GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Pre-Design Investigation Work Plan

Nyack Manufactured Gas Plant Site
Nyack, New York
NYSDEC Site # 3-44-046

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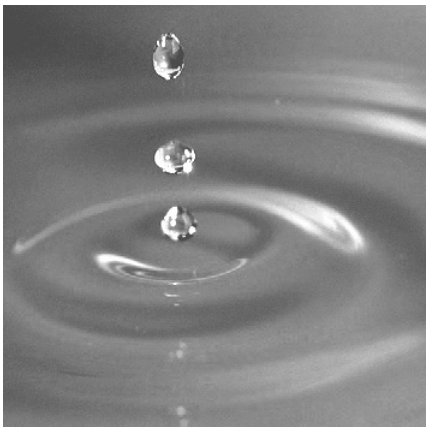

Certification

I, John T. Finn,P.E., certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375, and that this Pre-Design Investigation Work Plan was prepared in accordance with all applicable statutes and regulations, and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

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Abbreviations and Acronyms

ASTM	ASTM International (formerly American Society for Testing and Materials)
bgs	Below Ground Surface
bss	Below Sediment Surface
CAMP	Community Air Monitoring Plan
EPA	United States Environmental Protection Agency
FSAP	Field Sampling and Analytical Plan
FSR	Feasibility Study Report
GEI	GEI Consultants, Inc.
GPS	Global Positioning System
HASP	Health and Safety Plan
HSA	Hollow-Stem Auger
IDW	Investigation-Derived Waste
ISS	In-Situ Solidification
MGP	Manufactured Gas Plant
MHW	Mean High Water
NAD83	North American Horizontal Datum 1983
NAPL	Non-Aqueous Phase Liquids
NAVD88	North American Vertical Datum 1988
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
O&R	Orange & Rockland Utilities, Inc.
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PAH34	PAHs defined by EPA for Sediment Toxicity Evaluation
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PID	Photo-Ionization Detector
PLS	Professional Land Surveyor
PPE	Personal Protection Equipment
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision

Abbreviations and Acronyms (cont.)

SIM	Select Ion Monitoring
SPME	Solid-Phase Microextraction
SPT	Standard Penetration Testing
SQT	Sediment Quality Triad
SVOC	Semi-Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TOGS	Technical Operation Guidance Series
USCS	Unified Soil Classification System
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound

1. Introduction

This Work Plan describes the scope of work and proposed methods and procedures to be used for the Pre-Design Investigation (PDI) of Operable Unit 2 (OU2) at the Nyack Former Manufactured Gas Plant (MGP) located in Nyack, Rockland County, New York (site).

Orange & Rockland Utilities, Inc. (O&R) is performing the PDI to obtain the data necessary for the OU2 Remedial Design. The PDI also addresses New York State Department of Environmental Conservation (NYSDEC) comments [NYSDEC, 2010] on the Feasibility Study Report (FSR) prepared by ARCADIS [ARCADIS, 2010], and incorporates the requirements in the OU2 Record of Decision (ROD) [NYSDEC, 2011]. Figure 1 shows the soil remediation areas on the terrestrial portion of OU2 as identified in the ROD. Figure 2 shows the sediment remediation areas in the Hudson River as identified in the ROD.

1.1 PDI Scope of Work

The proposed PDI activities include:

- Soil borings to assess the extent of coal tar non-aqueous phase liquid (NAPL) impacts between the existing Operable Unit 1 (OU1) in-situ solidification (ISS) monolith and the mean high water (MHW) line of the adjacent Hudson River.
- Geotechnical borings and geotechnical laboratory testing for remedial design of environmental/temporary structural control systems, if required, between the OU1 ISS monolith and the MHW line of the Hudson River.
- Sediment sampling in the Hudson River to delineate the northern extent of MGP-impacted sediment requiring removal near the Nyack Boat Club, and near two offshore mooring structures.
- A bathymetric survey and shoreline topographic survey to establish survey controls to be used during the preparation of the remedial design.
- A magnetometer survey in the Hudson River Area to assess the presence of any significant ferrous objects such as pipelines and cables.
- A treatability study to identify the ISS solidification components for the OU2 ISS area. Bulk samples for the treatability study will be collected during the PDI.

Four appendices have been developed which detail the procedures and protocols outlined in this Work Plan:

- **The Field Sampling and Analytical Plan (FSAP)** provides information regarding field sampling methods and procedures that will be used during the investigation.
- **The Quality Assurance Project Plan (QAPP)** specifies the quality assurance/quality control (QA/QC) procedures that will be implemented during the field work and in the laboratory which performs the chemical analyses of the samples collected during the PDI.
- **A Community Air Monitoring Plan (CAMP)** provides information regarding the procedures to be used to monitor and control, if necessary, the potential release of airborne constituents at the downwind perimeters of the investigation work areas. Included in the CAMP are procedures regarding the control of odors that may be present as a result of the intrusive site investigation activities.
- **A Site-Specific Health and Safety Plan (HASP)** has been prepared to outline procedures that will be undertaken to protect site workers, visitors, and the public in the areas adjacent to the site from potential hazards that may exist as a result of the field work performed during the PDI. Please note that the attached HASP has not yet been reviewed and accepted by O&R's Safety Department, but the final document will be similar to the version which is attached. The final O&R approved HASP will be submitted to the NYSDEC prior to the start of field work.

1.2 Work Plan Organization

Following this introduction, the remainder of this Work Plan describes the proposed PDI activities.

- **Section 2** – describes the proposed field activities and laboratory analyses.
- **Section 3** – describes the companion documents that are included as appendices to the Work Plan, including the FSAP, QAPP, CAMP, and HASP.
- **Section 4** – presents the approximate project schedule, with key milestones, and describes the reporting activities.
- **Section 5** – provides a list of the references cited in this Work Plan.

Appendices to the Work Plan include the following:

- Previous investigation soil boring, well completion logs, and sediment cores for the PDI areas are included in Appendix A.
- A Pre-Characterization Work Plan for profiling soil and sediment in the OU2 remedial areas for disposal is included in Appendix B.
- The FSAP is included as Appendix C.

- The QAPP is included as Appendix D.
- The CAMP is included as Appendix E.
- The HASP is included as Appendix F.

2. OU2 Pre-Design Investigation Activities

This section describes the tasks which will be implemented during the PDI. The previous and proposed soil boring locations are shown on Figure 3. The previous and proposed sediment sample locations are shown on Figure 4. Figure 5 is a cross section location map. The cross sections are included as Figure 6 (Cross Section A-A'), Figure 7 (Cross Section B-B'), Figure 8 (Cross Section C-C'), Figure 9 (Cross Section D-D'), Figure 10 (Cross Section E-E'), Figure 11 (Cross Section F-F'), and Figure 12 (Cross Section G-G').

2.1 Utility Clearance

Clearance of underground utilities will be performed prior to the start of any intrusive field activities. Dig Safely New York (1-800-962-7962) will be contacted at least 72 hours prior to initiating field work to identify utilities where ground-intrusive activities (i.e., drilling and vibracoring) will occur. Available utility plates, drawings, OU1 ISS area obstruction/structure observations, navigation charts, and/or maps will be reviewed for the on-site investigation area and the Hudson River area to evaluate the approximate size and location of aboveground, underground, and submarine utilities.

Based on previous investigations performed at the site, the only known on-site subsurface utility in the OU1/OU2 area is a storm water drain pipe located along the southern boundary of the site. Other than an underground communications cable which crosses the river bed beginning at the end of the Hudson Vista bulkhead (off-site area to the south), there are no known utilities in the river area. All on-site and off-site utilities will be confirmed through the Dig Safely mark-out task.

2.2 NAPL Delineation Borings

The previous borings advanced in the investigation area, and the proposed soil borings for the PDI are summarized in Table 1. The soil boring locations are shown on Figure 3. The locations of 15 borings are shown on Figure 3; however, up to 20 borings may be advanced during the PDI, if needed. Actual locations may be modified in the field based on access, and preceding boring observations.

The borings will be advanced between the OU1 ISS area and the MHW line to evaluate the vertical extent of coal tar NAPL-impacted soil to the depth of the bedrock, and/or the depth to the silt unit (if present). The borings will be used to establish the three dimensional design configuration of the OU2 ISS area above the MHW line and to evaluate if shallow NAPL excavation (up to 7 feet) instead of ISS may be appropriate in certain upland areas.

The existing rip-rap material along the shoreline will be removed and replaced as necessary using an excavator. The borings will be advanced in the MHW area to a depth of approximately 1 foot into the silt unit (approximate depth of 15 feet below ground surface [bgs]), or to the top of bedrock (approximate depth of 20 to 30 feet bgs) if the silt unit is not present or the boring is also designated as a geotechnical boring (discussed below). Soil borings will be installed using hollow-stem auger (HSA) methods. Soil samples will be collected continuously from the ground surface to the bottom of the boring by advancing a 2-foot long, 2-inch outer diameter split-spoon device ahead of the augers. Soil recovered from each sample interval will be visually characterized (for soil type, grain size, color, texture, and moisture content) and placed in a container for headspace screening using a photo-ionization detector (PID). In addition, the presence of visible staining, NAPL, and odors, if any, will be noted.

Following completion, soil borings will be tremie grouted to the ground surface using a cement-bentonite grout, and the location and ground surface elevation of each boring will be surveyed. As shown on Table 1, samples will not be collected for analytical characterization during this task.

2.3 Geotechnical Borings and Analyses

Ten borings will be advanced as geotechnical borings to obtain data for the remedial design of environmental/temporary structural control systems. The proposed borings and the analyses to be performed are summarized in Table 1. The locations of the borings are shown on Figure 3. Note that some of the borings identified for the NAPL delineation task above will also be used to obtain the geotechnical data described below.

At each of these geotechnical borings, continuous standard penetration testing (SPT) of the overburden will be performed using 2-inch outside diameter split-spoon samplers in accordance with American Society of Testing and Materials (ASTM) D1586. Each boring will extend to the bedrock (approximate depth of 20 to 30 feet bgs).

Soil recovered from each sample interval will be visually characterized (for soil type, grain size, color, texture, and moisture content) and placed in a container for headspace screening using a PID. In addition, the presence of visible staining, NAPL, and odors, if any, will be noted.

2.3.1 Laboratory Analyses

As shown in Table 1, samples of the silt, fill and sand/sandy silt units will be collected for geotechnical analysis. Proposed sample locations are presented on Table 1 and are shown on Figure 3; however, final depth intervals will be selected in the field as the field work progresses in consultation with GEI's senior geotechnical engineering personnel.

Silt Unit

Six Shelby tube samples of the silt unit will be collected for the following geotechnical laboratory analyses:

- Moisture Content via ASTM D2216
- Atterberg Limits via ASTM D4318
- Grain Size – Sieve and Hydrometer via ASTM D422 and D1140
- Flexible-wall Permeability via ASTM 5084
- One-dimensional consolidation via ASTM D2435
- CU Tri-axial Compression with pore water measurement via ASTM D4767

Fill and Sandy Silt Unit

Eight samples of the fill and sand/sandy silt unit will be collected for the following geotechnical laboratory analyses:

- Moisture Content via ASTM D2216
- Unit Weight
- Grain Size – Sieve and Hydrometer via ASTM D422 and D1140
- Three-point Direct Shear via ASTM D3080

At four of the boring locations (shown in Table 1), one 5-foot long bedrock core run will be collected using a diamond-bit rock coring method and NX-size double tube core barrel in accordance with ASTM D2113. Retrieved bedrock cores will be logged in terms of lithology, texture, color, and fracture pattern. Fractures in the core will be logged in terms of depth, dip angle, coloration, staining, and presence/absence of sheen/NAPL.

Following completion of the geotechnical borings, each boring will be tremie grouted to ground surface using a cement-bentonite grout.

2.4 Sediment Coring and Analysis

The extent of MGP-related residuals in the Hudson River Area has not been fully delineated near the Nyack Boat Club, and near the offshore mooring structures to the east of the site. Visible impacts (medium to heavy staining, sheens, or NAPL blebs) were observed from 1.2 to 1.4 feet below sediment surface (bss) at boring E11 adjacent the Nyack Boat Club. MGP-

related impacts (polycyclic aromatic hydrocarbons [PAHs]) were also observed within 2 feet of the sediment surface in the area near the offshore mooring structures.

Additional sampling is necessary in order to complete the delineation of sediments to be removed from these areas. As specified by the ROD, this Work Plan is designed to establish the limits of visible MGP tar at the locations described below, and to establish through multiple lines of evidence whether an impact to the environment from MGP-related contamination is present.

2.4.1 Sampling Procedures

Sediment cores will be advanced in the two target areas to assess the horizontal and vertical extent of MGP-impacted sediments. Near the Nyack Boat Club, two core sample locations will initially be completed north and east of E11. Near the offshore mooring structures, four sediment cores will initially be advanced north, south, east and west of the structures. A dredge sample will also be collected adjacent to each core location for collecting surface sediments. The proposed locations for the cores are shown on Figure 4. The proposed sediment analyses are summarized in Table 2.

Shallow sediment cores will be collected using hand/push-core, piston-core, or vibracore methods to refine the horizontal and vertical extent of MGP-impacted sediments in each of the two target areas. Each core will be advanced a minimum of 2 feet bss. Adjacent to each core, dredge samples of the 0 to 0.5 foot interval will also be collected to provide sufficient sample volume to assess surface sediment. The location, top of water elevation, water column length, and top of sediment elevation will be measured at each sediment sampling station. All depth measurements will be corrected for tidal changes and reported relative to the datum established for the site. Actual locations may be modified in the field based on preceding core observations. The number of cores and dredge deployments at each station will be determined by the efficiency of sediment recovery and the volume of sediment needed for testing. During the sampling, the presence of any sheens in the water column while disturbing the sediments will be noted.

The sediment cores will be visually characterized for sediment types and characteristics, along with the presence or absence of NAPL, sheens, staining, and odors. If MGP-related impacts are observed at these locations, additional core/dredge samples will be collected at a spacing of approximately 10 feet from the initial location. The target sediment locations are shown on Figure 4.

Sediment samples will be collected for laboratory testing at each sampling location where MGP-related impacts are **not** observed, to verify and document the sediment quality where sediments meeting the cleanup criteria are located. These samples will be subject to chemical analysis.

Additional cores will be obtained to collect sediment for assessing dredged materials handling, including grain size, moisture content, and unit weight (bulk density). These cores will be advanced to sample the full target interval in each sediment removal cell. These cores and analyses will be performed as part of the waste disposal pre-characterization program for the sediments, which is described in Appendix B.

2.4.2 Laboratory Analyses

At each sampling location where MGP-related impacts are not visually observed, sediment samples will be collected from the 0 to 0.5 foot, 0.5 to 1 foot, and 1 to 2 foot depth intervals. Note that the 0 to 0.5 foot interval will be obtained from the sediment dredge. The 0.5 to 1 and 1 to 2 foot intervals will be obtained from the sediment cores only to ensure proper depth control.

As specified by the ROD, sediment requiring removal is defined as having visible MGP tar, or where it is demonstrated through multiple lines of evidence that MGP-related contamination has an impact to the environment. The Remedial Investigation (RI) for OU2 used the following sediment characteristics to characterize and establish the limits of MGP contamination:

- Visual observations of sediment quality (presence of tar or staining)
- PAH concentration
- Solid-phase microextraction (SPME) testing to assess sediment toxicity
- Laboratory toxicity testing on two test organisms
- Characterization of the benthic macroinvertebrate community
- Forensic analysis

The analysis of toxicity of the sediments and the effects of the sediment on the biological community have shown that there is no impact to the environment from MGP contamination at the locations which are the subject of the PDI. Further toxicity testing at locations where MGP tar or staining is not present will not provide further information which can be used to delineate or document sediment conditions. The determinant which will therefore be used to identify sediment for removal will be the presence or absence of visible MGP tar impacts. We will analyze each interval for PAH concentration at each location where MGP tar impacts are not observed to provide documentation samples for the excavation limits.

Each sediment sample will be analyzed for the following:

- United States Environmental Protection Agency (EPA) sediment target list of 34 PAHs (18 parent plus 16 groups of alkylated compounds) via EPA SW-846 Method 8270 (subsequently referred to as "PAH34")
- Total Organic Carbon (TOC) via Lloyd Kahn

Forensic analysis may be performed if it appears that non-MGP impacts are present in the sediment samples. At locations where forensic analysis may be necessary, EPA Method 8270 analysis will be performed in select ion monitoring (SIM) mode, and the PAH34 analyte list will be expanded to include dibenzothiophenes (parent and alkylated, C0, C1, C2, C3, and C4), carbozoles, and dibenzofuran. These compounds may be used to assess source attribution using diagnostic PAH ratios. The samples will be classified as:

- Background
- Coal tar/MGP related
- Mixed (petrogenic and pyrogenic)

Supplemental step-out locations approximately 10 feet beyond visually clean locations may be advanced and archived during the field program. Sediments collected from these supplemental locations would be analyzed only if the lines of evidence in the initial step-out locations indicated the presence of MGP-related tar or staining in the sediment, which the ROD specifies must be removed. The supplemental locations would minimize the need to remobilize to the site for further sediment delineation.

2.5 Offshore and Shoreline Topographic Surveys

2.5.1 Bathymetric Survey

A 1-foot contour interval bathymetric survey will be performed across transects established throughout the targeted survey area in waters greater than approximately 2.5 feet in depth. The survey data will be provided in New York State Plane Coordinates (NAD83) and North American Vertical Datum 1988 (NAVD88). The accuracy of the bathymetric survey will meet the United States Army Corps of Engineers (USACE) Class 1 Hydrographic Survey Standard [USACE, 2004].

2.5.2 Magnetometer Survey

The magnetometer survey will be completed with sufficient spacing to identify any significant ferrous objects such as pipelines and cables in general and specifically the former oil pipeline(s) from OU1 to the mooring structures.

2.5.3 Shoreline Topographic Survey

A shoreline topographic survey using the datums specified above will also be performed between the MHW line and the limits of the bathymetric survey along the site. One-foot contour intervals will be obtained under the supervision of a New York State licensed surveyor (PLS).

2.6 ISS Treatability Testing

ISS has been selected as the remedial technology for deeper impacts present in the on-shore area between the existing ISS mass completed on the OU1 Lower Terrace and the MHW line. The objective of the ISS treatability study is to identify the solidification additives and their relative proportions to best achieve the desired results in the OU2 ISS area. ISS is a technology based on the use of augers or other device to mix a slurry of pozzolanic additives, typically Portland cement, into soils to solidify them in situ. As the mixing tool is advanced into the soil, reagent is injected. ISS results in a solidified mass with greater strength, lower permeability, and reduced contaminant mobility.

The treatability work will assess the effectiveness of the reagent mix design used successfully for the ISS on the Lower Terrace, and evaluate other similar mix designs to develop a proposed mix design for OU2. The testing results will be compared against the proposed performance requirements. The proposed requirements based on the ISS performed as part of the OU1 Lower Terrace remediation are presented in Table 4.

2.6.1 Sample Location, Collection Methods, and Equipment

The study will be initiated by collecting representative samples of sediment and MGP material at four locations within proposed ISS footprint. Proposed ISS sample locations will be combined with other exploratory borings and are shown on Figure 3 and described in Table 2.

Samples will be collected from a 3-inch split-spoon sampling device within the proposed ISS zone. Sample material will only be collected at depths where ISS is planned. Discreet samples will be collected from each of the four proposed sample locations and placed in sealed 5-gallon buckets. After the borings are completed and the materials have been collected, they will be evaluated by an experienced geologist and ISS specialist.

The samples will be visually evaluated to determine soil type and degree of contamination and to verify the expected conditions. Simple field tests such as pH, texture, and water content may also be performed to aid in the evaluation. The samples will be photographed and the characteristics logged in the field notebook. If the four samples exhibit similar visual characteristics, a composite sample consisting of equal aliquots from each location will be mixed, placed in a sealed 5-gallon bucket, and placed on ice prior to shipping to the testing

laboratory. If the sample characteristics substantially differ, a judgment will be made to select the worst case scenario as determined by extent of visual impacts. The worst case sample will then be sealed, kept on ice for shipment to the testing laboratory.

One 5-gallon bucket of material will be transported directly to the KEMRON Environmental Services Treatability Laboratory in Atlanta, Georgia. KEMRON will perform the laboratory treatability testing under the supervision of GEI.

2.6.2 Experimental Procedures

Based on previous experience with MGP-residual impacted soils, the treatability program will identify one or more mix designs that meet the minimum criteria. The testing program is discussed below and shown in Table 3.

2.6.3 Untreated Material Characterization – Phase I

Upon receipt of the samples at the laboratory, they will be maintained in refrigerated storage at a temperature of 4 degrees Celsius (^{o}C) until tested. The laboratory will homogenize the untreated soil to provide a more uniform material for treatability testing. The homogenization will take place in the refrigerator using stainless steel instruments to minimize volatilization of organic compounds. To ensure the reproducibility of the tests, particles larger than 0.5 inch in diameter will be removed. After homogenization, representative aliquots of the soils will be collected for characterization testing. The untreated samples will be tested for physical properties. Grain size, bulk density, and moisture content testing will be performed on the untreated samples to assess baseline sample homogeneity. Baseline samples will be remixed if homogeneity is not indicated.

2.6.4 Solidification Testing – Phase II

Testing will be performed on six different mix designs. The proposed mixes will determine if the mix design used during OU1 ISS (8% Portland cement and .5% bentonite by weight) will be successful on the OU2 materials or if adjustments will be necessary. Testing will also be performed using mixes using blast furnace slag to determine if its use is successful in improving strength and reducing permeability when compared to mixes just using Portland cement. The preliminary mix designs are provided in Table 5. The laboratory blending process has been developed to mimic the full-scale solidification process on a laboratory scale. First, a fluid grout is created by blending pre-weighed proportions of water and reagent in a high-speed mixer. Water will be added at a ratio of 1:1 by weight of reagent. Viscosity and density of the grout may be measured to gauge workability. Next, the fluid grout is added to a measured proportion of the untreated materials in a low-speed mixer and blended at a rate of approximately 30 to 40 revolutions per minute for 60 to 90 seconds or until homogeneous.

The "wet" treated material is next placed into plastic molds that measure 2 inches in diameter by 4 inches long. Air voids in the specimens are minimized by tamping, rodding, and/or vibrating. The specimens are covered and cured in a temperature and moisture controlled room until tested. Usually, about 6 to 10 specimens are made of each mixture to provide sufficient samples for testing plus reserves. During mixing, the workability of the grout and the grout/soil mixture will be evaluated. Volume measurements will be taken to assess expansion. If excessive heat or vapors are generated during mixing, PID and temperature will be monitored.

As the samples harden, simple penetration tests will be conducted (at 1, 3, and 7 days) to see if the reagents satisfy basic solidification criteria, i.e. strength. In addition, the solidified samples will be subjected to visual observations for residual MGP material. Solidified samples will be immersed in water after 7 days of curing to observe for any sheen or disintegration of the sample (i.e., slaking).

These tests are useful in narrowing the range of admixture percent application rates. This round of tests will usually require about 2 weeks. Unified Soil Classification System (USCS) tests will be performed after 28 days. Measurements will also be made of the volume increase from solidification treatment. For samples that pass the USCS criteria at 28 days, hydraulic conductivity testing will be performed using a flexible wall permeameter to model the effects of overburden pressures on the solidified materials. The hydraulic conductivity tests will model *In-Situ* conditions of the solidified materials by imposing pressures on the specimen that are similar to the stresses the solidified materials will experience when buried at the bottom of the treated monolith. The specimens will be permeated with standard laboratory water per ASTM D 5084 until steady state values are obtained.

A sample of solidified material that exhibits the best performance for both USCS and permeability will be analyzed according to modified ANS 16.1 leachability testing.

2.7 Surveying

A survey of the investigation sampling points and important site features will be performed at the end of the field activities by a New York State licensed surveyor. All horizontal locations will be reported in the applicable New York State horizontal coordinates (North American Horizontal Datum 1983 [NAD83] NYS Central Zone) and latitude and longitude coordinates. All vertical measurements will be reported in NAVD88.

The location and elevation of all shoreline soil borings and two survey control points for the bathymetric survey will be performed under the supervision of a New York State licensed surveyor. In addition, the survey activities will include establishing two stream gauge locations in the Hudson River for use during the field program. Horizontal and vertical coordinates will be presented in NAD83 and the NAVD88, respectively.

Sediment core locations will be surveyed under the supervision of a New York State licensed surveyor using Global Positioning System (GPS) equipment/techniques. Horizontal and vertical coordinates will be presented in NAD83 and the NAVD88, respectively. The vertical elevation of the water surface will be recorded by the GPS and a concurrent water depth measurement will be used to determine the sediment surface elevation.

