist and Certification
National Grid Former Sag Harbor MGP Site
Sag Harbor, New York

Property: ____________________

Type	**Inspection Task**	**Status**	**Condition**	**Date Completed**	**Initials**	**Remarks**
Infrastructure	Building (s)					
	Building Slabs and Floor					
	Pavements					
	Underground Services					
	New Structures					
	Monitoring Wells					
Physical	Site Fences					
	Topography					
	Surface Drainage					
	Depressions					
	Vegetation					
	Ground Cover					
	Surface Soil					
Contamination	Odors					
	Staining					
	Sheens					
Property Owner/ Representative	New					
	Interview					

Inspection and Interview Acknowledgement	Signature/Date: ____________________	____________________
	Name: ____________________ National Grid/Representative	____________________ Property Owner/Representative

Notes:

Status - Modified/Unchanged

Condition - Unchanged/Deteriorated

Interview - Work completed during the previous year and future plans

Soil Removal - Any soil removal activities will be detailed here and the SMP revised accordingly.