2.8 Community Air Monitoring

Community air monitoring will be performed to provide real-time measurements of total volatile organic compounds (VOCs) and particulate (airborne dust) concentrations in air at the downwind perimeter of each designated work area when intrusive investigation activities such as test pitting or drilling are in progress at the site. The monitoring is designed to provide protection for the downwind community, including residences and businesses and on-site workers not directly involved with the PDI work activities, from potential releases of airborne constituents resulting from the investigation activities.

The procedures used will follow methods described in the CAMP (Appendix E). Additionally, site personnel will monitor the perimeter stations to determine if any odors are being produced as a result of the intrusive sampling activities. The New York State Department of Health (NYSDOH)-specific action levels for VOCs and particulates are provided in the CAMP. Action levels will not be exceeded during the intrusive investigation activities at any time during the PDI. Controls will be used to mitigate odors as necessary.

2.9 Investigation-Derived Waste Management

Investigation-derived waste (IDW) will be placed in appropriate waste containers and temporarily staged at a location arranged with O&R and the property owner. Soil cuttings, personal protective equipment (PPE), and spent disposable sampling materials will be placed in New York State Department of Transportation (NYSDOT)-approved steel 55-gallon drums. Decontamination water and drilling water will be stored in closed-top NYSDOT-approved steel 55-gallon drums. Storage containers will be appropriately labeled with the contents, generator, location, and date for appropriate off-site transportation and disposal at an O&R approved facility.

Three composite samples, one each of soil cuttings, sediment, and wastewater generated by the field activities, will be collected and submitted for laboratory analysis using the toxicity characteristic leaching procedure (TCLP) followed by laboratory analysis of the leachate for VOCs (SW 8260B), semi-volatile organic compounds (SVOCs) [SW 8270C], and metals (SW 6010B). In addition, the samples will be analyzed for polychlorinated biphenyls (PCBs) [SW 8082], cyanide (SW 9012A), total sulfur (SW D129), corrosivity (SW 9040B), ignitability (SW 1010), and reactivity [sulfide (SW 9034) and cyanide (SW 9012)].

3. Additional Work Plan Documents

Four companion documents have been prepared to detail the methods and procedures to be used during the PDI. Each of the documents is included as an appendix to this Work Plan.

3.1 Field Sampling and Analytical Plan

All sampling and analyses will be conducted in accordance with the methods described in the site-specific FSAP. The FSAP provides a description of the objectives and methods for each of the investigation field activities, and details concerning the project organization.

3.2 Quality Assurance Project Plan

In addition to the FSAP, a full QAPP has been developed for use on this project. The QAPP identifies the quality assurance objectives for the measurement data, the QA/QC procedures to be used in the field, the sample chain-of-custody methods to be used, and the analytical procedures to be followed. The QAPP will also include a description of the manner in which each type of data is to be used.

3.3 Community Air Monitoring Plan

A CAMP has been developed for this project that will be followed during all invasive field work (soil borings, borings for well installations, and test pitting). Included in the CAMP is a description of methods that may be used to control odors during the investigation field activities, if needed.

3.4 Site-Specific Health and Safety Plan

A site-specific HASP has been prepared to describe health and safety risks and procedures for all site workers and visitors. Included in the HASP is information regarding physical and chemical hazards at the site, emergency procedures and contact information, incident reporting procedures, and the route to the hospital.

3.5 Pre-Characterization Work Plan

A Pre-Characterization Work Plan is included in Appendix B. The plan describes methods to be used to obtain samples of soil and sediment from the remedial areas. The results of the analyses will be provided to disposal facilities to profile the soil and sediment for waste disposal purposes during remediation.

4. Project Schedule and Deliverables

4.1 Schedule

The PDI field work will be initiated following approval of this Work Plan by the NYSDEC. A revised schedule with more specific dates will be submitted upon approval of the Work Plan by the NYSDEC. The initial target dates for the project milestones are as follows:

1. **Late March 2012** – PDI Work Plan submitted to the NYSDEC for review, comment, and approval.
2. **Early Spring 2012** – NYSDEC approves the PDI Work Plan.
3. **Spring** – After the PDI Work Plan is approved, the field investigation activities will be initiated.
4. **Spring 2012** – The Remedial Design Work Plan (RDWP) will be submitted to the NYSDEC for review and approval.
5. **Late Spring/Early Summer 2012** – The PDI Data Transmittal Report will be prepared.

The milestones presented above are subject to change based on regulatory approval, the scheduling of the consulting firm and subcontractors, and delays caused by weather and unforeseen circumstances. However, it is intended to maintain a schedule to complete the project as expeditiously as possible.

4.2 Reporting

A letter report will be prepared to summarize the results of the PDI. The report will include a summary of the field activities performed, boring and sediment core logs, tables presenting the chemical and geotechnical data, a figure showing NAPL distribution in soil and in the river area, cross sectional views of the soil removal and ISS areas, a figure showing the sediment removal area, and copies of the laboratory analytical and geotechnical data reports. All sample elevation and location data, and the chemical data will be submitted to the NYSDEC website, as required by the NYSDEC. The report will include an interpretation of the sediment forensic and sediment quality triad (SQT) evaluations, and recommendations for further assessment, if appropriate.

Following approval of a draft report by O&R, the report will be submitted to the NYSDEC. A conference call will be held with the NYSDEC to discuss the results and any proposed changes to the remediation areas. The PDI data will then be used during the preparation of the RD as an element in the RDWP.

5. References

ARCADIS, 2010. Feasibility Study Report, Nyack Former MGP Site, Operable Unit 2, Nyack, New York. Prepared for Orange & Rockland. August 2010.

EPA, 2003. Equilibrium partitioning sediment guidelines (ESGs) for the protection of benthic organisms: PAH mixtures. U.S. Environmental Protection Agency Office of Science and Technology and Office of Research and Development.

NYSDEC, 2011. New York State Department of Environmental Conservation – Record of Decision, Nyack Former MGP Site, March 2011.

NYSDEC, 2010. New York State Department of Environmental Conservation – Feasibility Study Report Comment Letter dated July 28, 2010.

USACE, 2004. U.S. Army Corps of Engineers (USACE) Standard, EM 1110-2-1003 Title: Engineering and Design - Hydrographic Surveying, Proponent: CECW-EE, CECW-OD, Publication Date: 01 Jan 02 2002, updated 01 April 2004.

Tables

Table 1
Previous and Proposed Subsurface Soil Boring Summary
Nyack MGP Site

Sample Summary											MGP Delineation Analyses					ISS Treatability	Standard Penetration Testing (SPT)	Bedrock Core	Geotechnical Analysis - Shelby Tube - Silt and Sandy-Silt Units							Geotechnical Analysis - Shelby Tube - Fill and Sand Units			
Sample Designation	Date	Sample Location or Rationale	Ground Surface Elevation (Feet NAVD88)	Northing (NAD83)	Easting (NAD83)	Latitude	Longitude	Total Depth (Feet)	Depth to Bedrock (Feet)	Elevation of Bedrock (Feet NAVD88)	Laboratory Sample Depth (Feet)	VOC	SVOC	TAL Metals	Total Cyanide	5 gallon sample	ASTM D1586	ASTM D2113	Moisture content - ASTM D2216	Plasticity (atterburg limits) - ASTM D4318	Grain Size - ASTM D422/D1140	Permeability - ASTM 5084	One-dimensional Consolidation - ASTM D2435	CU tri-axial compression - ASTM D4767	Moisture content - ASTM D2216	Unit Weight	Grain Size - ASTM D422/D1140	Direct shear - ASTM D3080
Proposed Soil Borings																													
SB59	TBD	Soil Area C - to assess the vertical extent of NAPL impacts, depth to bedrock, and depth to the silt unit (if present)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB60	TBD	Soil Area C - to assess the vertical extent of NAPL impacts, depth to bedrock, and depth to the silt unit (if present), and to obtain ISS Treatability sample	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB61	TBD	Soil Area C - to assess the vertical extent of NAPL impacts, depth to bedrock, and depth to the silt unit (if present), and to obtain a bedrock core	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	X	X	X	X	X	X	X	X	X	X	X	X
SB62	TBD	Soil Area C - to assess the vertical extent of NAPL impacts, depth to bedrock, and depth to the silt unit (if present), and to obtain a bedrock core	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	X	X	X	X	X	X	X	X	X	X	X	X
SB63	TBD	Soil Area C - to assess the vertical extent of NAPL impacts, depth to bedrock, and depth to the silt unit (if present). To obtain a bedrock core and ISS Treatability sample	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SB64	TBD	Soil Area B - to assess the vertical extent of NAPL impacts, depth to bedrock, and depth to the silt unit (if present), and to obtain a bedrock core	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	X	X	X	X	X	X	X	X	X	X	X	X
SB65	TBD	Soil Area B - to assess the vertical extent of NAPL impacts, and the depth to the silt unit	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	X	X	X	X	X	X	NA	NA	NA	NA
SB66	TBD	Soil Area B - to assess the vertical extent of NAPL impacts, and the depth to the silt unit	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	X	X	X	X	X	X	NA	NA	NA	NA
SB67	TBD	Soil Area B - to assess the vertical extent of NAPL impacts, and the depth to the silt unit. ISS Treatability sample	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB68	TBD	Soil Area B - to assess the vertical extent of NAPL impacts, and the depth to the silt unit, and to obtain a bedrock core	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB69	TBD	Soil Area B - to assess the vertical extent of NAPL impacts, and the depth to the silt unit	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB70	TBD	Soil Area B - to assess the vertical extent of NAPL impacts, and the depth to the silt unit	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB71	TBD	Soil Area A - to assess the vertical extent of NAPL impacts, and the depth to the silt unit (if present), and the depth to bedrock	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB72	TBD	Soil Area A - to assess the vertical extent of NAPL impacts, and the depth to the silt unit (if present), and the depth to bedrock, and to obtain an ISS treatability sample	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB73	TBD	Soil Area A - to assess the vertical extent of NAPL impacts, and the depth to the silt unit (if present), and the depth to bedrock	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Contingency Borings to be Added if Necessary																													
SB74	TBD	Boring to be added to obtain additional information regarding the extent of NAPL impacts, the presence of the silt unit, or the depth to bedrock	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
SB75	TBD	Boring to be added to obtain additional information regarding the extent of NAPL impacts, the presence of the silt unit, or the depth to bedrock	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
SB76	TBD	Boring to be added to obtain additional information regarding the extent of NAPL impacts, the presence of the silt unit, or the depth to bedrock	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
SB77	TBD	Boring to be added to obtain additional information regarding the extent of NAPL impacts, the presence of the silt unit, or the depth to bedrock	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
SB78	TBD	Boring to be added to obtain additional information regarding the extent of NAPL impacts, the presence of the silt unit, or the depth to bedrock	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	NA	X	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table 1
Previous and Proposed Subsurface Soil Boring Summary
Nyack MGP Site

Sample Summary											MGP Delineation Analyses					ISS Treatability	Standard Penetration Testing (SPT)	Bedrock Core	Geotechnical Analysis - Shelby Tube - Silt and Sandy-Silt Units							Geotechnical Analysis - Shelby Tube - Fill and Sand Units			
Sample Designation	Date	Sample Location or Rationale	Ground Surface Elevation (Feet NAVD88)	Northing (NAD83)	Easting (NAD83)	Latitude	Longitude	Total Depth (Feet)	Depth to Bedrock (Feet)	Elevation of Bedrock (Feet NAVD88)	Laboratory Sample Depth (Feet)	VOC	SVOC	TAL Metals	Total Cyanide	5 gallon sample	ASTM D1586	ASTM D2113	Moisture content - ASTM D2216	Plasticity (atterburg limits) - ASTM D4318	Grain Size - ASTM D422/D1140	Permeability - ASTM 5084	One-dimensional Consolidation - ASTM D2435	CU tri-axial compression - ASTM D4767	Moisture content - ASTM D2216	Unit Weight	Grain Size - ASTM D422/D1140	Direct shear - ASTM D3080
Previous Investigation Soil Borings																													
SB11	1999	To assess the extent of NAPL impacts	1.4	TBD	TBD	TBD	TBD	16.0	NA	NA	4-6	X	X	X	X	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB14	2001	To assess the extent of NAPL impacts	6.6	TBD	TBD	TBD	TBD	24.0	NA	NA	8-12	X	X	X	X	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB26	2001	To assess the extent of NAPL impacts	6.8	TBD	TBD	TBD	TBD	24.0	24.0	NA	16-20	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB30	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB31	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB32	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	X	NA
SB33	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB34	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB35	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB36	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB37	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA	X	NA
SB38	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB39	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB40	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB41	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	X	NA	NA	NA	NA	NA	NA
SB42	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB43	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB44	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	X	NA
SB45	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB46	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB47	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB48	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB49	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB50	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB51	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB52	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB53	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB54	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB55	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB56	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB57	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SB58	2008	To assess the extent of NAPL impacts	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Previous Investigation Soil Borings for Monitoring Well Installation																													
MW7D	1999	To assess the extent of NAPL impacts and to install a well to asses groundwater quality	8.37	TBD	TBD	TBD	TBD	47.0	16.0	NA	14-16	X	X	X	X	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW10S	2001	To assess the extent of NAPL impacts and to install a well to asses groundwater quality	9.36	TBD	TBD	TBD	TBD	16.3	15.0	NA	12-14	X	X	X	X	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW10D	2001	To assess the extent of NAPL impacts and to install a well to asses groundwater quality	7.00	TBD	TBD	TBD	TBD	40.0	18.4	NA	12-13	X	X	X	X	NA	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW19D	2008	To assess the extent of NAPL impacts and to install a well to asses groundwater quality	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	X	NA	NA	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW40	2008	To assess the extent of NAPL impacts and to install a well to asses groundwater quality	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW42	2008	To assess the extent of NAPL impacts and to install a well to asses groundwater quality	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TBD - To be determined or measured during PDI field activities.
NA - Not applicable.
Horizontal Coordinates to be reported in New York State Plane, East Zone, NAD83 North American Datum 1983 (NAD83), and latitude and longitude.
Vertical Coordinates to be reported in North American Datum 1988 (NAVD88).

Table 2
Proposed Sediment Core Summary
Nyack MGP Site

Sample Summary									Visual Observations Of Hydrocarbon Impacts	Vibracore/Dredge Delineation Samples - Non-Impacted Locations (0.0-0.5 ft bss, 0.5-1.0 ft bss, and 1.0-2.0 ft bss)		Forensic Evaluation
Sample Designation	**Date**	**Sample Location or Rationale**	**River Bottom Elevation (Feet NAVD88)**	**Northing (NAD83)**	**Easting (NAD83)**	**Latitude**	**Longitude**	**Total Depth (Feet bss)**	**Visual Observations**	**PAH34 - EPA 8270**	**TOC - Lloyd Kahn**	**EPA 8270C SIM**
Proposed Sediment Cores												
SD63	TBD	To assess the extent of MGP-related impacts.	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	TBD
SD64	TBD	To assess the extent of MGP-related impacts.	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	TBD
SD65	TBD	To assess the extent of MGP-related impacts.	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	TBD
SD66	TBD	To assess the extent of MGP-related impacts.	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	TBD
SD67	TBD	To assess the extent of MGP-related impacts.	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	TBD
SD68	TBD	To assess the extent of MGP-related impacts.	TBD	TBD	TBD	TBD	TBD	TBD	X	X	X	TBD

TBD - To be determined or measured during PDI field activities.
NA - Not available.
Horizontal Coordinates to be reported in New York State Plane, East Zone, NAD83 North American Datum 1983 (NAD83), and latitude and longitude.
Vertical Coordinates to be reported in North American Datum 1988 (NAVD88).

Table 3
In-Situ Solidification Evaluation Criteria
In-Situ Solidification Treatability Study Work Plan
Nyack MGP Site

Physical Characteristic	Parameter	Test/Method	Criterion	Note
Ability of the solidified mass to minimize groundwater flow through it	Hydraulic Conductivity	ASTM D5084, Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter	Average of all treated material equal to or less than K 10-6 cm/sec. No single sample >K 10-5 cm/sec.	NA
Strength of ability of the solidified mass to endure stresses	Unconfined Compressive Strength (UCS)	ASTM D2166, Standard Test Method for Unconfined Compressive Strength of Cohesive Soil	Average of all treated material equal to more than UCS 50 psi. No single sample less than 40 psi.	NA
Long-term leachability as a function of surface area	The rate of leaching over an extended period (several months)	ANS 16.1 Leach testing (5 day leach tests, Total BTEX by EPA 8260, Total PAH by EPA 8270)	A numerical value may be developed based on site-specific groundwater concentrations.	This test takes too long to be used for real-time performance monitoring, but test results will provide insight into long-term performance of the chosen formulation.

Notes:

1. BTEX = Benzene, toluene, ethylbenzene, xylene
2. PAH = Polycyclic Aromatic Hydrocarbons
3. NA = Not applicable
4. ASTM = American Society of Testing Materials
5. EPA = Environmental Protection Agency
6. UCS = Unconfined Compressive Strength

Table 4
Analytical Testing Program
In-Situ Solidification Treatability Study Work Plan
Nyack MGP Site

Phase I: Untreated Material Characterization	**Test Methods**	**Number of Samples**
Sample Homogenization	NA	1
Moisture Content	ASTM D 2216	1
Bulk Density	ASTM D 2937	1
Material pH	EPA Method 9045C	1
Grain Size Distribution (with hydrometer)	ASTM D422	1
Phase II: Stabilization Evaluations	**Test Methods**	**Number of Samples**
Mixture Development (9 Material x 6 Mixtures)	NA	6
UCS Testing (28 day cure)	ASTM D2166	6
Penetrometer Evaluations	NA	6
Hydraulic Conductivity (falling head) (28 day)	ASTM D5084	6
Volumetric Expansion (Bulking) (7 days)	NA	6
ANS 16.1 Leach Testing (5 day leach - 7 Cycles)	NA	1
Total BTEX	EPA Method 8260	7
Total PAH	EPA Method 8270	7

Notes:

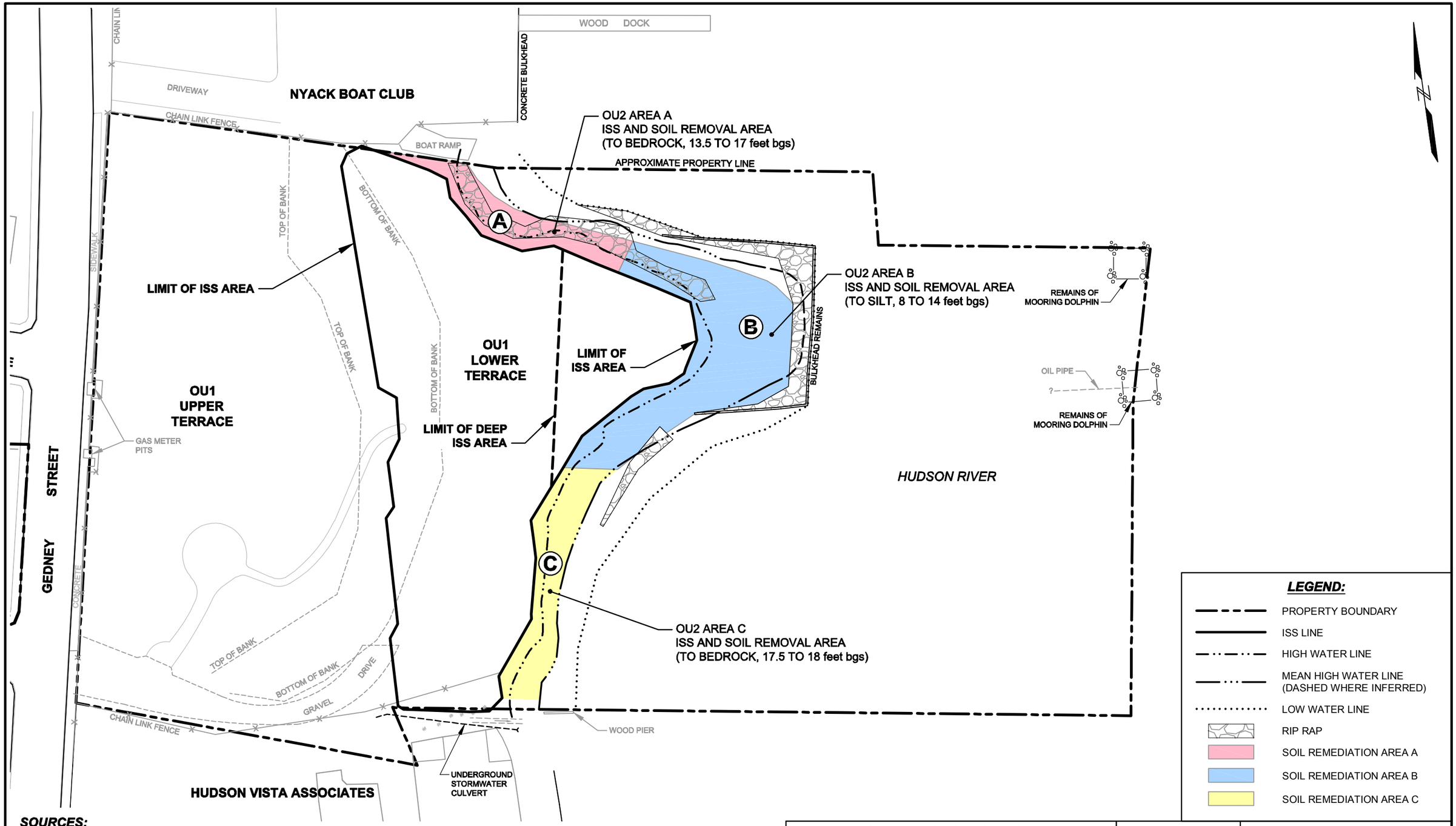
1. BTEX = Benzene, toluene, ethylbenzene, xylene
2. PAH = Polycyclic Aromatic Hydrocarbons
3. NA = Not applicable
4. ASTM = American Society of Testing Materials
5. EPA = Environmental Protection Agency
6. UCS = Unconfined Compressive Strength

Table 5
Test Mix Design
In-Situ Solidification Treatability Study Work Plan
Nyack MGP Site

Reagents	Treatability Sample Number					
	1	2	3	4	5	6
Portland Cement	8%	10%	12%	4%	5%	6%
Blast Furnace Slag				4%	5%	6%
Bentonite	1%	1%	1%	1%	1%	1%

Water addition ration - 1:1 by weight of reagent

Figures



SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 19: SOIL ALTERNATIVES S4* OF THE OU2 FEASIBILITY STUDY REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: AUGUST 2010.

0 50 100

SCALE, FEET

PRE-DESIGN INVESTIGATION WORK PLAN
OPERABLE UNIT 2
NYACK FORMER MGP SITE
NYACK, NEW YORK

ORANGE AND ROCKLAND UTILITIES, INC.
SPRING VALLEY, NEW YORK

GEI Consultants

OU2 SOIL ALTERNATIVE SUMMARY

Project 121640-1001 | March 2012 | Figure 1

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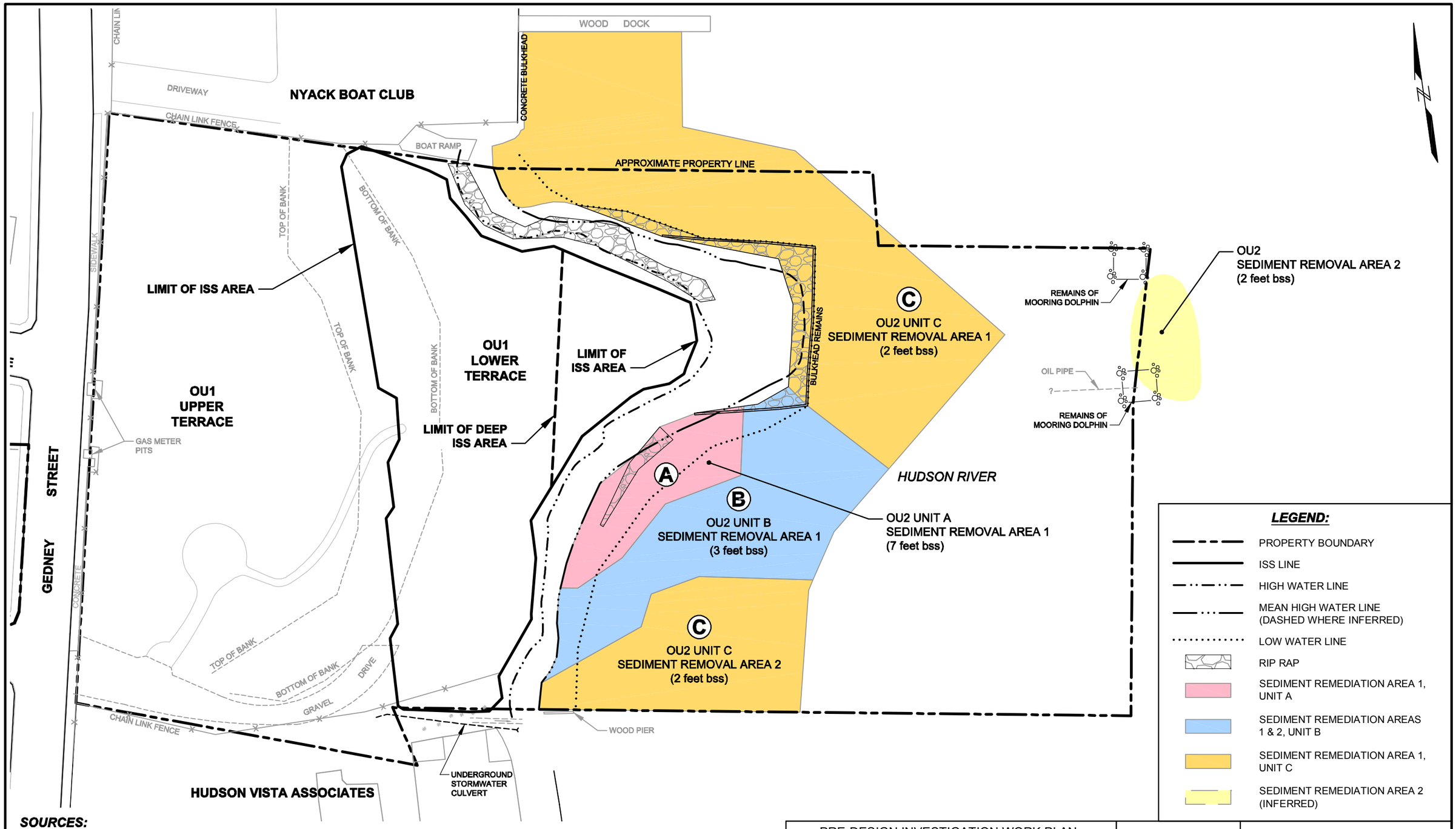

SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 22: SEDIMENT ALTERNATIVE SED4* OF THE OU2 FEASIBILITY STUDY REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: AUGUST 2010.

0 50 100

SCALE, FEET

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OU2 SEDIMENT ALTERNATIVE SUMMARY

Project 121640-1001 | March 2012 | Figure 2

I:\Project\ORANGE & ROCKLAND\Nyack\PDI Work Plan\Drawings\2012-03\Nyack-PDIWP Figures_032312.dwg

NYACK BOAT CLUB

CHAIN LINK FENCE

BOAT RAMP

APPROXIMATE PROPERTY LINE

SB55 MW10S SB54 SB52 SB73 SB58 SB30 SB32 SB51 SB31 SB72 SB33 SB71 SB34 SB70 SB35 SB36 SB69 SB67 SB68 SB66 SB11 SB37 SB65 SB39 SB64 SB41 SB38 SB63 SB40 SB56 SB62 SB43 SB42 SB53 MW40 SB57 SB44 SB61 SB45 SB46 SB47 SB60 SB48 SB59 SB49 SB50

MW43 MW42 MW44 MW41 MW45 MW33D

LIMIT OF ISS AREA

LIMIT OF ISS AREA

LIMIT OF DEEP ISS AREA

OU1 LOWER TERRACE

OU1 UPPER TERRACE

TOP OF BANK

BOTTOM OF BANK

TOP OF BANK

BOTTOM OF BANK

SIDEWALK

GAS METER PITS

GEDNEY STREET

CONCRETE

TOP OF BANK

BOTTOM OF BANK

DRIVE

GRAVEL

CHAIN LINK FENCE

BULKHEAD REMAINS

REMAINS OF MOORING DOLPHIN

OIL PIPE

?

REMAINS OF MOORING DOLPHIN

WOOD PIER

HUDSON RIVER

N

0 40 80

SCALE, FEET

LEGEND:

- PROPERTY BOUNDARY
- ISS LINE
- HIGH WATER LINE
- MEAN HIGH WATER LINE (DASHED WHERE INFERRED)
- LOW WATER LINE
- RIP RAP
- SB59 PROPOSED SOIL BORING
- MW42 MONITORING WELL
- SB11 SOIL BORING
- COAL TAR OR NAPL-SATURATED SOIL
- MEDIUM TO HEAVY STAIN, SHEEN OR NAPL BLEBS
- SLIGHT HYDROCARBON-LIKE ODOR, HYDROCARBON STAINING, SLIGHT SHEEN

SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 2: PROPOSED SOIL BORING LOCATIONS* OF THE OU2 PRE-DESIGN INVESTIGATION WORK PLAN, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: 2011.

PRE-DESIGN INVESTIGATION WORK PLAN
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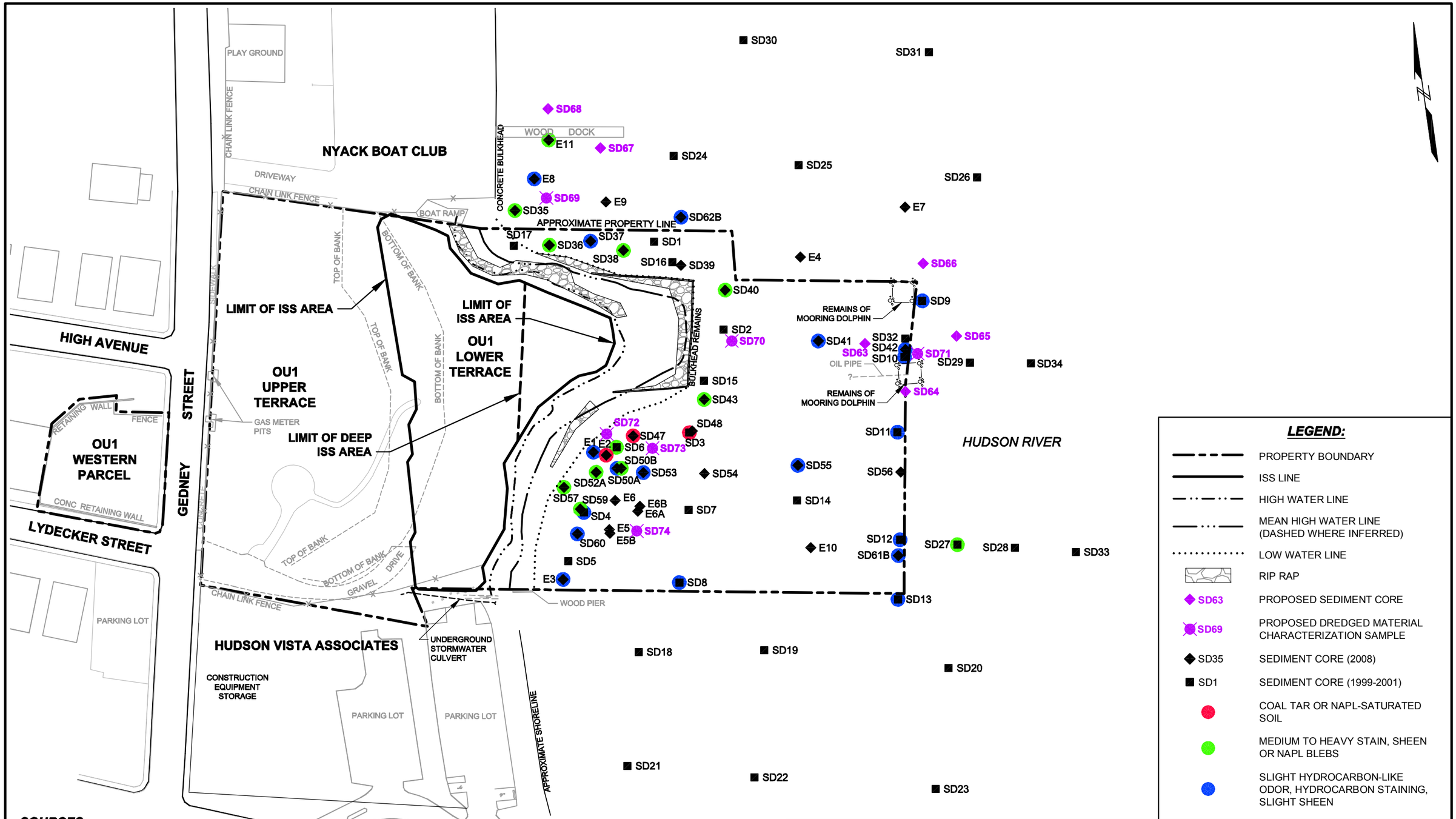
PREVIOUS AND PROPOSED SOIL BORING LOCATIONS

Project 121640-1001 | March 2012 | Figure 3

I:\Project\ORANGE & ROCKLAND\Nyack\PDI Work Plan\Drawings\2012-03\Nyack-PDIWP Figures_032312.dwg



LEGEND:

- PROPERTY BOUNDARY
- ISS LINE
- HIGH WATER LINE
- MEAN HIGH WATER LINE (DASHED WHERE INFERRED)
- LOW WATER LINE
- RIP RAP
- SD63 — PROPOSED SEDIMENT CORE
- SD69 — PROPOSED DREDGED MATERIAL CHARACTERIZATION SAMPLE
- SD35 — SEDIMENT CORE (2008)
- SD1 — SEDIMENT CORE (1999-2001)
- COAL TAR OR NAPL-SATURATED SOIL
- MEDIUM TO HEAVY STAIN, SHEEN OR NAPL BLEBS
- SLIGHT HYDROCARBON-LIKE ODOR, HYDROCARBON STAINING, SLIGHT SHEEN

SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 3: PROPOSED SEDIMENT CORING LOCATIONS* OF THE OU2 PRE-DESIGN INVESTIGATION WORK PLAN, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: 2011.

0 75 150

SCALE, FEET

PRE-DESIGN INVESTIGATION WORK PLAN
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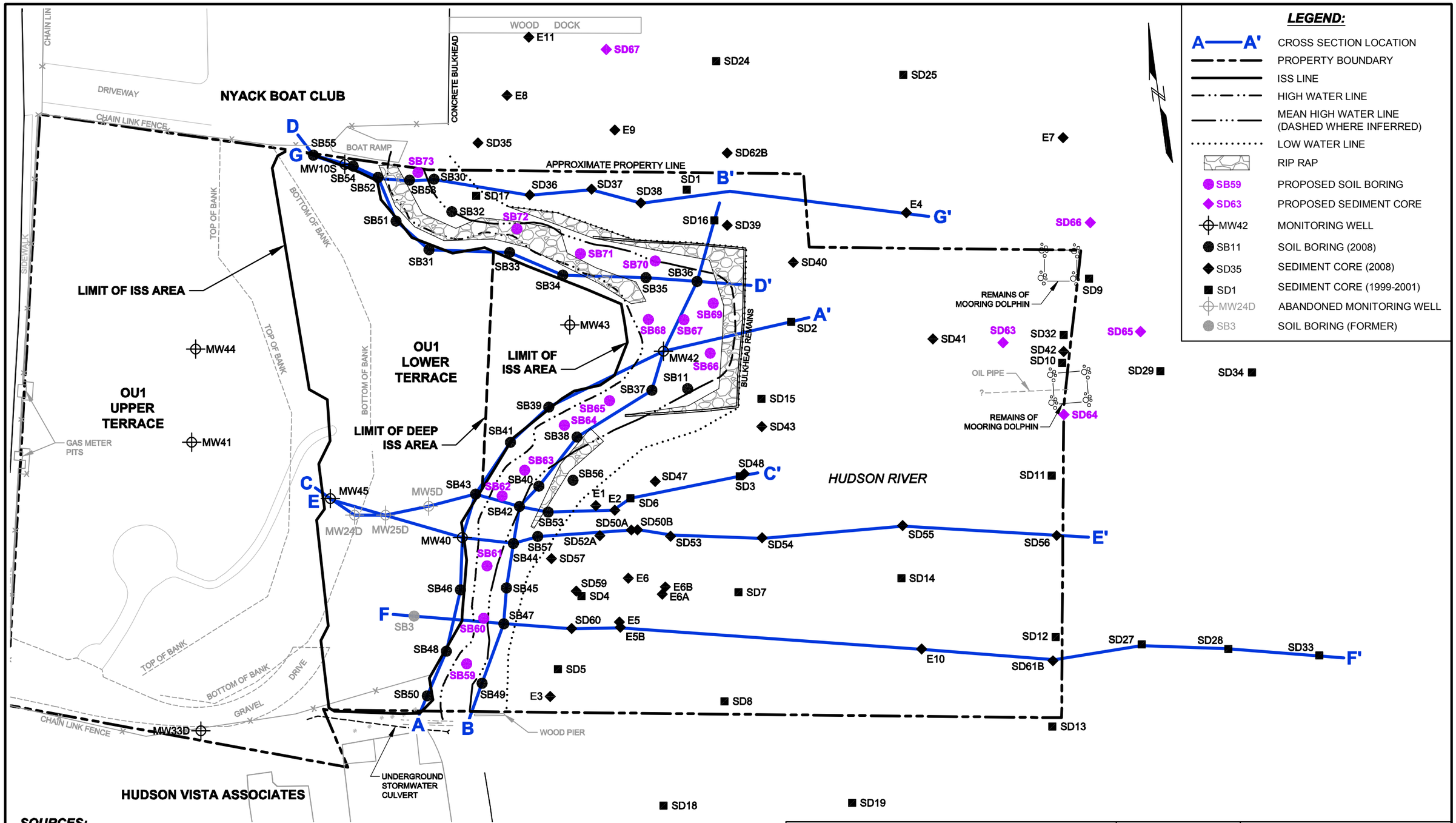
PREVIOUS AND PROPOSED SEDIMENT SAMPLE LOCATIONS

March 2012 Figure 4

I:\Project\ORANGE & ROCKLAND\Nyack\PDI Work Plan\Drawings\2012-03\Nyack-PDIWP Figures_032312.dwg



SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 19: SOIL ALTERNATIVES S4* OF THE OU2 FEASIBILITY STUDY REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: AUGUST 2010.

PRE-DESIGN INVESTIGATION WORK PLAN
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CROSS SECTION LOCATION MAP

March 2012 Figure 5

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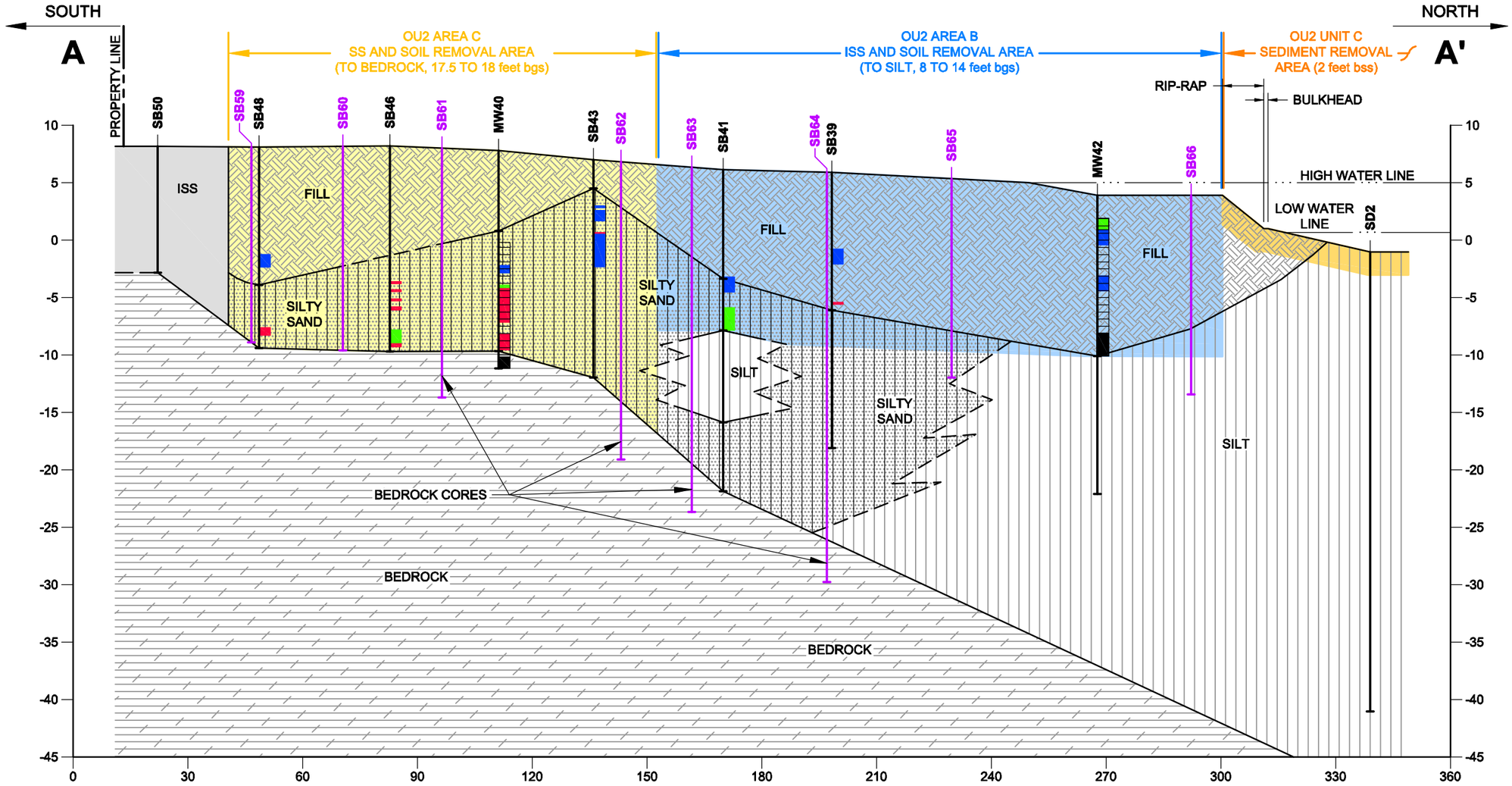
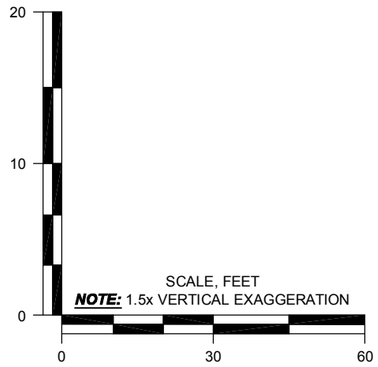


LEGEND:

OBSERVED HYDROCARBON IMPACTS

- HYDROCARBON ODOR, LIGHT STAINING
- HEAVY COAL TAR STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR COAL TAR/ NAPL

- ISS
- FILL
- SILT
- SILTY SAND
- BEDROCK
- DIRECT CONTACT
- INFERRED CONTACT
- WATER LEVEL
- SEDIMENT/SOIL BORING
- ABANDONED WELLS
- PROPOSED BORING (LOCATION APPROXIMATE)
- MONITORING WELL SCREEN
- SUMP



SOURCE:

FIGURE 4-3: CROSS-SECTION A-A' OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, HORIZONTAL SCALE: 1" = 30', VERTICAL SCALE: 1" = 10', DATE: 04/6/09.

PRE-DESIGN INVESTIGATION WORK PLAN
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SPRING VALLEY, NEW YORK

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CROSS SECTION A-A'

March 2012

Figure 6

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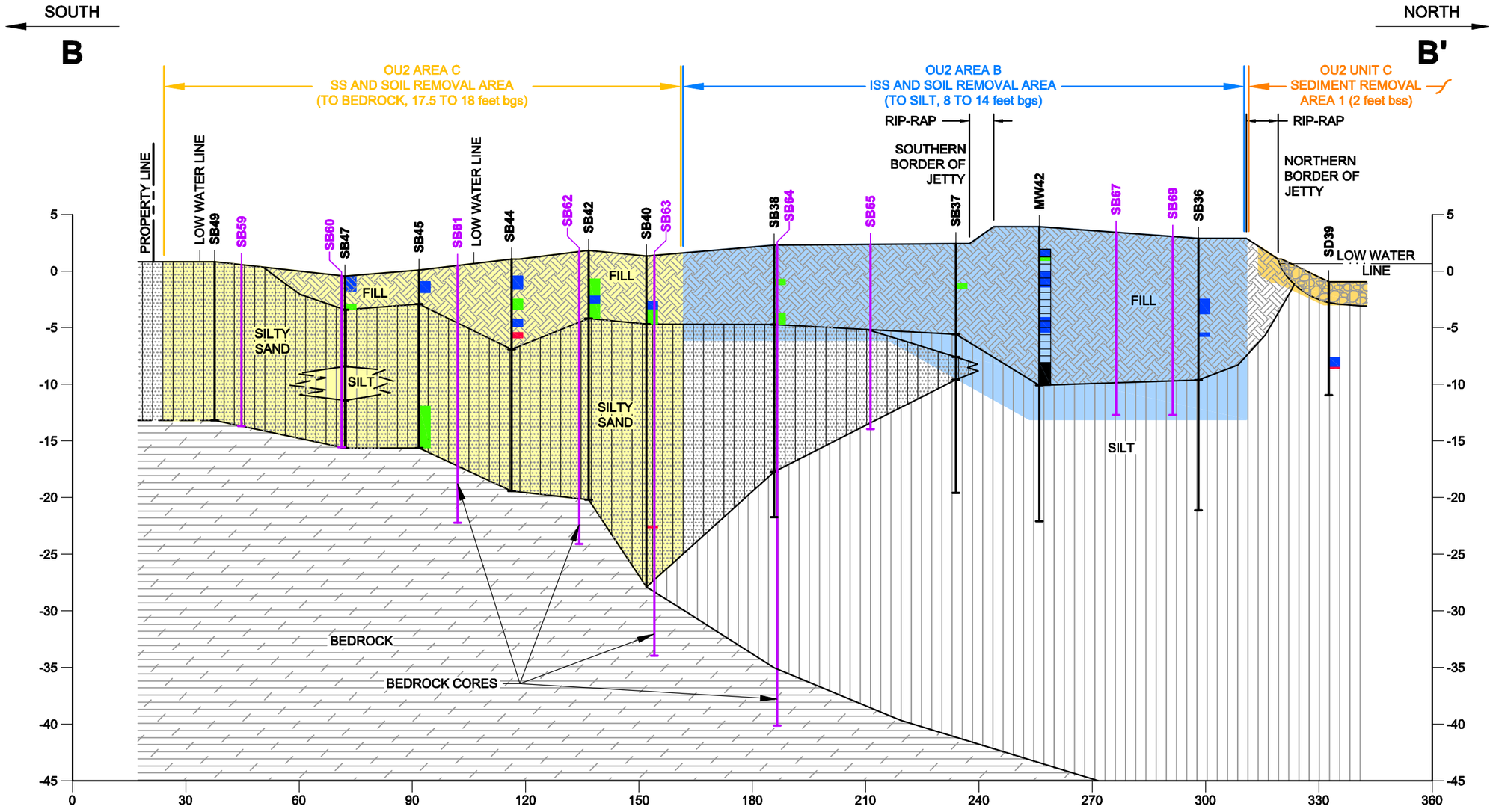
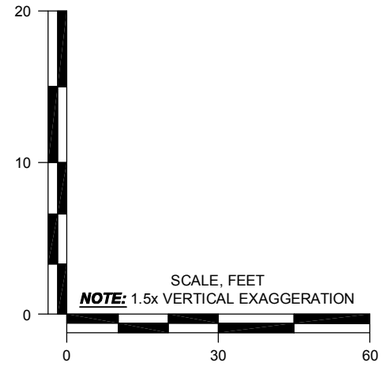


LEGEND:

OBSERVED HYDROCARBON IMPACTS

- HYDROCARBON ODOR, LIGHT STAINING
- HEAVY COAL TAR STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR COAL TAR/ NAPL

- ISS
- FILL
- SILT
- SILTY SAND
- BEDROCK
- DIRECT CONTACT
- INFERRED CONTACT
- WATER LEVEL
- SEDIMENT/SOIL BORING
- ABANDONED WELLS
- PROPOSED BORING (LOCATION APPROXIMATE)
- MONITORING WELL SCREEN
- SUMP



SOURCE:

FIGURE 4-4: CROSS-SECTION B-B' OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, HORIZONTAL SCALE: 1" = 30', VERTICAL SCALE: 1" = 10', DATE: 04/6/09.

PRE-DESIGN INVESTIGATION WORK PLAN
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ORANGE AND ROCKLAND UTILITIES, INC.
SPRING VALLEY, NEW YORK

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CROSS SECTION B-B'

Project 121640-1001 | March 2012 | Figure 7

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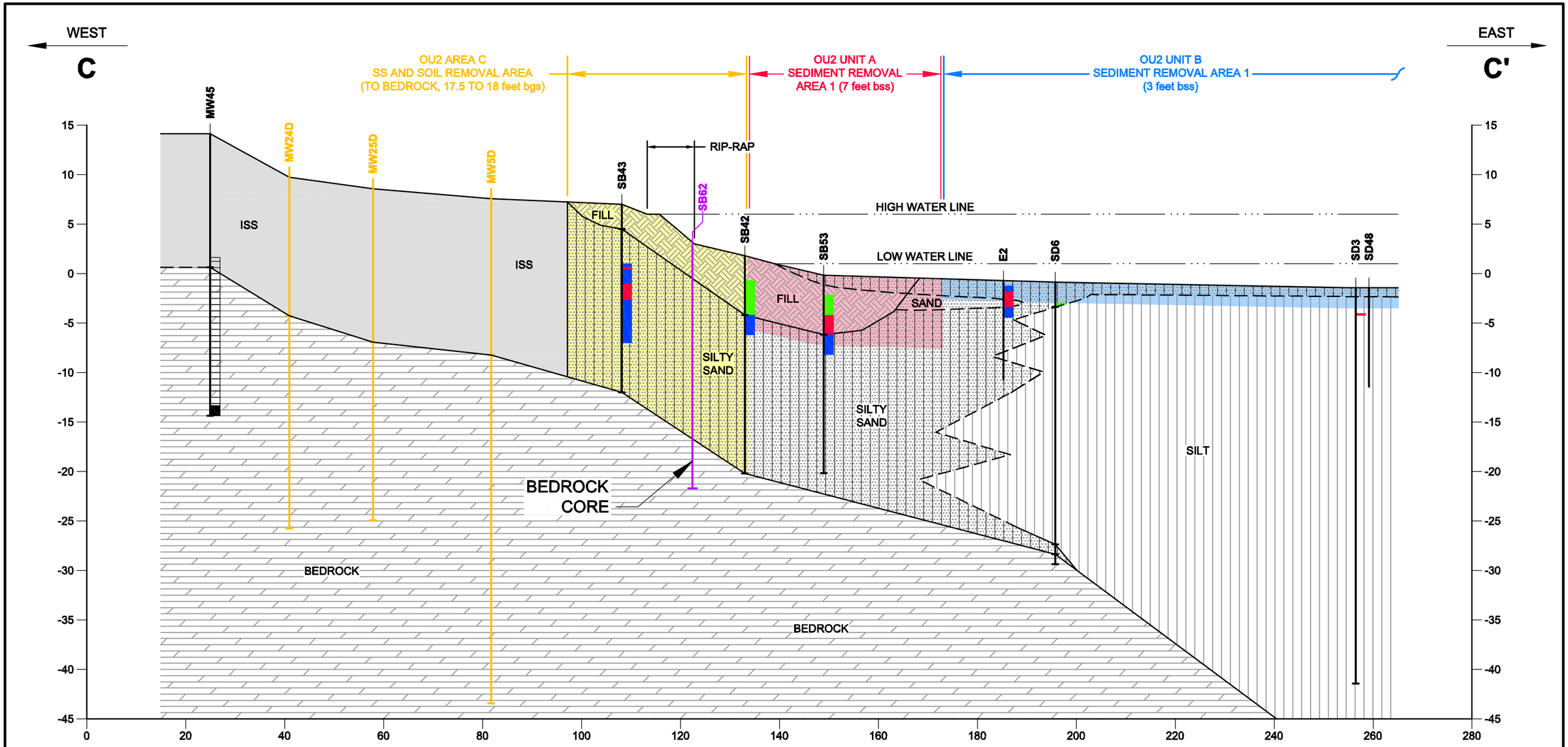
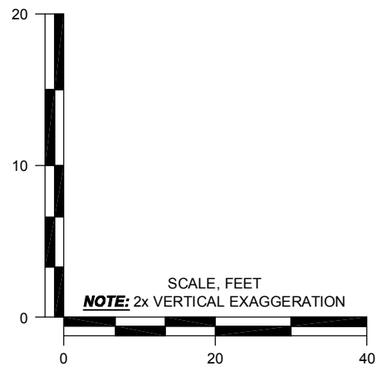


LEGEND:

OBSERVED **HYDROCARBON IMPACTS**

- HYDROCARBON ODOR, LIGHT STAINING
- HEAVY COAL TAR STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR COAL TAR/ NAPL

- ISS
- FILL
- SILT
- SILTY SAND
- BEDROCK
- DIRECT CONTACT
- INFERRED CONTACT
- WATER LEVEL
- SEDIMENT/SOIL BORING
- ABANDONED WELLS
- PROPOSED BORING (LOCATION APPROXIMATE)
- MONITORING WELL SCREEN
- SUMP



SOURCE:

FIGURE 4-5: CROSS-SECTION C-C' OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, HORIZONTAL SCALE: 1" = 20', VERTICAL SCALE: 1" = 10', DATE: 04/6/09.

PRE-DESIGN INVESTIGATION WORK PLAN OPERABLE UNIT 2 NYACK FORMER MGP SITE NYACK, NEW YORK	GEI Consultants	**CROSS SECTION C-C'**
ORANGE AND ROCKLAND UTILITIES, INC. SPRING VALLEY, NEW YORK	Project 121640-1001	March 2012 Figure 8

I:\Project\ORANGE & ROCKLAND\Nyack\PDI Work Plan\Drawings\2012-03\Nyack-PDIWP Figures_032312.dwg

WEST

D

EAST

D'

OU2 AREA A
ISS AND SOIL REMOVAL AREA
(TO BEDROCK, 13.5 TO 17 feet bgs)

OU2 AREA B
ISS AND SOIL REMOVAL AREA
(TO SILT, 13.5 TO 14 feet bgs)

PROPERTY LINE

SB55 SB54 SB52 SB51 SB31 SB72 SB33 SB34 SB71 SB35 SB70 SB36 SB69

RIP-RAP

RIP-RAP

BULKHEAD

HIGH WATER LINE

FILL

FILL

FILL

SILTY SAND

SILTY SAND

BEDROCK

BEDROCK CORE

SILT

SILT

SILT

10 5 0 -5 -10 -15 -20 -25 -30

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280

LEGEND:

OBSERVED HYDROCARBON IMPACTS

- HYDROCARBON ODOR, LIGHT STAINING
- HEAVY COAL TAR STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR COAL TAR/ NAPL

- ISS
- FILL
- SILT
- SILTY SAND
- BEDROCK
- DIRECT CONTACT
- INFERRED CONTACT
- WATER LEVEL
- SEDIMENT/SOIL BORING
- ABANDONED WELLS
- PROPOSED BORING (LOCATION APPROXIMATE)
- MONITORING WELL SCREEN
- SUMP

20 10 0

0 20 40

SCALE, FEET

NOTE: 2x VERTICAL EXAGGERATION

SOURCE:

FIGURE 4-6: CROSS-SECTION D-D' OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, HORIZONTAL SCALE: 1" = 20', VERTICAL SCALE: 1" = 10', DATE: 04/6/09.

PRE-DESIGN INVESTIGATION WORK PLAN
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SPRING VALLEY, NEW YORK

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CROSS SECTION D-D'

Project 121640-1001 | March 2012 | Figure 9

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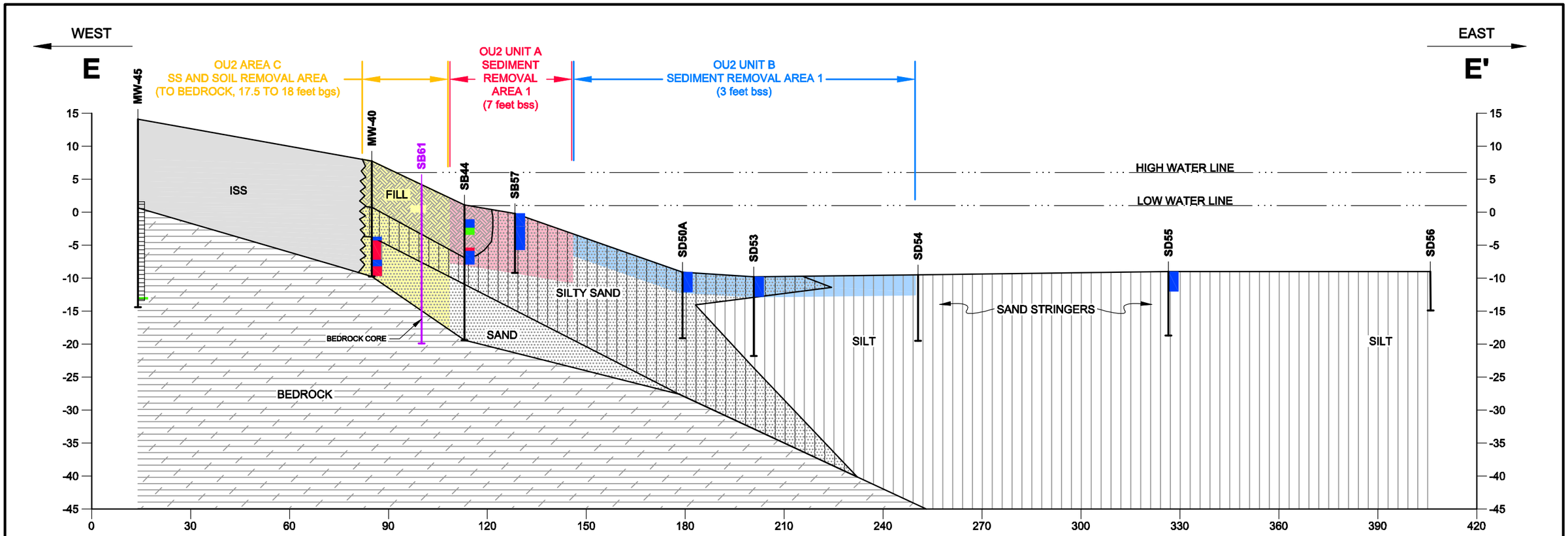

LEGEND:

OBSERVED HYDROCARBON IMPACTS

- HYDROCARBON ODOR, LIGHT STAINING
- HEAVY COAL TAR STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR COAL TAR/ NAPL

- ISS
- FILL
- SILT
- SILTY SAND
- BEDROCK
- DIRECT CONTACT
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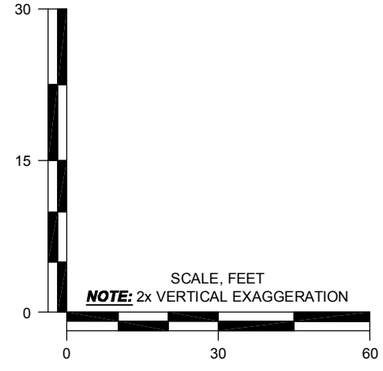
- WATER LEVEL
- SEDIMENT/SOIL BORING
- ABANDONED WELLS
- PROPOSED BORING (LOCATION APPROXIMATE)
- MONITORING WELL SCREEN
- SUMP



SOURCE:

FIGURE 4-7: CROSS-SECTION E-E' OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, HORIZONTAL SCALE: 1" = 30', VERTICAL SCALE: 1" = 15', DATE: 04/6/09.

PRE-DESIGN INVESTIGATION WORK PLAN
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SPRING VALLEY, NEW YORK

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CROSS SECTION E-E'

Project 121640-1001 | March 2012 | Figure 10

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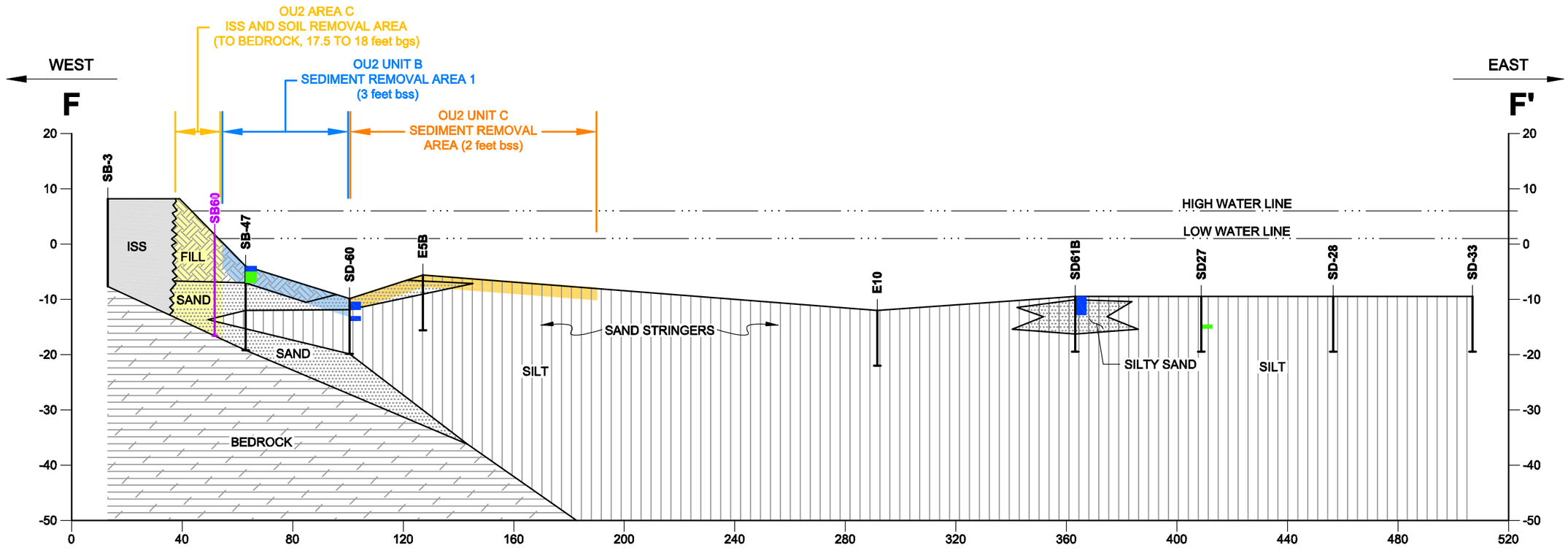

LEGEND:

OBSERVED HYDROCARBON IMPACTS

- HYDROCARBON ODOR, LIGHT STAINING
- HEAVY COAL TAR STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR COAL TAR/ NAPL

- ISS
- FILL
- SILT
- SILTY SAND
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- PROPOSED BORING (LOCATION APPROXIMATE)
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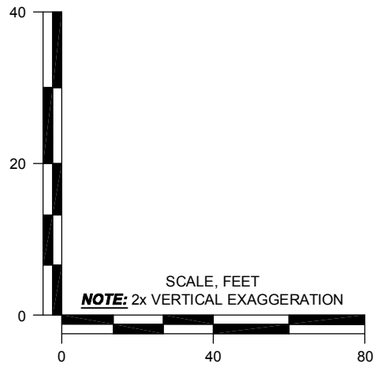
- SUMP



SOURCE:

FIGURE 4-8: CROSS-SECTION F-F' OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, HORIZONTAL SCALE: 1" = 40', VERTICAL SCALE: 1" = 20', DATE: 04/6/09.

PRE-DESIGN INVESTIGATION WORK PLAN
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Project 121640-1001

CROSS SECTION F-F'

March 2012 Figure 11

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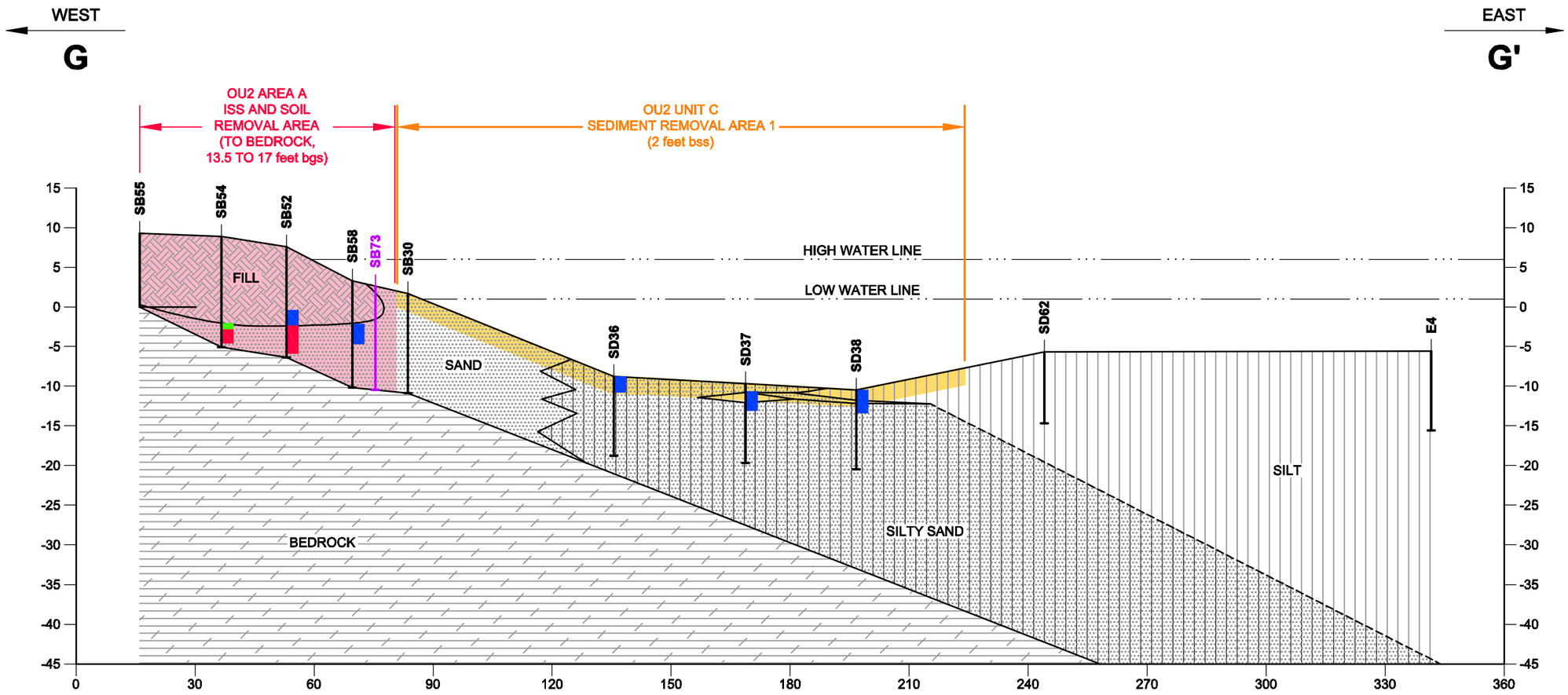
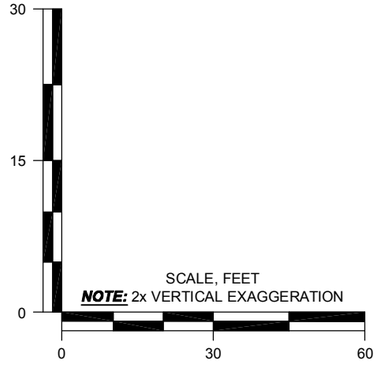


LEGEND:

OBSERVED HYDROCARBON IMPACTS

- HYDROCARBON ODOR, LIGHT STAINING
- HEAVY COAL TAR STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR COAL TAR/ NAPL

- ISS
- FILL
- SILT
- SILTY SAND
- BEDROCK
- DIRECT CONTACT
- INFERRED CONTACT
- WATER LEVEL
- SEDIMENT/SOIL BORING
- ABANDONED WELLS
- PROPOSED BORING (LOCATION APPROXIMATE)
- MONITORING WELL SCREEN
- SUMP



SOURCE:

FIGURE 4-9: CROSS-SECTION G-G' OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, HORIZONTAL SCALE: 1" = 30', VERTICAL SCALE: 1" = 15', DATE: 04/6/09.

PRE-DESIGN INVESTIGATION WORK PLAN
OPERABLE UNIT 2
NYACK FORMER MGP SITE
NYACK, NEW YORK

ORANGE AND ROCKLAND UTILITIES, INC.
SPRING VALLEY, NEW YORK

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CROSS SECTION G-G'

Project 121640-1001 | March 2012 | Figure 12

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Appendix A

Previous Borelogs and Monitoring Well Construction Logs

ThermoRetec Corporation
1001 W. Seneca St., Suite 204
Ithaca, NY 14850-3342
(607) 277-5716 Phone
(607) 277-9057 Fax
www.thermoretec.com

BOREHOLE LOG

ID: SB11

Project Number: ORAN2-04301	**Drilling Co.:** Maxim Technologies	**Surface Elevation: (MSL)** 1.4
Client: Orange and Rockland Utilities	**Driller:** Walt Ketter	**Water Level During Drilling:** NA
Site Location: Nyack MGP Site	**Casing ID:** NA	**Stickup:** NA
Start Date: 11/4/99	**Method:** 4 1/4" ID Hollow Stem Auger	**MP Elevation: (MSL)** NA
Completion Date: 11/4/99	**Logged By:** James Edwards	**Total Depth:** 16
Location: Eastern Parcel - Jetty Area		

Depth (ft)	Recovery (ft)	Blow Counts/6"	Sample Depth	PID Measurements (ppm)	Lithology (symbols)	Description
1	0.9	2 2 4 3	0-2	0.0		**Fill** Fill material: Sand; mixed with ash-like material; gravel; cinders; coal fragments; moist; loose.
2						Trace sandstone fragments.
3	0.5	4 3 2 1	2-4	4.1		
4						
5	0.6	1 3 5 1	4-6	87.0		Fill becomes: black silt; 20% coal fragments; hydrocarbon-like sheen; trace tar-like NAPL; wood fragments; wet.
6						
7	0.2	2 3 3 2	6-8	35.2		Black silt mixed with wood fragments; gravel; strong hydrocarbon-like odor and sheen.
8						
9	0.2	2 5 5 10	8-10	30.0		
10						Wood fragments in spoon tip - poor recovery.
11	0.1	1 1 5 1	10-12	NA		
12						
13	1.7	1 1 1 1	12-14	45.6		
14						**ML - Clayey Silt** Clayey Silt; grey; very fine; uniform; soft; wet.
15	1.9	1 1 2 1	14-16	24.1		
16						

Remarks:
Laboratory Sample Collected
SB11(4.0-6.0)
MGP Indicators

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SB14

Project Name: Nyack MGP Site
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 5-16-01
Drilling Company: Terra Probe, Inc.
Drilling Method: Direct Push
Sampling Method: Continuous 4 ft Macrocore

Boring Location: Eastern Parcel
Ground Elevation (ft/msl): 6.60
Total Depth (ft): 24.0
Boring Diameter Outer/Inner (in): 2 inch
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Blow Counts	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0	3.5			7.3	ML		Clayey silt with fine-medium sand and some fine-coarse gravel. Brown, dry.
-2							
-4							
	3.8			3.0	ML		
-6							
-8							
-10	3.7		SB14 (8-12)	25.7	FILL		Clinker-like material with coal fragments. Black, saturated. Hydrocarbon-like odor.
-12							
	3.8			0.0	ML		Clayey silt with interbedded fine-medium sand. Gray-black, saturated.
-14							
-16							
	3.5			0.0	ML		Clayey silt with interbedded fine-medium sand. Brown-gray, saturated. Clinker-like material at 16.5
-18							
-20							

Remarks:

Laboratory Sample: SB14 (8-12)

ThermoRetec
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Ithaca, NY 14850

Boring ID: SB14

Depth (Feet)	Recovery (Feet)	Blow Counts	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
-20							
-22	3.5			0.0	ML		Clayey silt with interbedded fine-medium sand. Brown-gray, saturated. Trace tar-like material from 21.0-21.5.
-24							Boring Complete at 24.0 ft.
-26							
-28							
-30							

Remarks:

Laboratory Sample: SB14 (8-12)

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Ithaca, New York 14850

Boring ID: SB26

Project Name: Nyack MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 5-16-01
Drilling Company: Terra Probe, Inc.
Drilling Method: Direct Push
Sampling Method: Continuous 4ft Macrocore

Boring Location: Eastern Parcel
Ground Elevation (ft/msl): 6.80
Total Depth (ft): 24.0
Boring Diameter Outer/Inner (in): 2 inch
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Blow Counts	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0	4.0			1.8	SM		Silt with fine-medium sand and some fine-coarse gravel. Brown, dry.
-2							
-4	3.5			1.8	SM		
-6							Clinker-like material 6.0-8.0 ft.
-8	2.0			2.6	FILL		Clinker-like material with coal and ash fragments. Black, saturated.
-10							
-12	3.5			3.2			Clayey silt with some fine-medium sand. Brown-gray, saturated.
-14					ML		
-16	3.5		SB26 (16-20)	1.3			
-18					ML		
-20	3.5			0.0			
-22							
-24							Driller reports refusal at 24.0 ft.
-26							
-28							
-30							

Remarks:

Laboratory Sample: SB26 (16-20)

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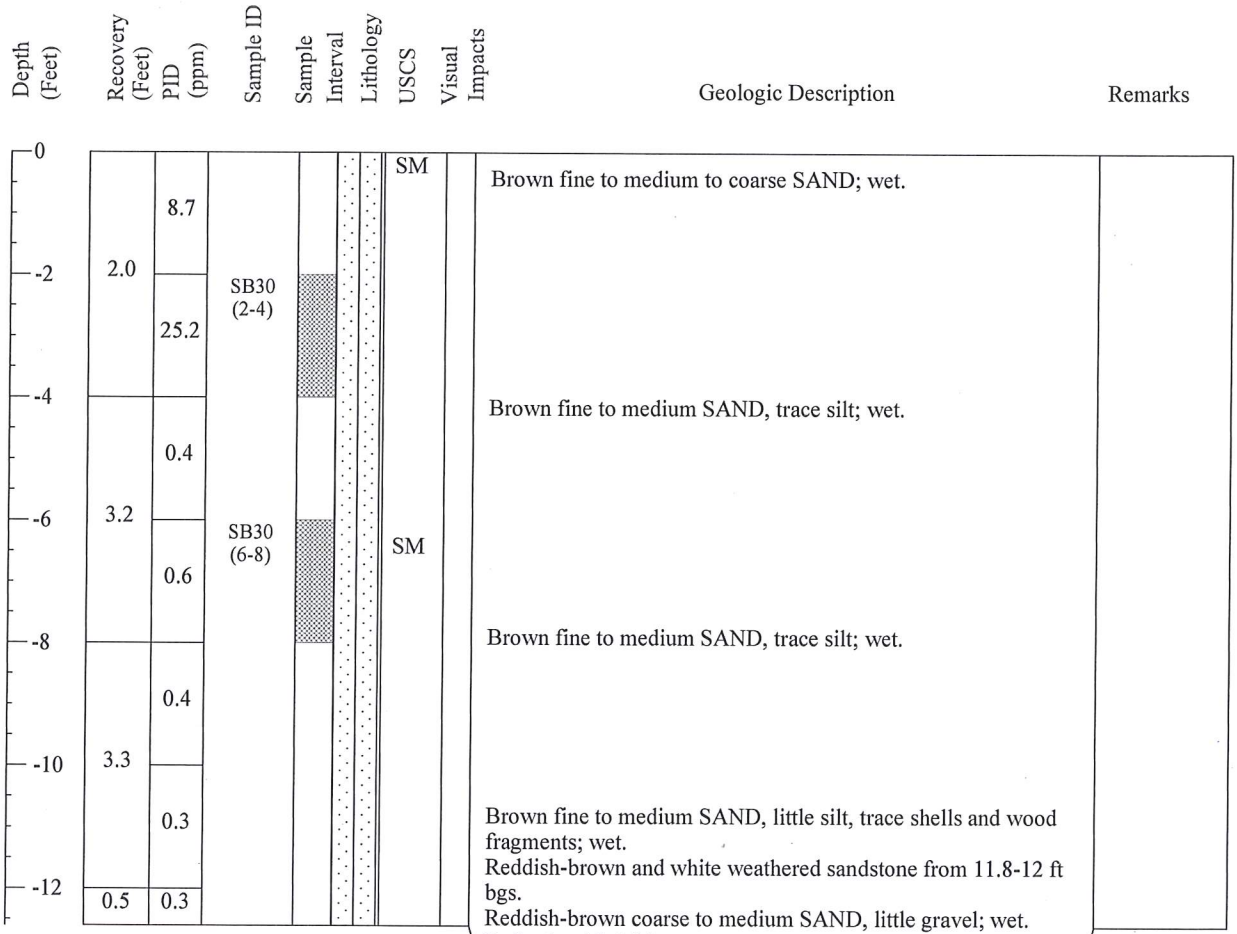
Boring ID: SB30

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 2, 2008
Boring Location: Intertidal zone, near boat club property line
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 1.66
Total Depth: 12.6 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB30(2-4) and SB30(6-8) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample SB30WC(2-4) was analyzed by a suite of analyses for waste characterization.

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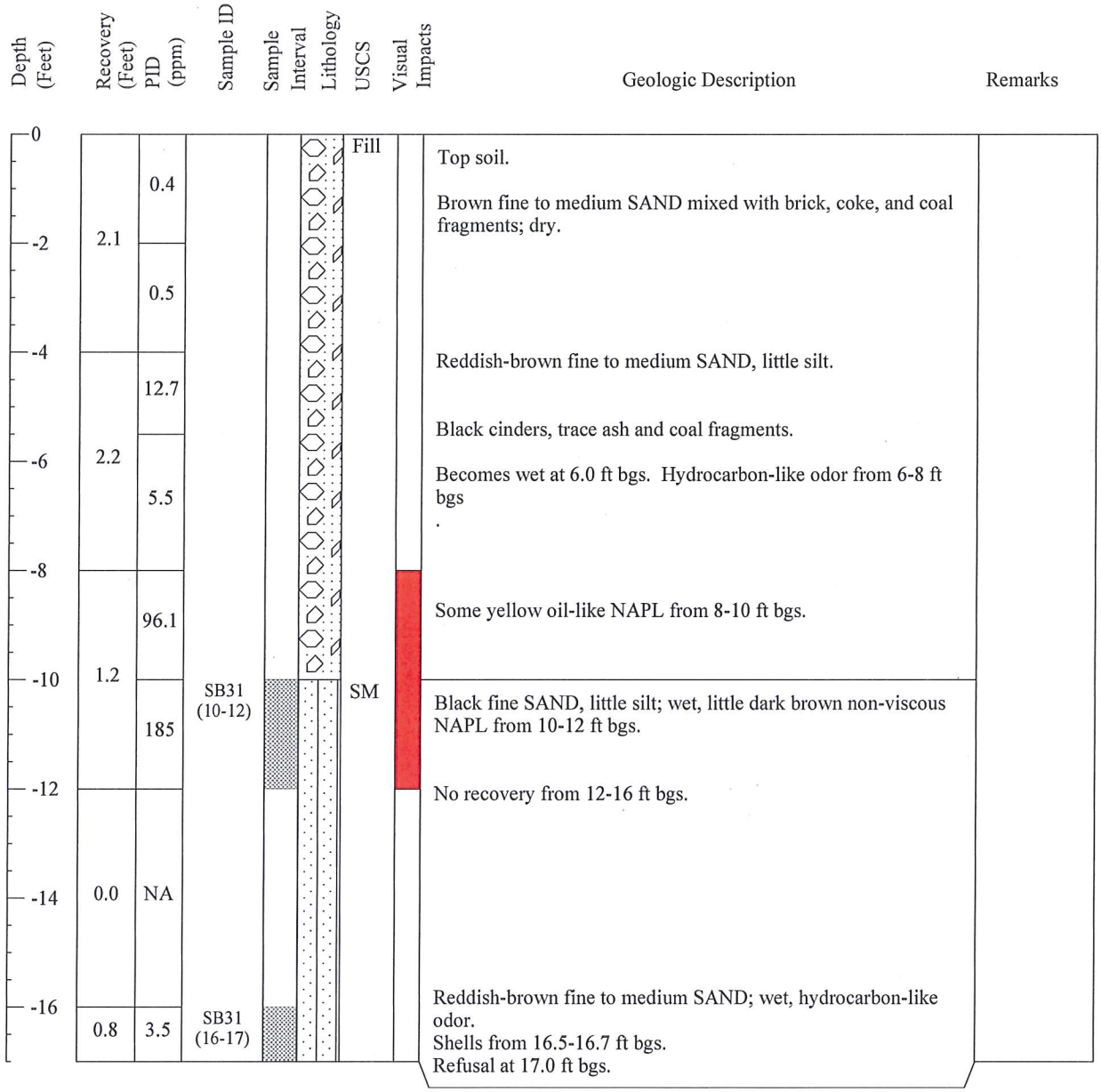
Boring ID: SB31

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 2, 2008
Boring Location: Northern shoreline area
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 7.22
Total Depth: 17.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB31(10-12) and SB31(16-17) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample SB31WC(0-17) was analyzed by a suite of analyses for waste characterization.

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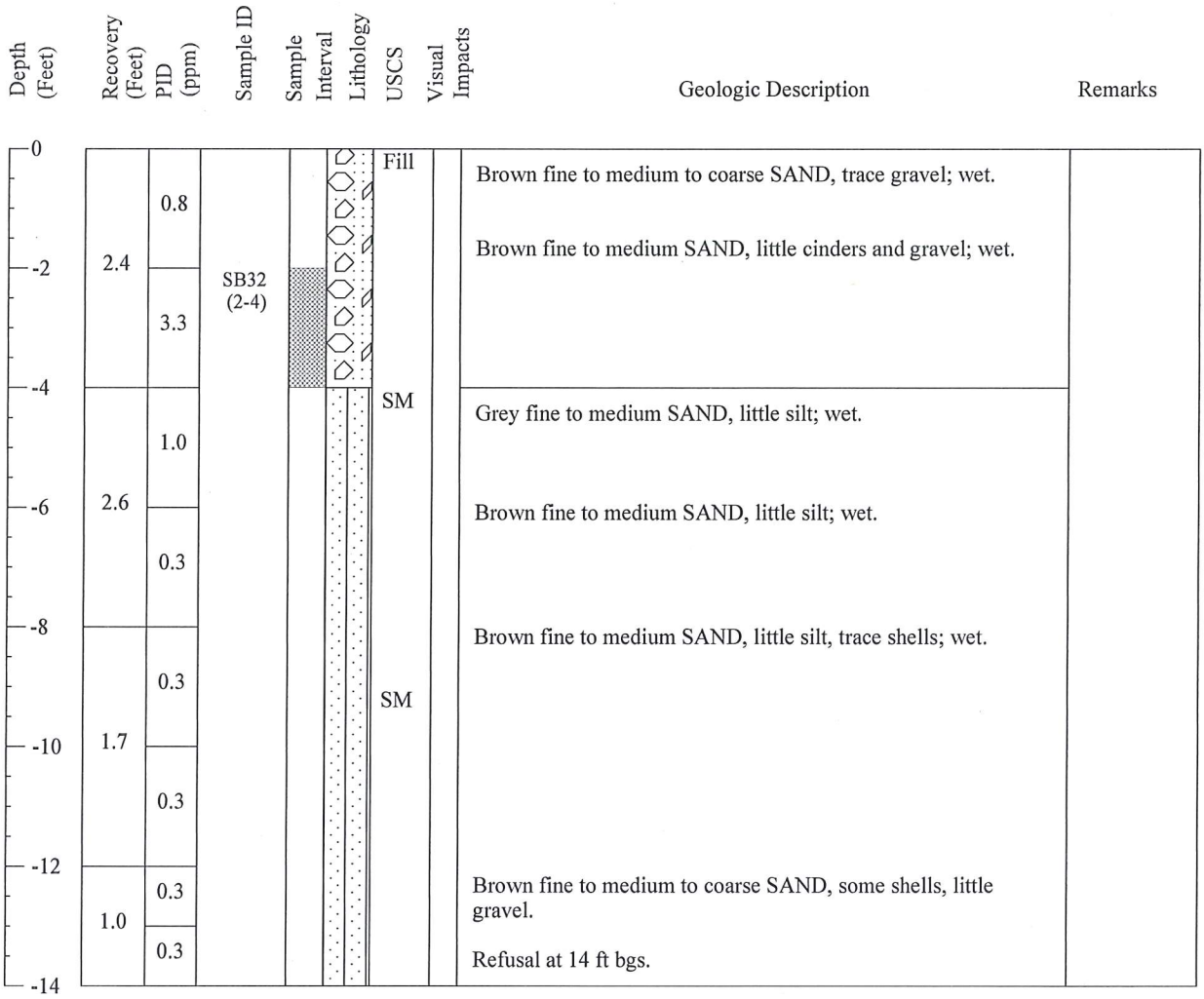
Boring ID: SB32

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 2, 2008
Boring Location: Intertidal zone, near boat club property line
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 2.08
Total Depth: 14.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB32(2-4) was analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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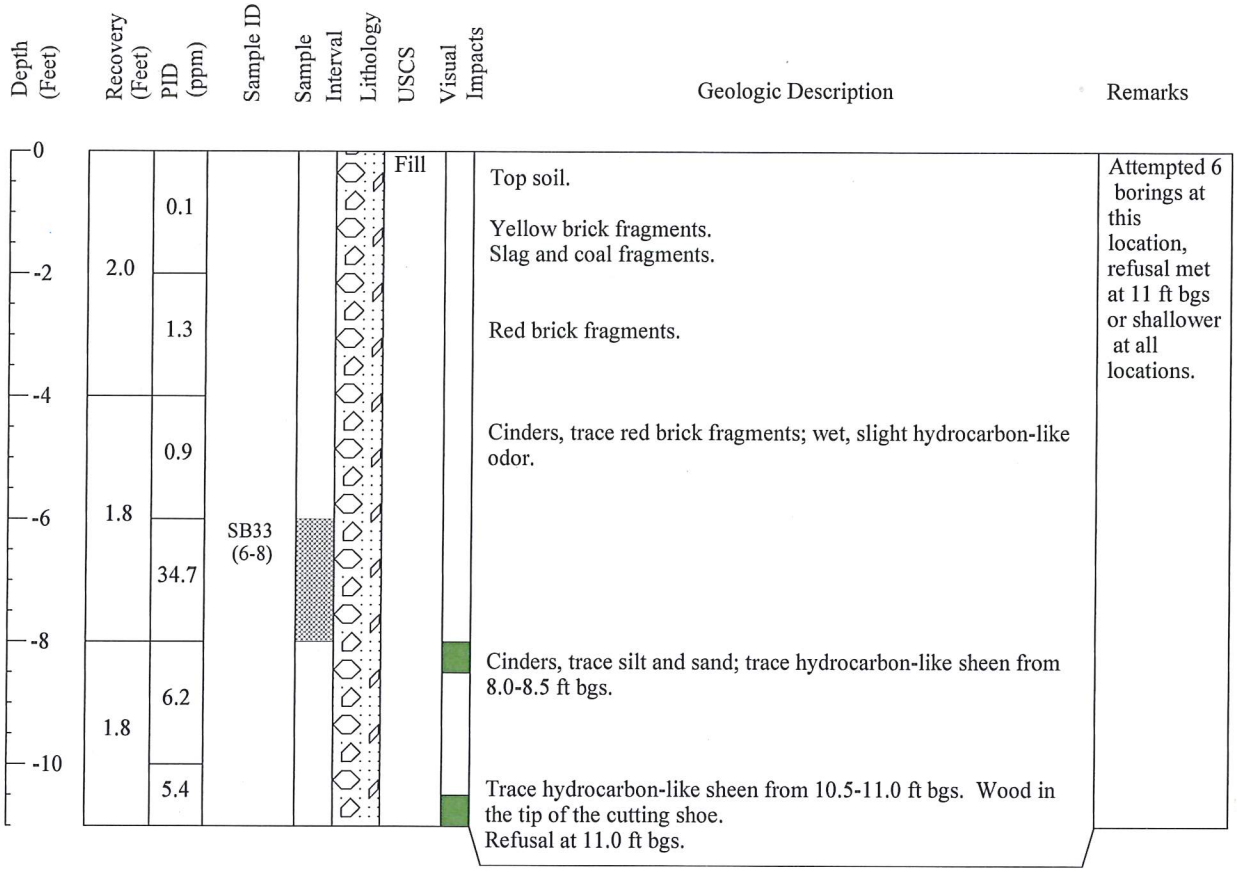
Boring ID: SB33

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Shoreline area of the northern part of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 7.15
Total Depth: 11.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB33(6-8) was analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample SB33WC(1-11) was analyzed by a suite of analyses for waste characterization.

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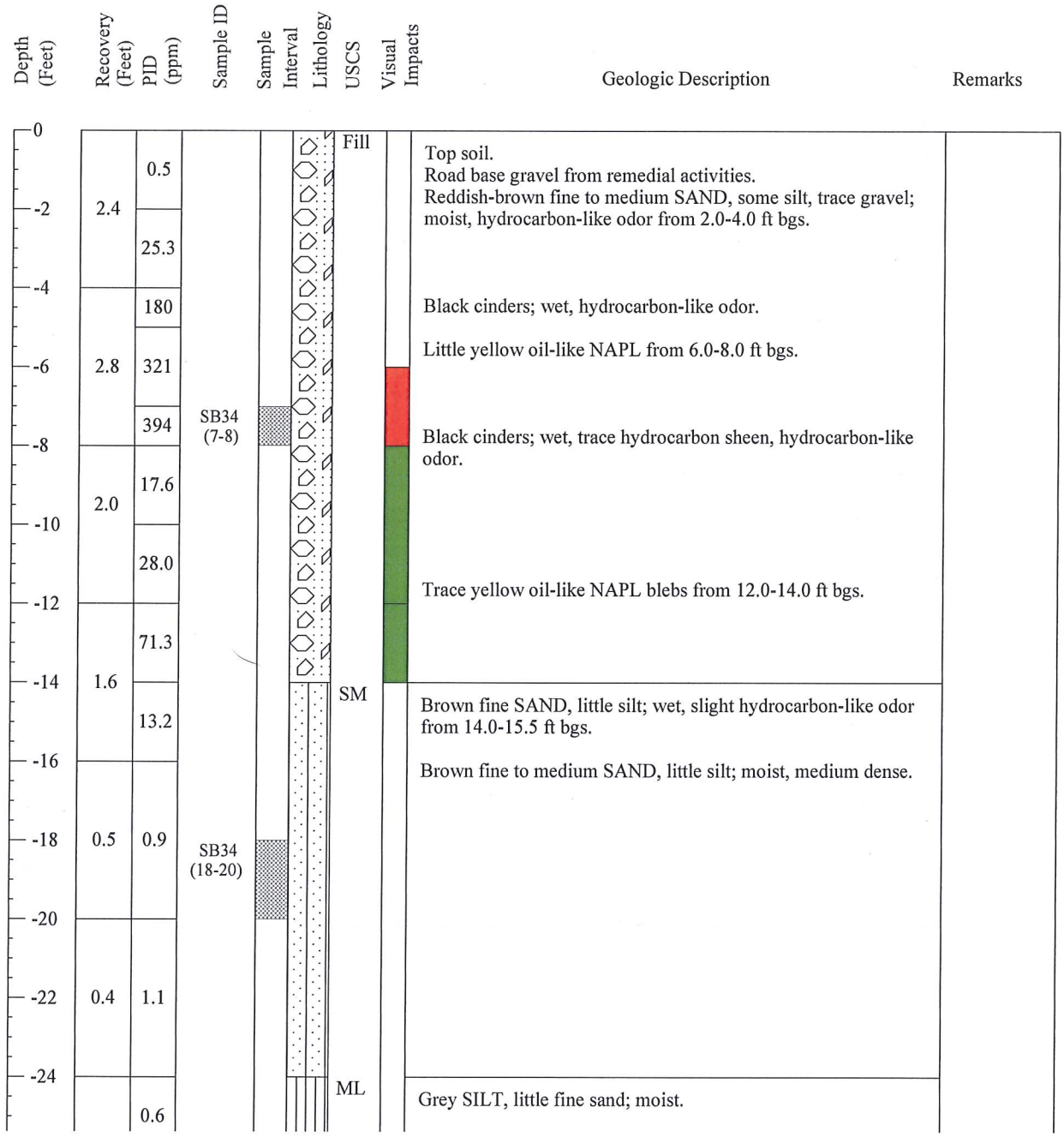
Boring ID: SB34

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 2, 2008
Boring Location: Shoreline area of the northern part of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 7.17
Total Depth: 32.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB34(7-8) and SB34(18-20) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample SB34WC(2-16) was analyzed by a suite of analyses for waste characterization.

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Boring ID: SB34

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 2, 2008
Boring Location: Shoreline area of the northern part of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 7.17
Total Depth: 32.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
-26	2.1	0.7				ML		Grey SILT, little fine sand; moist.	
-28		0.6							
-30	2.5	0.6						Boring terminated at 32.0 ft bgs.	
-32									

Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB34(7-8) and SB34(18-20) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample SB34WC(2-16) was analyzed by a suite of analyses for waste characterization.

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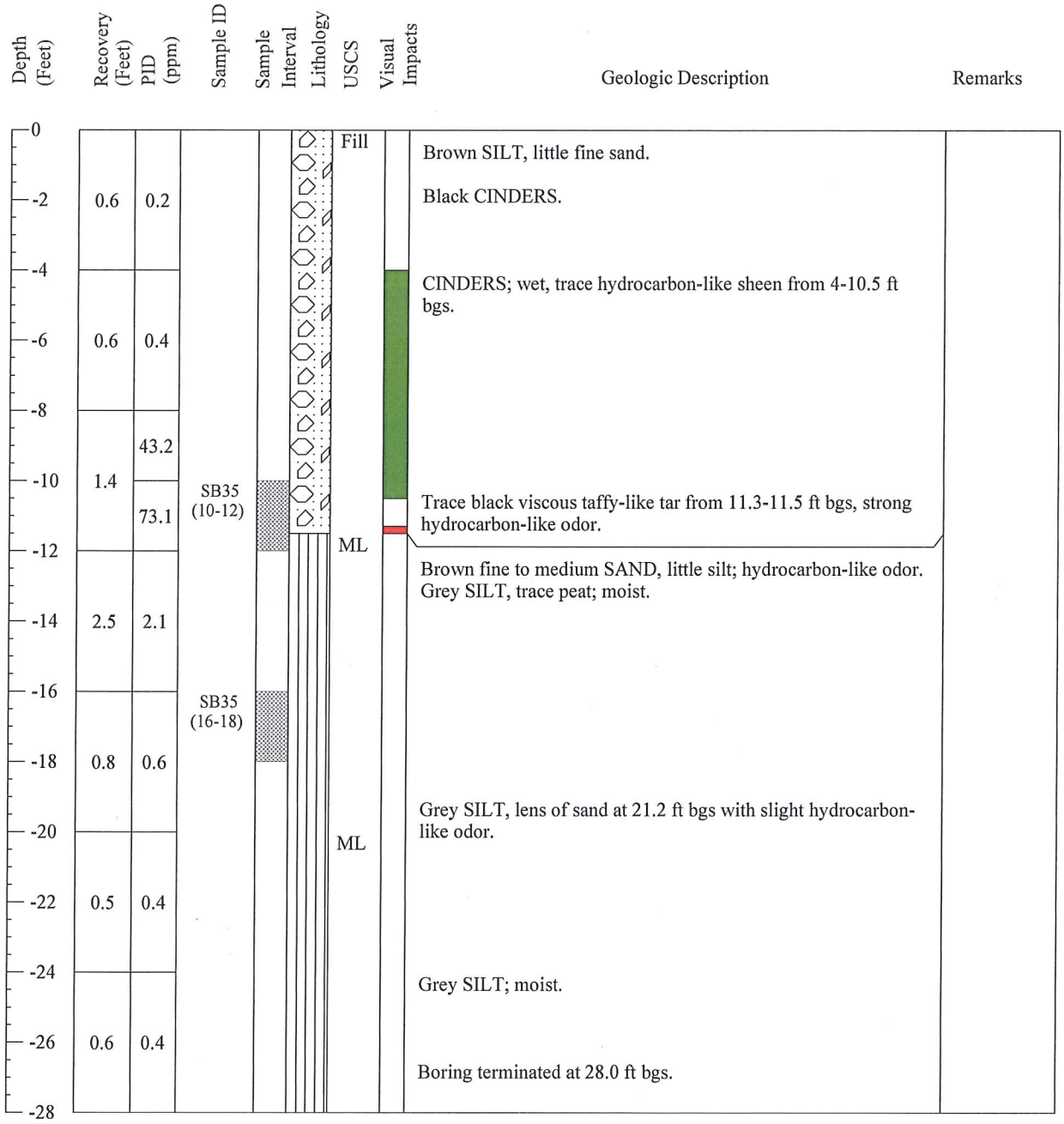
Boring ID: SB35

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Intertidal zone of jetty area
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 3.09
Total Depth: 28.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB35(10-12) and SB35(16-18) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample SB35WC(0-12) was analyzed by a suite of analyses for waste characterization.

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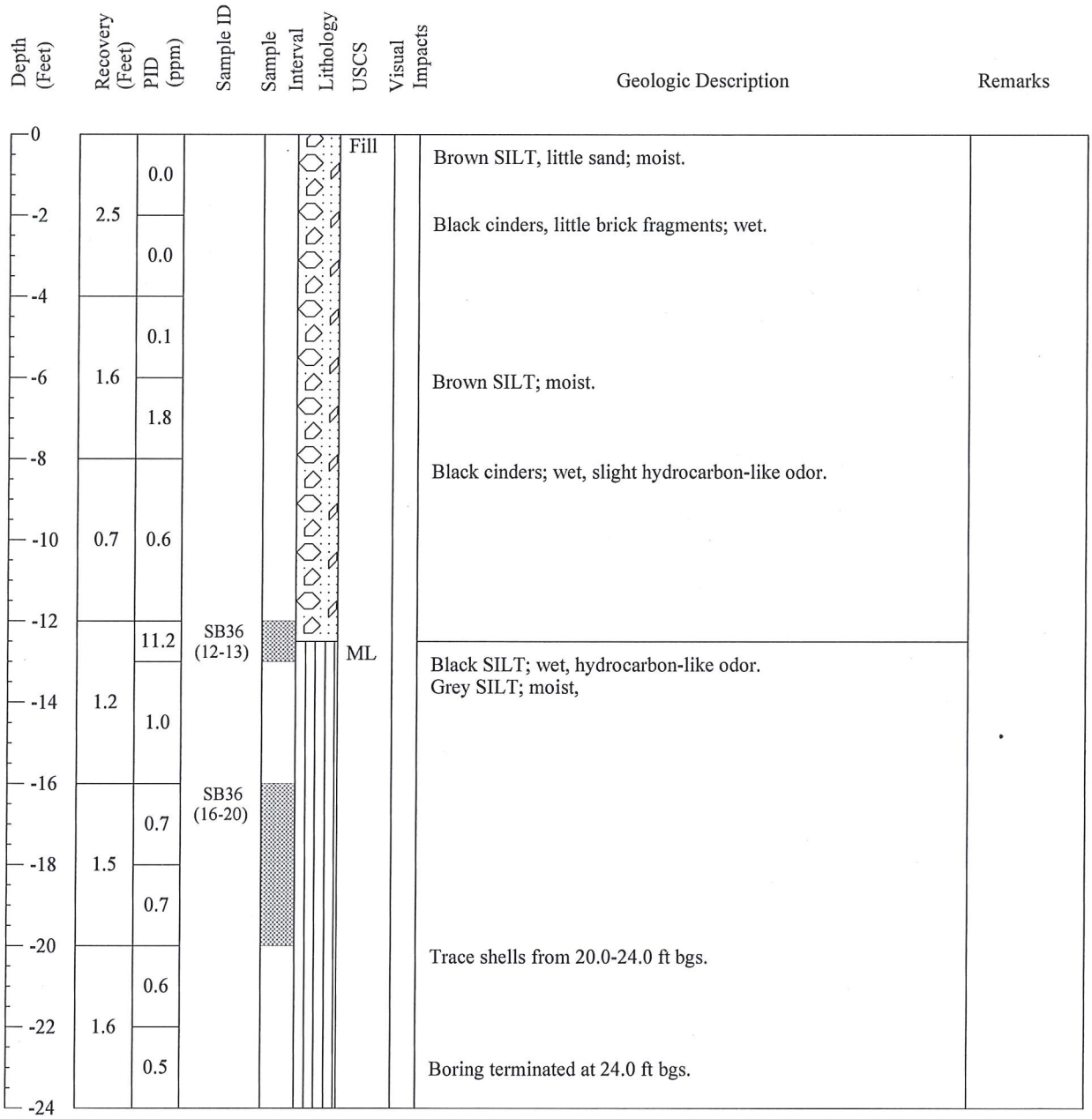
Boring ID: SB36

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Intertidal zone of jetty area
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 2.89
Total Depth: 24.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB36(12-13) and SB36(16-20) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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Boring ID: SB37

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 29, 2008
Boring Location: Intertidal zone of jetty area
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Hollow stem auger
Sampling Method: Split-spoon
Ground Elevation (ft/msl): 2.42
Total Depth: 22.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Blow Counts	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
0	1 2 4 3	1.0	0.3				Fill		Brown fine to medium SAND, some gravel, little silt; moist.	
-2	2 2 1 1	0.8	0.3						Becomes wet at 4 ft bgs, black hydrocarbon-like staining from 3.5-4.0 ft bgs.	
-4	1 1 2 1	1.0	0.2						Brown fine SILT, some fine sand, little coal fragments; wet.	
-6	1 1 1 1	0.8	10.2	SB37 (6-8)					Wood fragments from 5.7-6.0 ft bgs. Brown fine SILT, some fine sand, little coal fragments; wet.	
-8	1 2 1 1	0.4	3.5				ML		Wood fragments from 7.8-8.0 ft bgs. Grey SILT; wet.	
-10	17 2 3 2	0.5	1.2				SM		Grey medium SAND, trace silt; wet.	
-12	3 3 1 1	1.9	0.9	SB37 (12-14)			ML		Black SILT, some medium sand; wet.	
-14	NA	0.2	1.3						Grey SILT; wet. Shelby tube samples were attempted at 14-16.5 and 18-20.5 ft bgs.	
-16	1 WOH 1 WOH	0.8	2.2						Grey SILT; wet.	
-18	NA	2.0	0.8							
-20	WOH WOH WOH WOH	2.0	0.9						Boring terminated at 22.0 ft bgs.	
-22										

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB36(6-8) and SB36(12-14) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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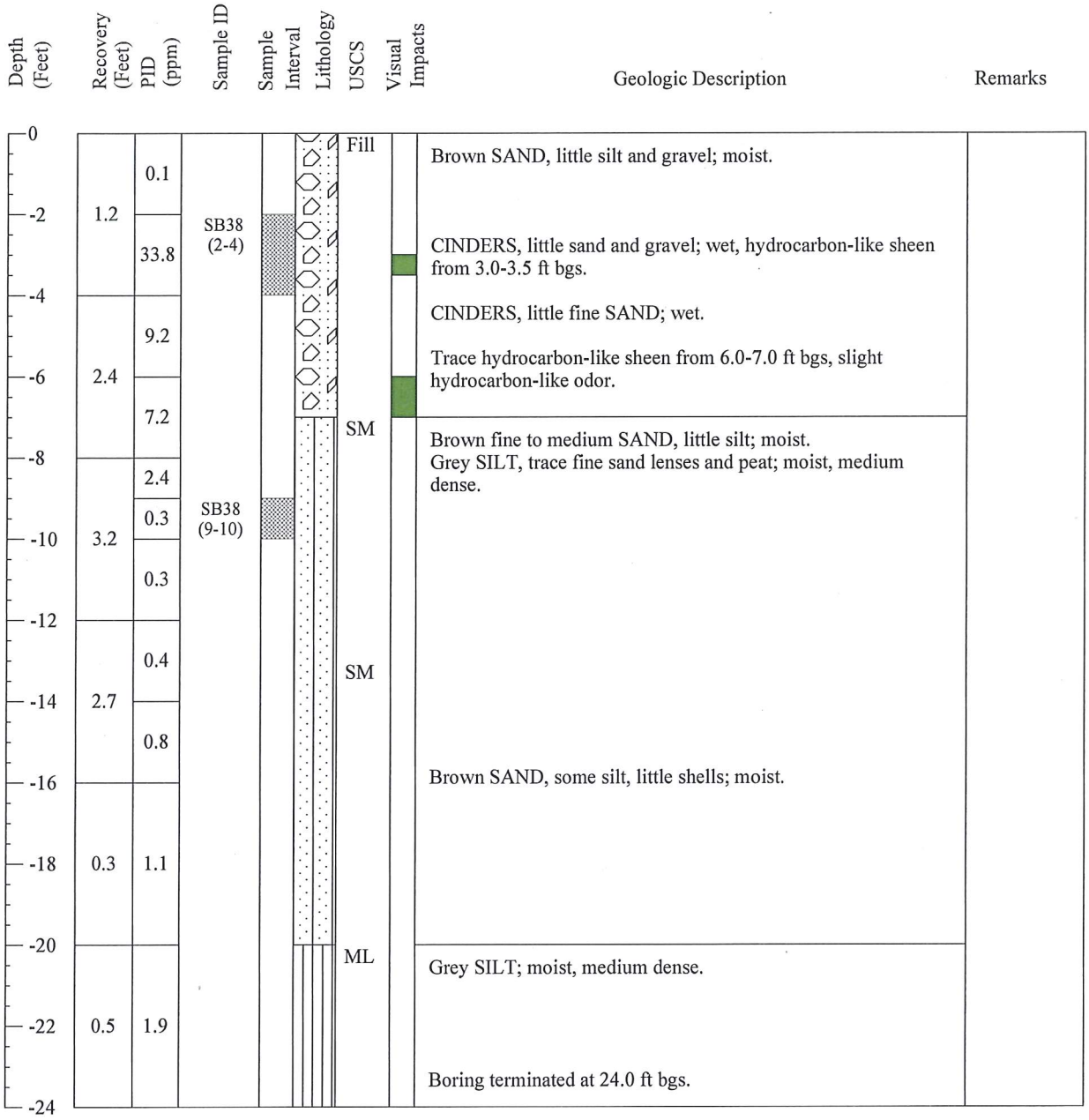
Boring ID: SB38

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 4, 2008
Boring Location: Intertidal zone of jetty area
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 2.28
Total Depth: 24.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB38(2-4) and SB38(9-10) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample SB38WC(0-10) was analyzed by a suite of analyses for waste characterization.

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Boring ID: SB39

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 28, 2008
Boring Location: Shoreline area of jetty
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Hollow stem auger
Sampling Method: Split-spoon
Ground Elevation (ft/msl): 5.90
Total Depth: 24.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Blow Counts	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
0							Fill		Brown fine to medium SAND, some gravel, trace coal fragments; moist.	
-2	NA	1.1	3.4							
-4	5 6 15 19	2.0	28.9						Brown fine to medium SAND, some silt, little coal fragments; dry.	
-6	11 12 17 19	2.0	25.6							
-8	7 8 11 11	1.8	26.3 16.0						Trace wood fragments from 8.0-9.5 ft bgs. Brown fine to medium SAND and brick fragments, little wood fragments. Brown fine SAND, some silt and wood fragments, trace coal fragments; wet, strong hydrocarbon-like odor.	
-10	7 11 6 6	1.9	10.4 188	SB39 (11-12)					Some black viscous NAPL from 11.3-11.5 ft bgs.	
-12	2 2 3 3	1.6	2.7				SM		Brown fine SAND, some silt; wet. Grey fine SAND and SILT; wet.	
-14	3 5 6 3	1.4	0.6	SB39 (14-16)						
-16	3 5 6 5	1.6	1.9							
-18	3 5 6 5	2.0	0.4						Brown fine SAND, little silt; wet. Trace shells from 20.0-22.0 ft bgs.	
-20	2 2 2 2	1.7	0.3							
-22	WOH	2.0	0.5						Grey fine SAND and SILT; wet.	
-24									Boring terminated at 24.0 ft bgs.	

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB39(11-12) and SB39(14-16) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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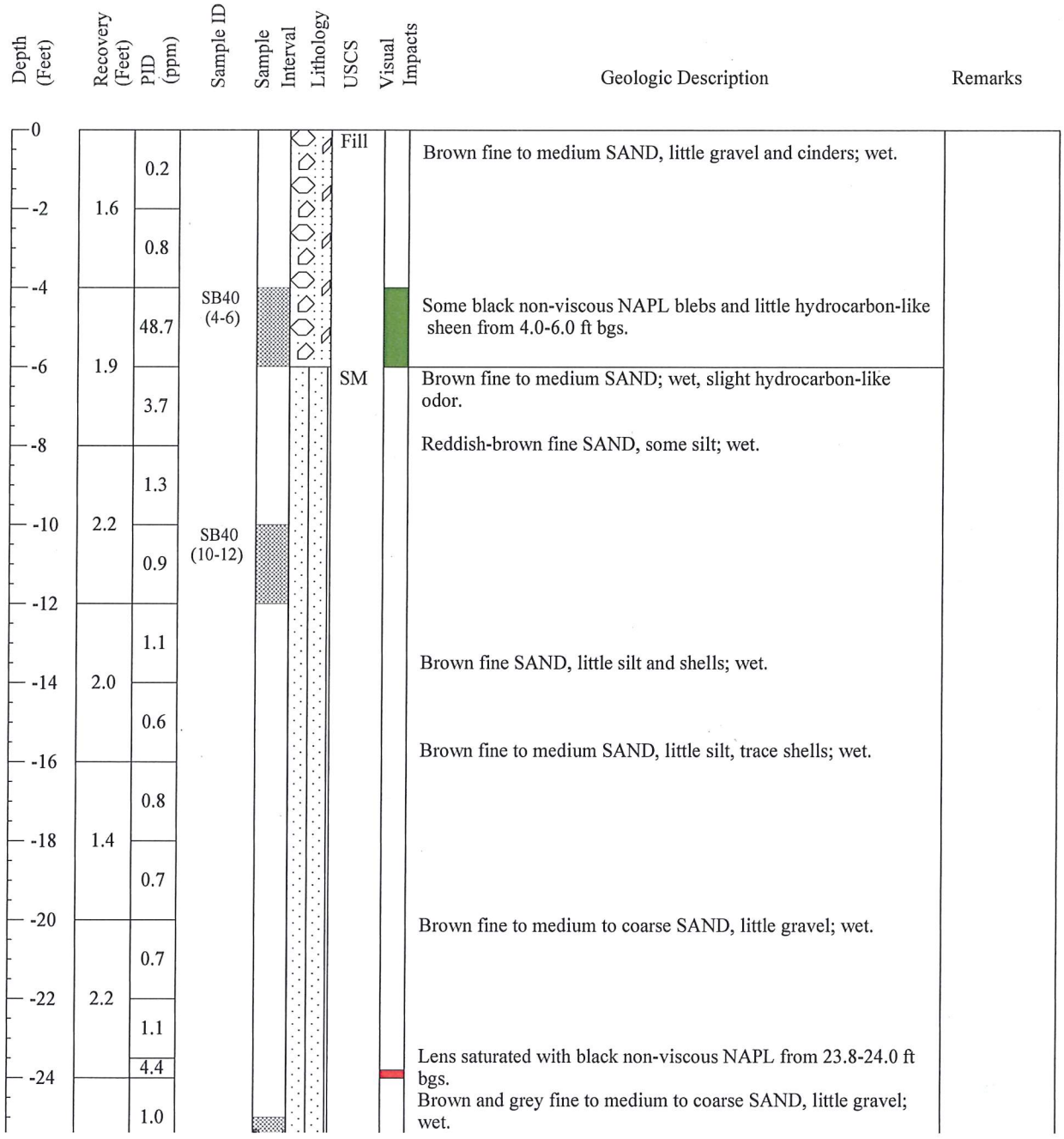
Boring ID: SB40

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 29, 2008
Boring Location: Intertidal zone south of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 1.31
Total Depth: 29.2 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB40(4-6), SB40(10-12), and SB40(25-27) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample SB40WC(2-14) was analyzed by a suite of analyses for waste characterization.

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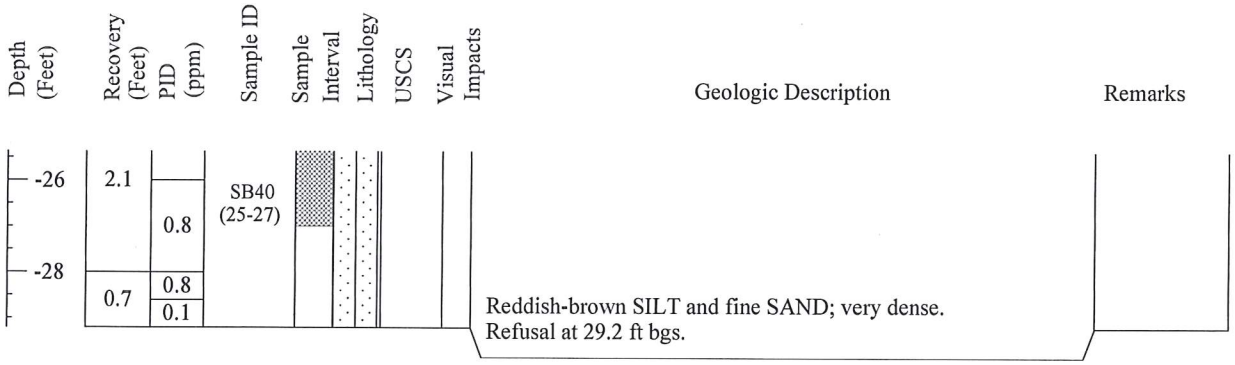
Boring ID: SB40

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 29, 2008
Boring Location: Intertidal zone south of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 1.31
Total Depth: 29.2 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB40(4-6), SB40(10-12), and SB40(25-27) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample SB40WC(2-14) was analyzed by a suite of analyses for waste characterization.

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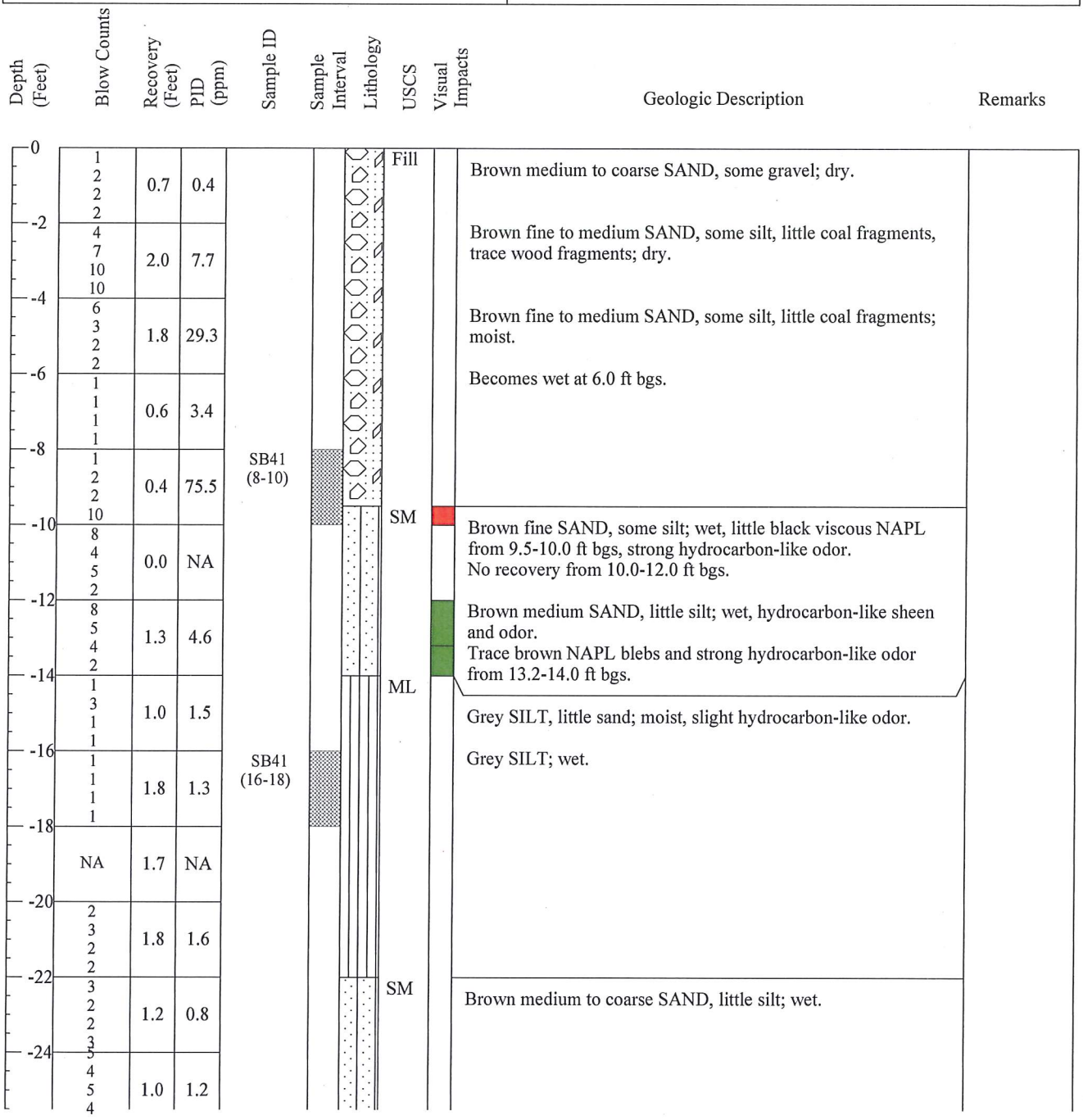
Boring ID: SB41

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 29, 2008
Boring Location: Shoreline Area
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Hollow stem auger
Sampling Method: Split-spoon
Ground Elevation (ft/msl): 6.13
Total Depth: 28.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB41(8-10) and SB41(16-18) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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Boring ID: SB41

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 29, 2008
Boring Location: Shoreline Area
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Hollow stem auger
Sampling Method: Split-spoon
Ground Elevation (ft/msl): 6.13
Total Depth: 28.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Blow Counts	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
-26	5 18 25 50/.1	2.1	1.8				SM		Brown medium to coarse SAND, little silt; wet. Refusal at 28.0 ft bgs.	
-28										

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB41(8-10) and SB41(16-18) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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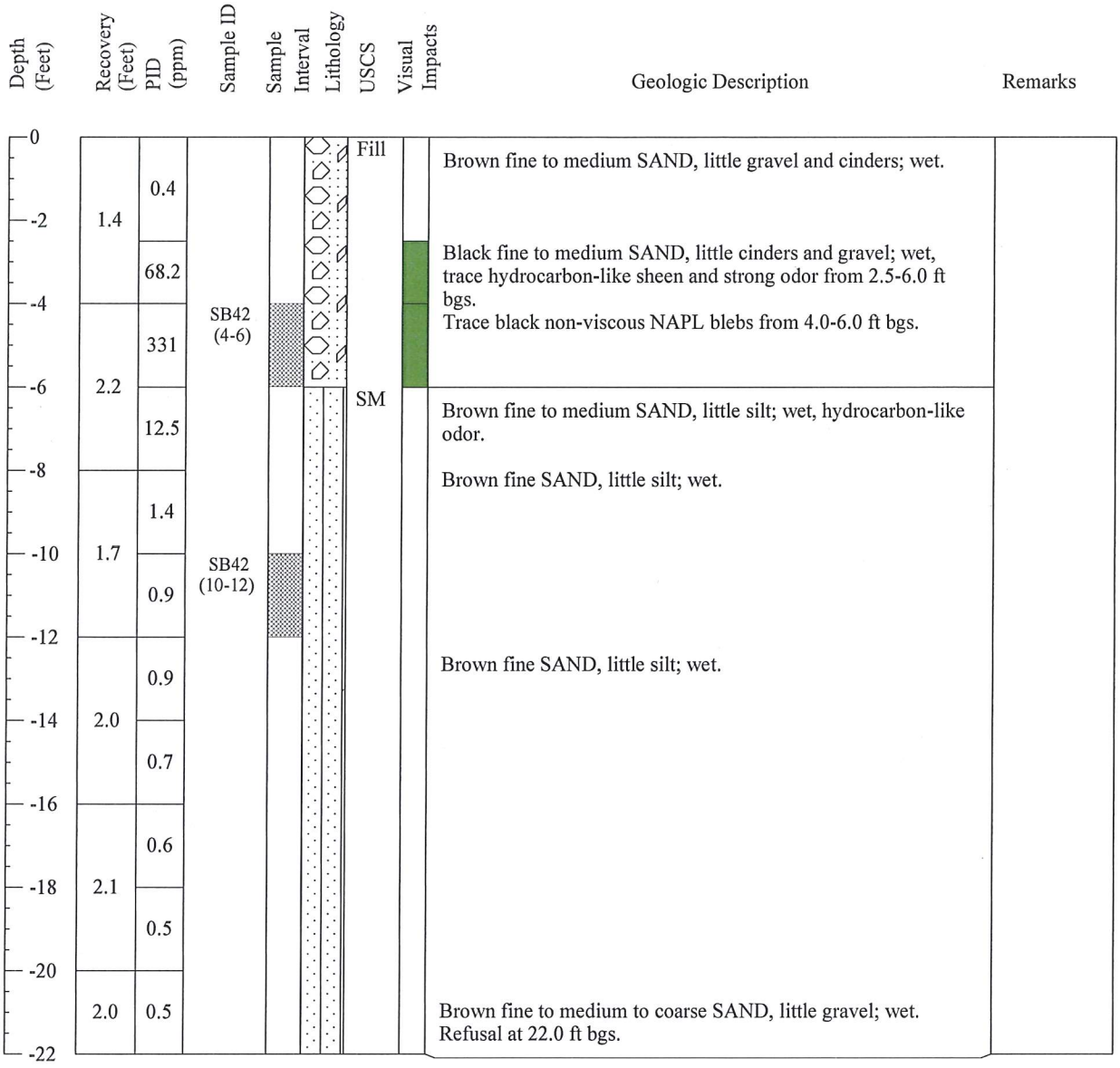
Boring ID: SB42

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 27, 2008
Boring Location: Intertidal zone south of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 1.82
Total Depth: 22.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB42(4-6) and SB42(10-12) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample SB42WC(2.5-10) was analyzed by a suite of analyses for waste characterization.

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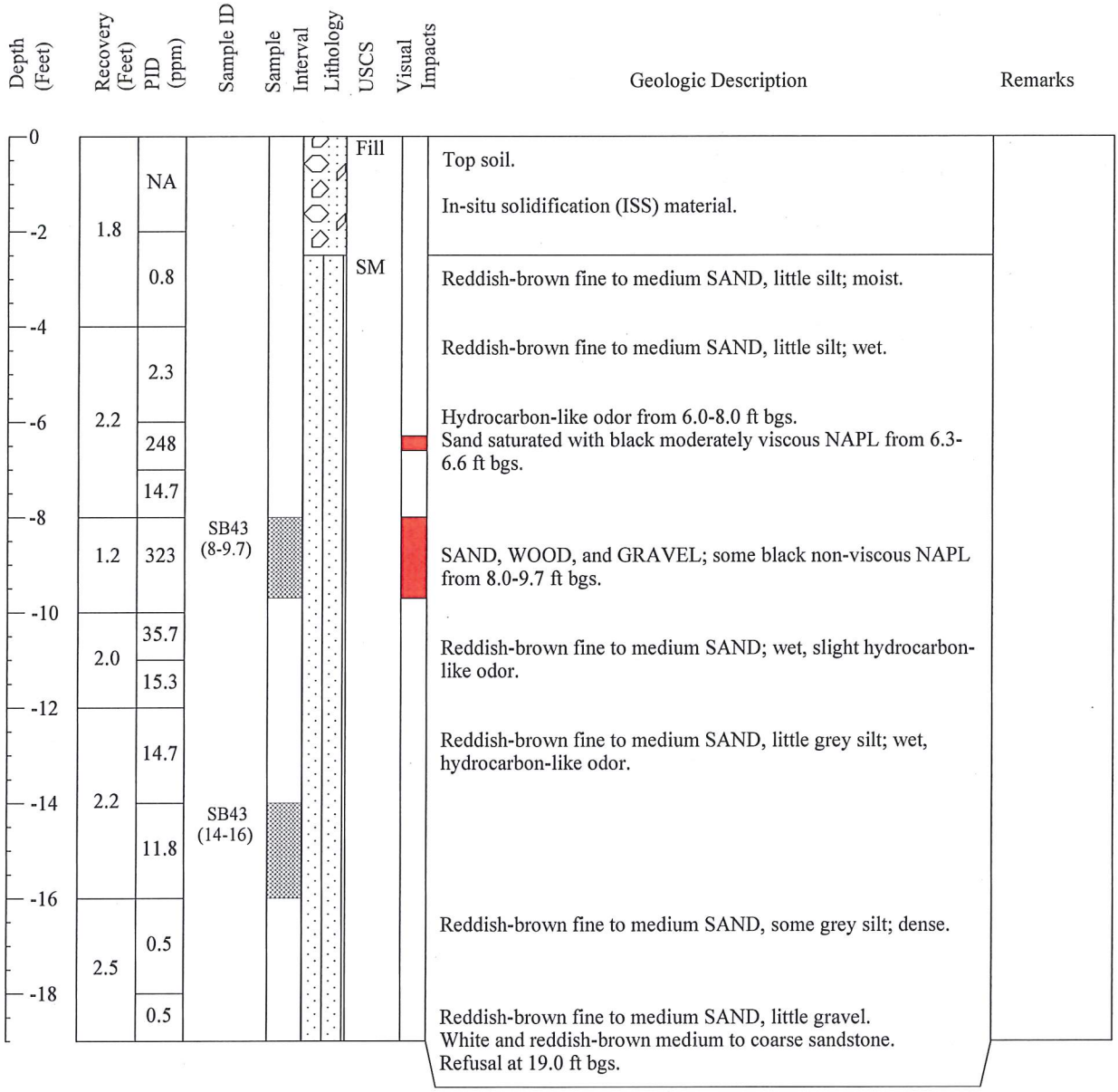
Boring ID: SB43

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 30, 2008
Boring Location: Shoreline Area
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 7.02
Total Depth: 19.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB43(8-9.7) and SB43(14-16) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample SB43WC(4-16) was analyzed by a suite of analyses for waste characterization.

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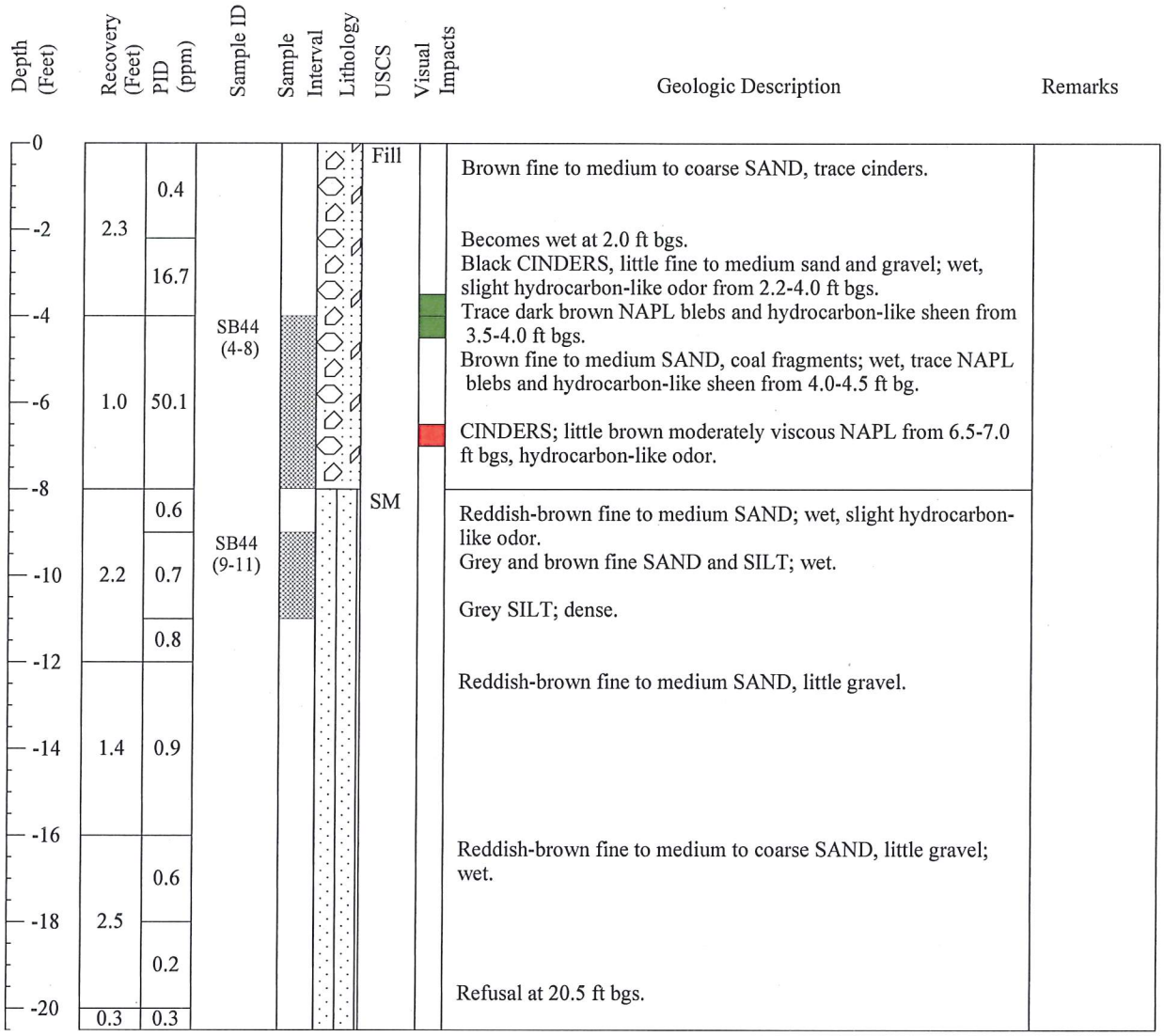
Boring ID: SB44

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 29, 2008
Boring Location: Intertidal zone south the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 1.07
Total Depth: 20.5 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB44(4-8) and SB44(9-11) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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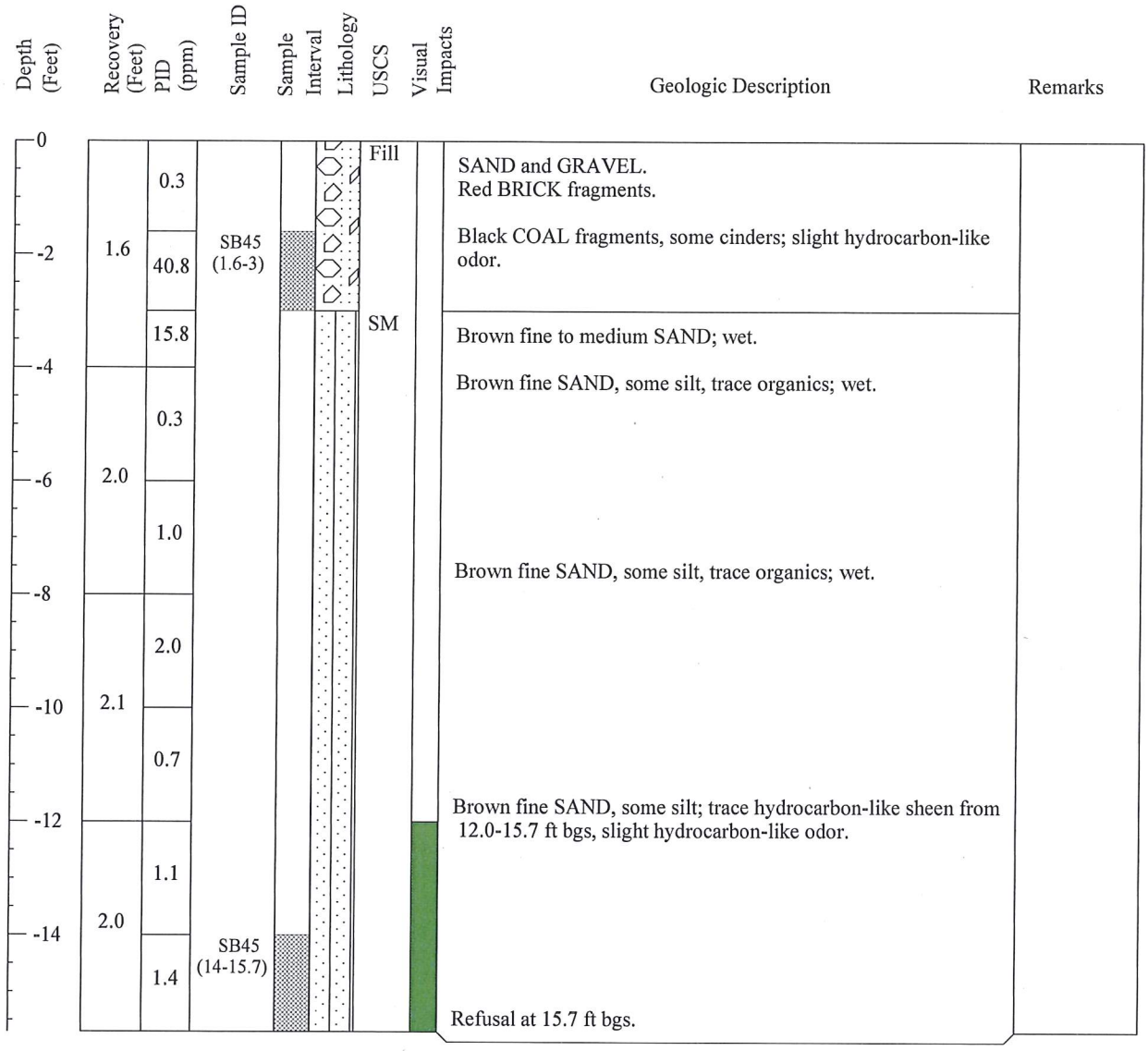
Boring ID: SB45

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 27, 2008
Boring Location: Intertidal zone south the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 0.08
Total Depth: 15.7 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB45(1.6-3) and SB45(14-15.7) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample SB45WC(1-15.7) was analyzed by a suite of analyses for waste characterization.

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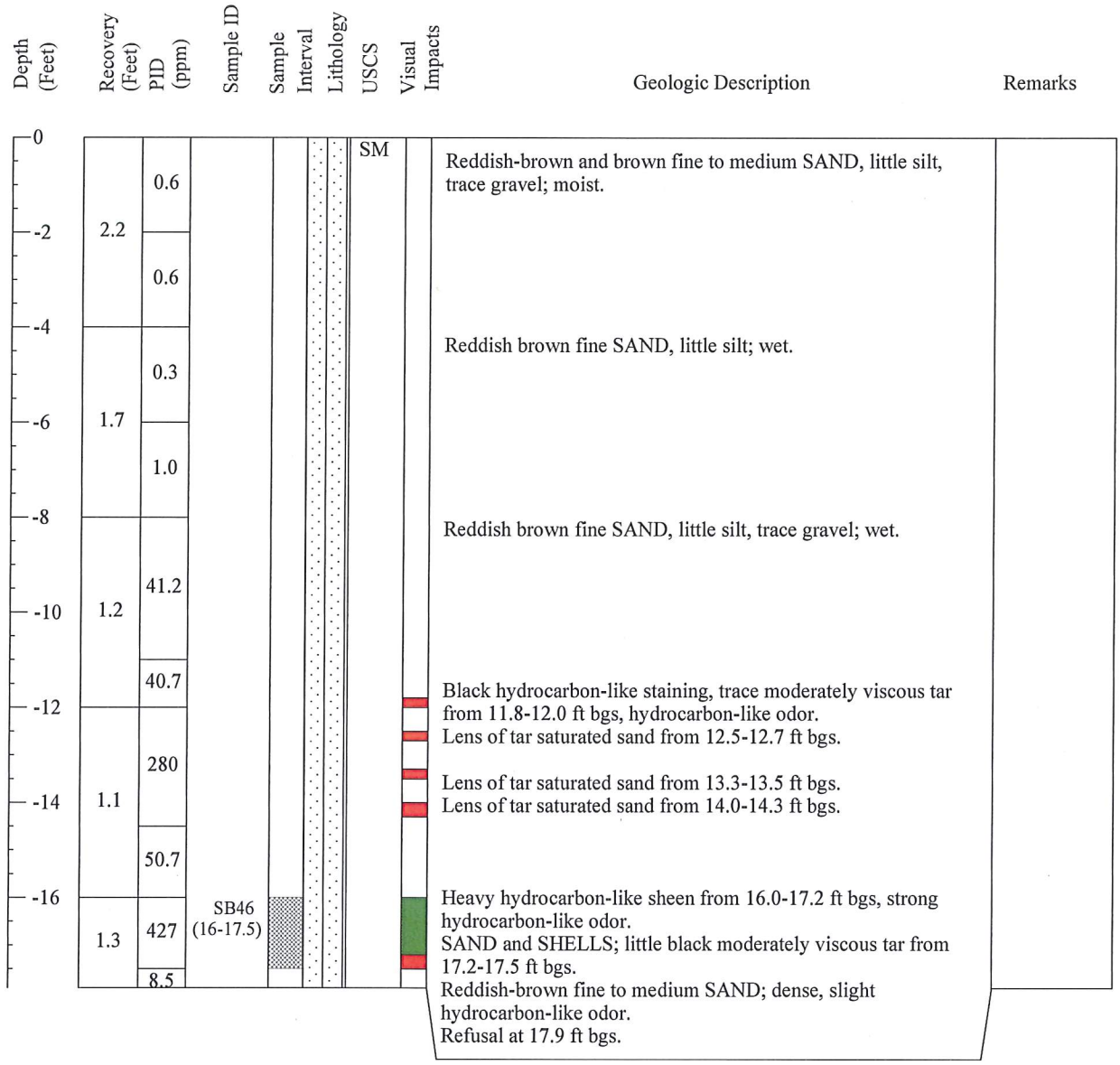
Boring ID: SB46

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 30, 2008
Boring Location: Shoreline Area
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 8.21
Total Depth: 17.9 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB46(16-17.5) was analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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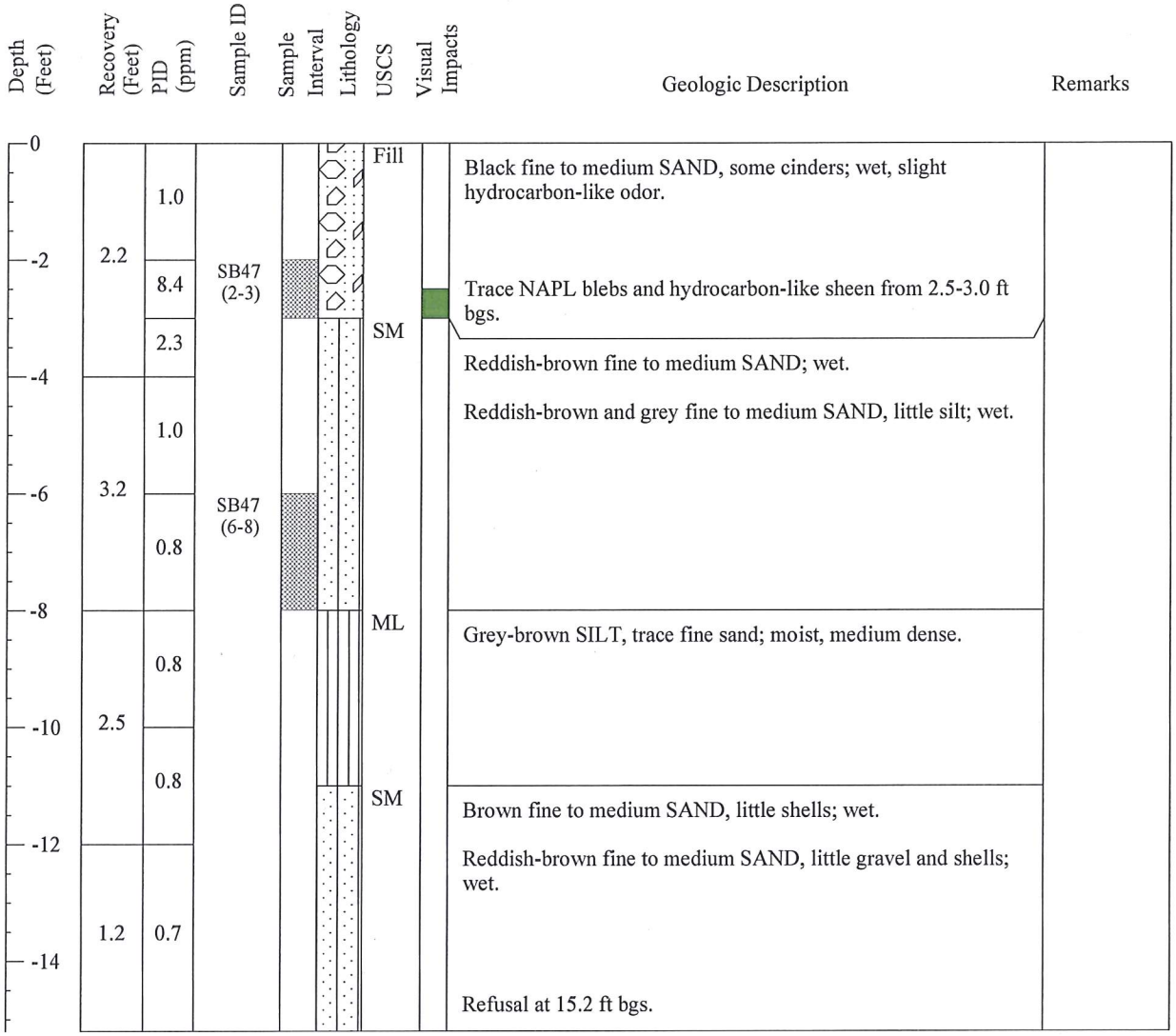
1001 West Seneca Street, Suite 204
Ithaca, New York, 14850

Boring ID: SB47

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 29, 2008
Boring Location: Intertidal zone south of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): -0.43
Total Depth: 15.2 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB47(2-3) and SB47(6-8) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample SB47WC(0-6) was analyzed by a suite of analyses for waste characterization.

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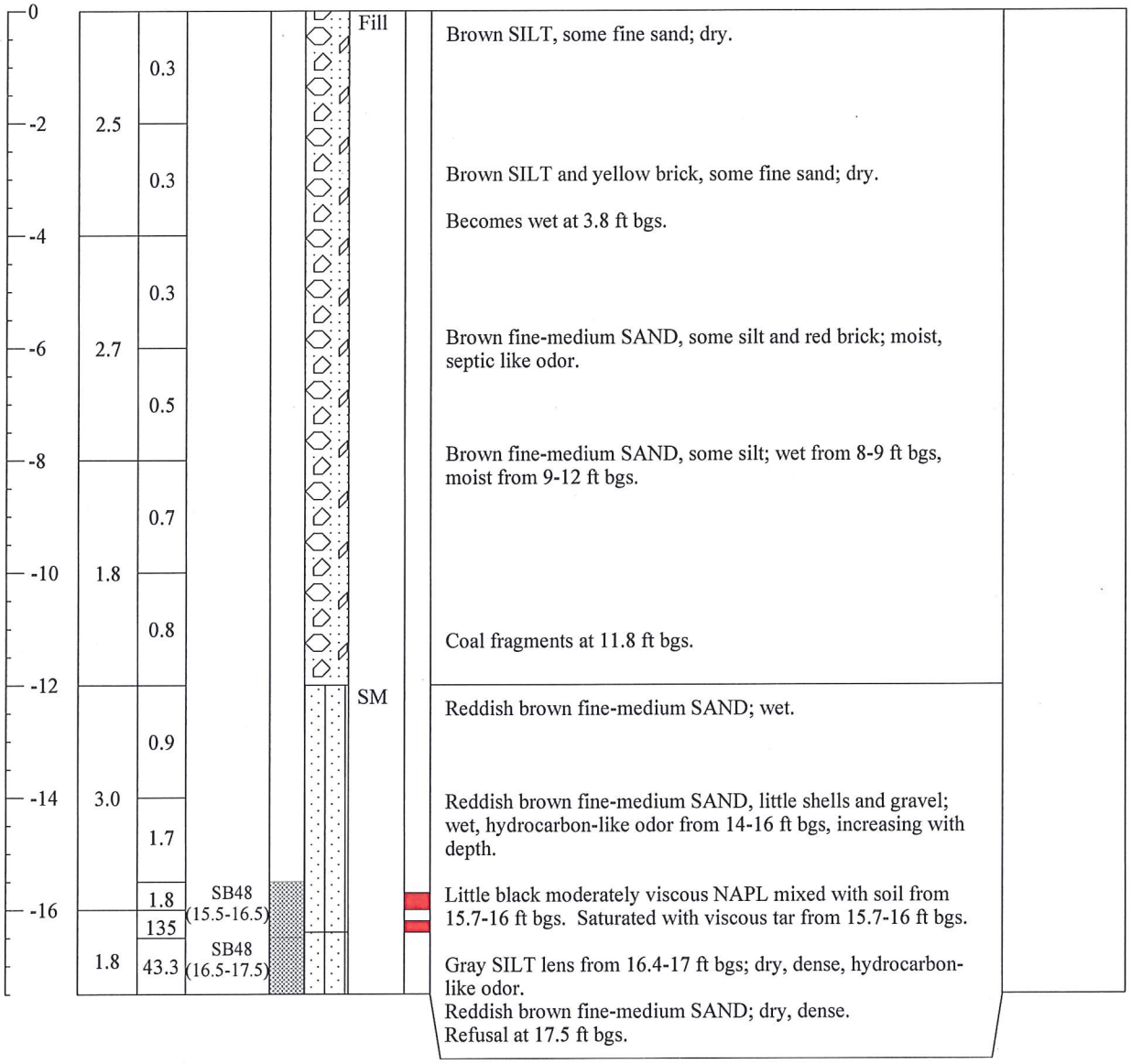
Ithaca, New York, 14850

Boring ID: SB48

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 30, 2008
Boring Location: Shoreline area
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 8.11
Total Depth: 17.5 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB48(15.5-16.5) and SB48(16.5-17.5) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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1001 West Seneca Street, Suite 204
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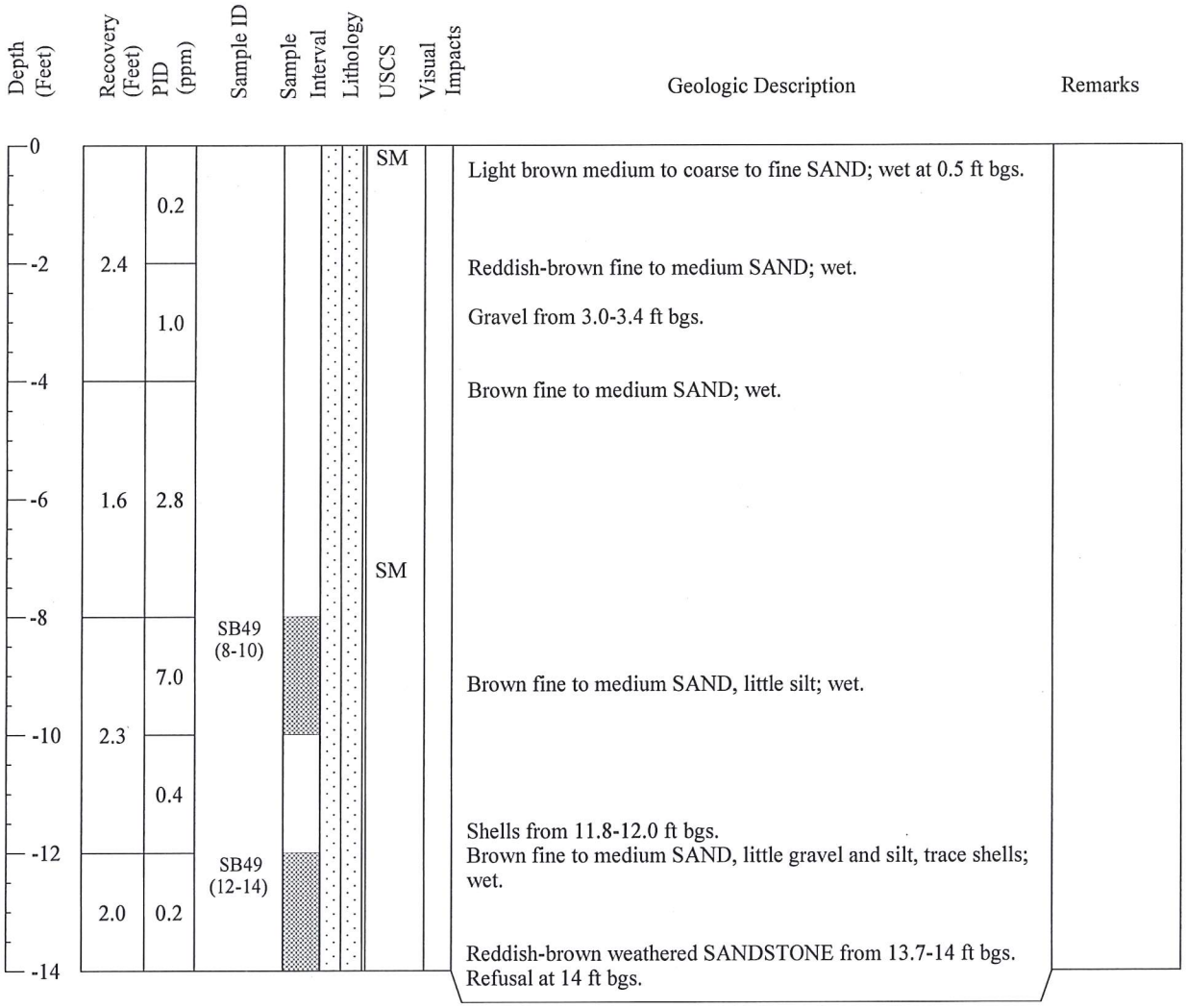
Boring ID: SB49

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Intertidal zone near Hudson Vista Property
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 0.81
Total Depth: 14.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB49(8-10) and SB49(12-14) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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Boring ID: SB50

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Shoreline area near Hudson Vista property
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 8.19
Total Depth: 11.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
0						Fill		Top soil.	
-2	3.2	NA				ISS		There was not enough space between the In-situ solidified (ISS) material and the rip-rap along the shoreline to advance a boring in the undisturbed overburden. The boring was advanced through the ISS material to observe the elevation of bedrock and to verify there was no free NAPL on top of the bedrock.	
-4									
-6	3.8	NA				ISS			
-8									
-10	2.7	NA						Refusal at 11.0 ft bgs.	

Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: No analytical samples were collected at this location.

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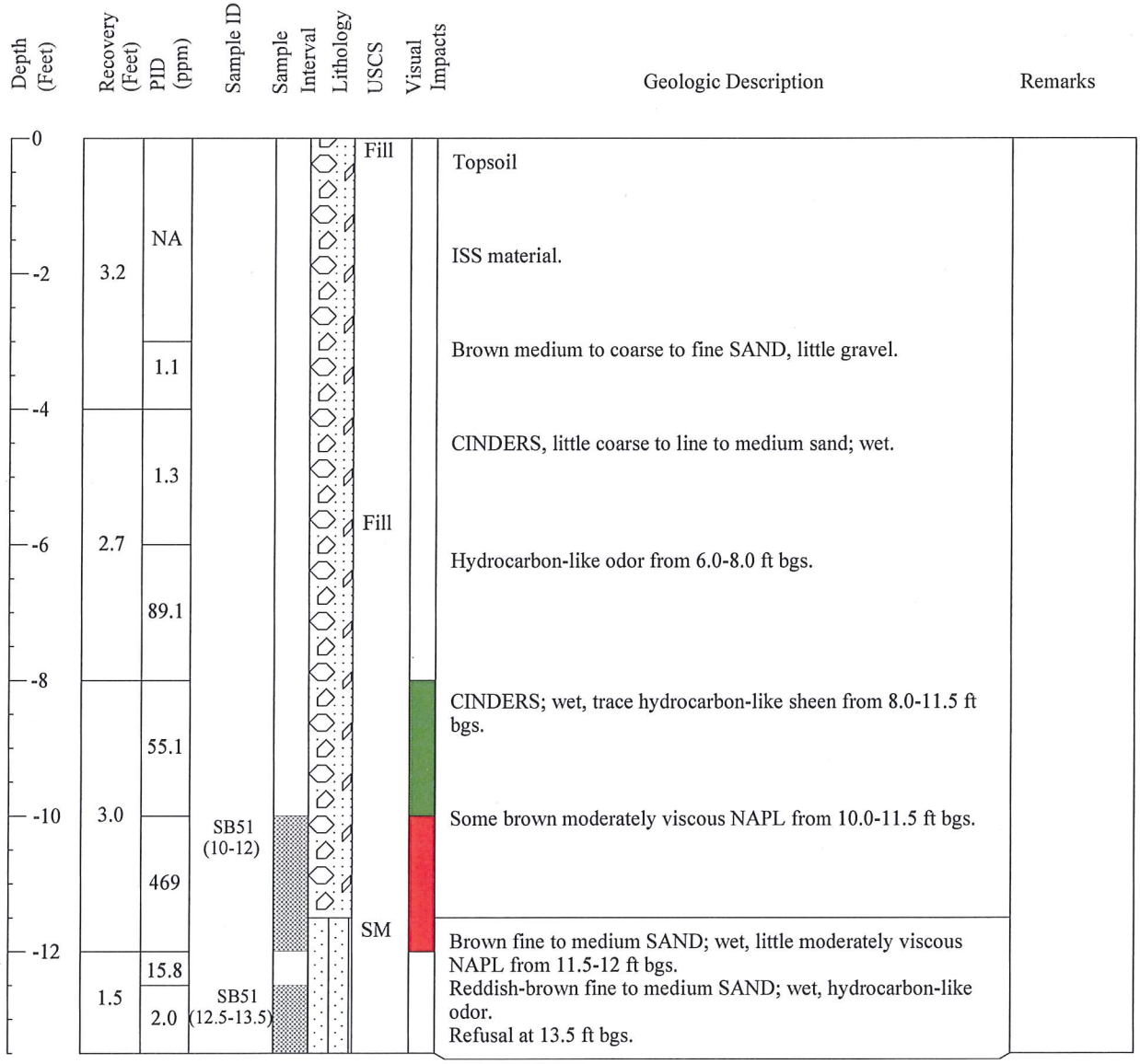
Boring ID: SB51

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Shoreline area near Boat Club Property line
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 7.25
Total Depth: 13.5 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB51(10-12) and SB51(12.5-13.5) were analyzed for VOCs, SVOCs, RCRA metals, total cyanide.

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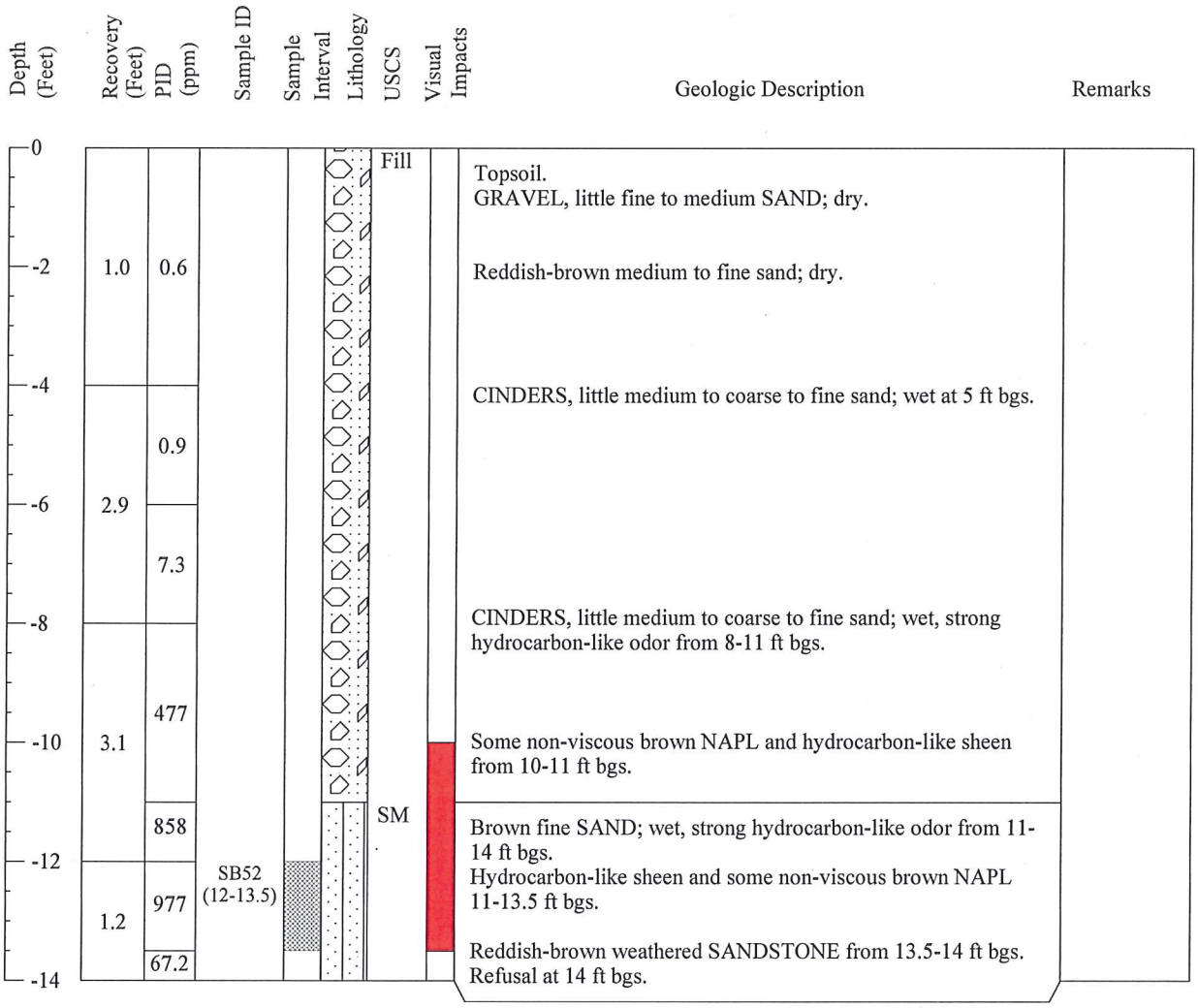
Boring ID: SB52

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Shoreline area near Boat Club Property line
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 7.63
Total Depth: 14.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB52(12-13.5) was analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample SB52WC(1-14) was analyzed by a suite of analyses for waste characterization.

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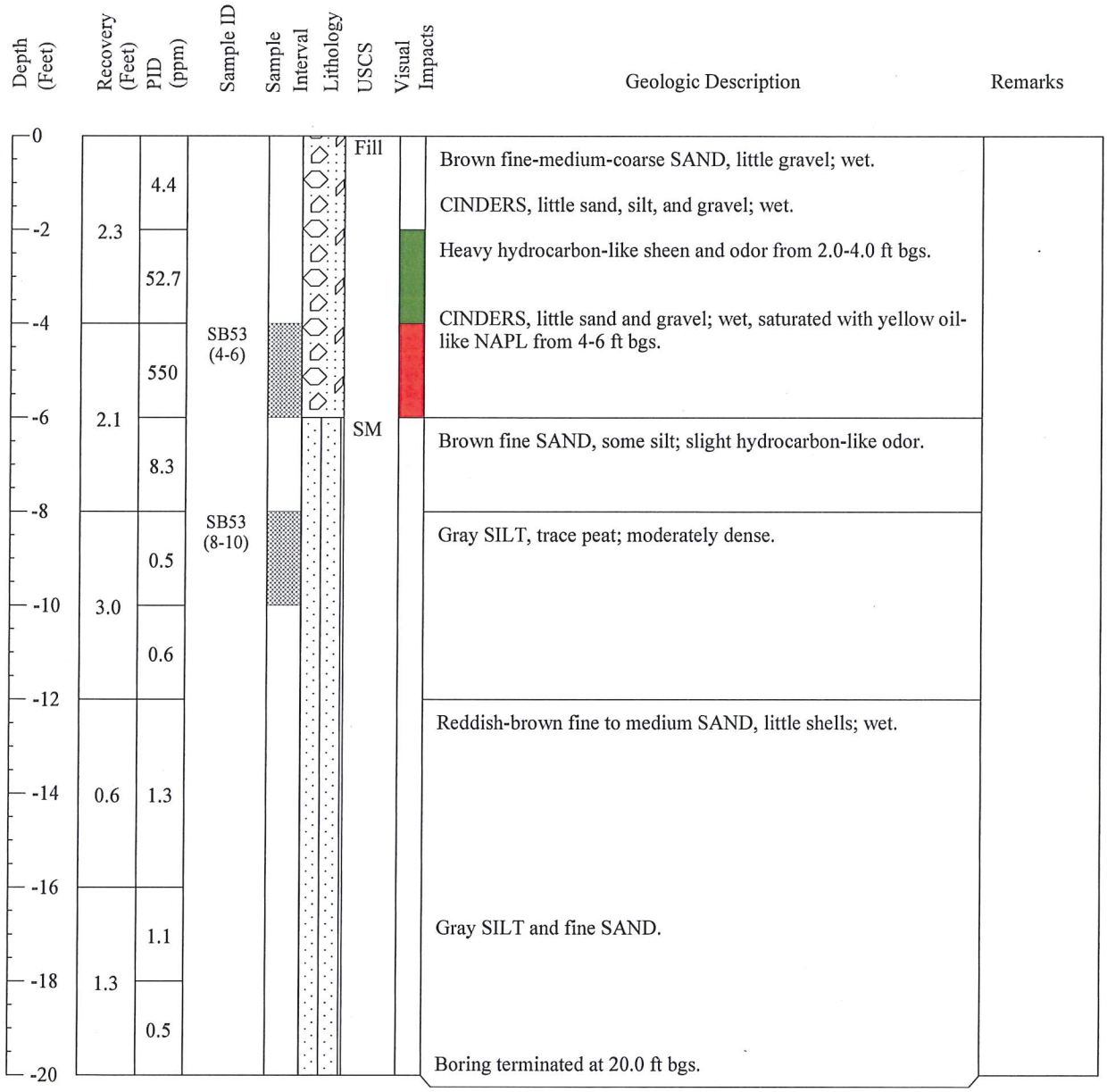
Boring ID: SB53

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 3, 2008
Boring Location: Intertidal zone south of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): -0.17
Total Depth: 20.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB53(4-6) and SB53(8-10) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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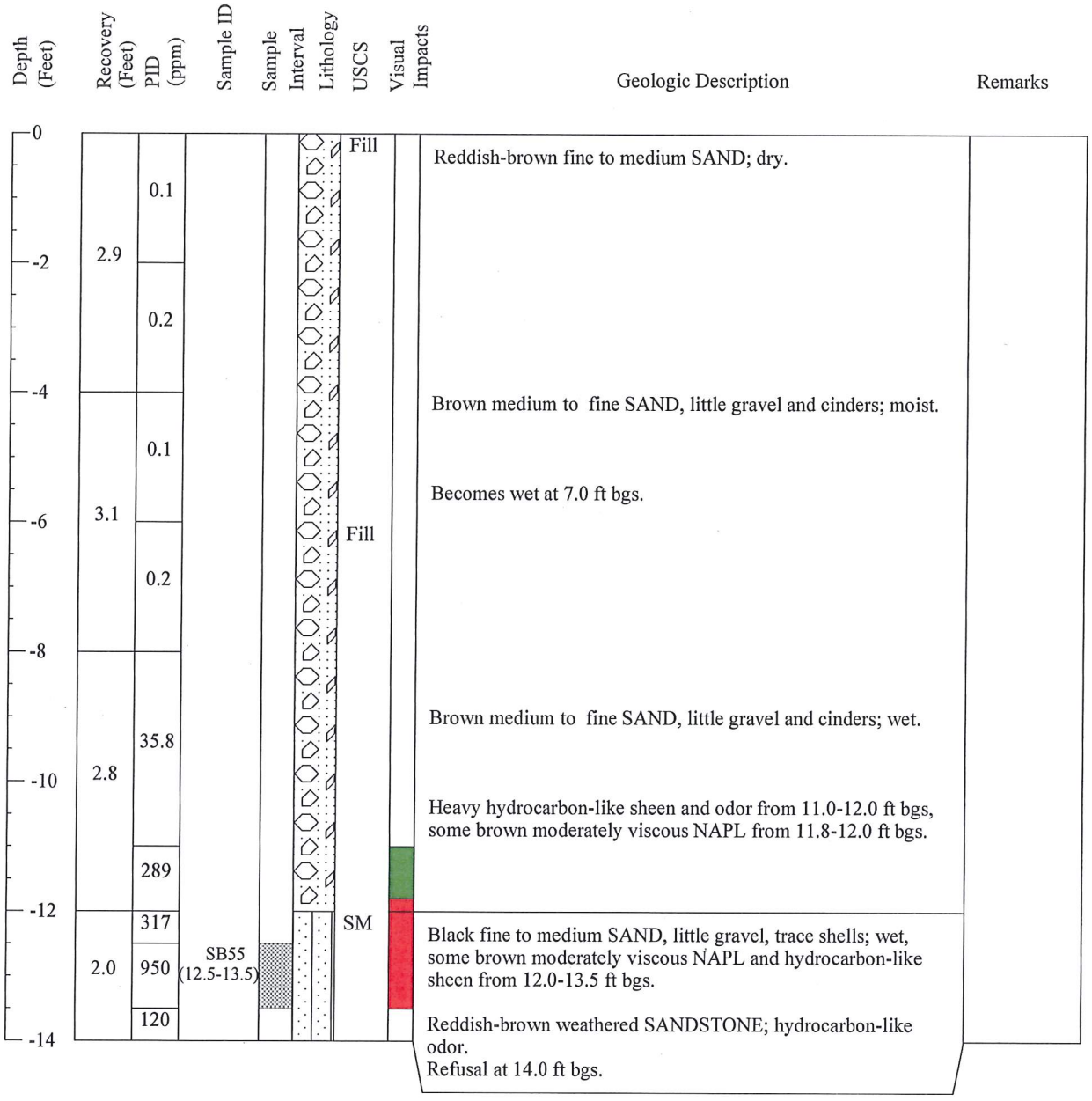
Boring ID: SB54

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 4, 2008
Boring Location: Shoreline area near Boat Club Property line
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 8.87
Total Depth: 14.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB54(12.5-13.5) was analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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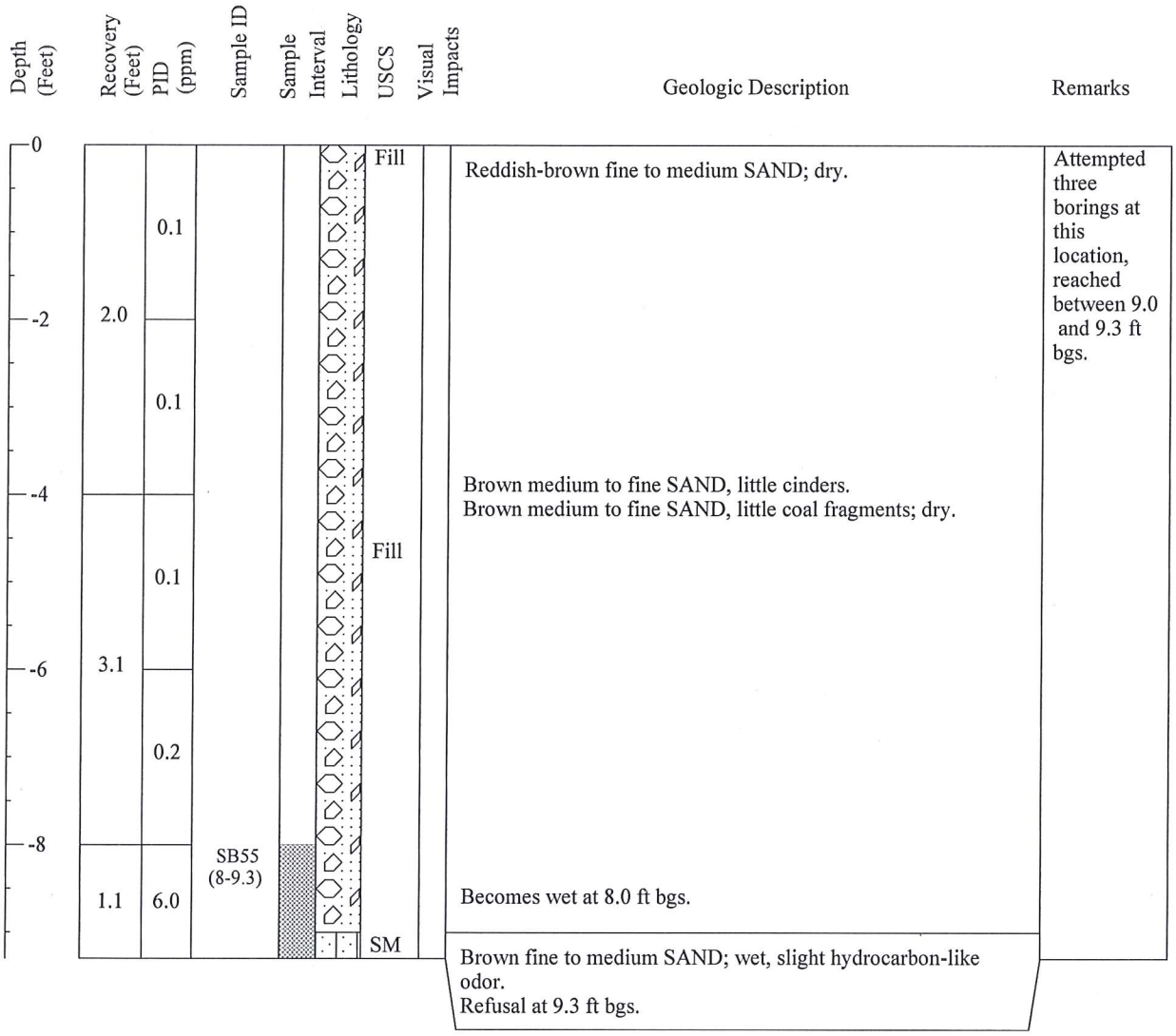
Boring ID: SB55

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 4, 2008
Boring Location: Near Boat Club Property line
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 9.10
Total Depth: 9.3 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB55(8-9.3) was analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

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Boring ID: SB56

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 4, 2008
Boring Location: Intertidal zone south of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): -0.07
Total Depth: 28.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
0	2.2	0.3	SB56 (2-4)			SM		Brown fine to medium SAND, some gravel; wet.	
-2		3.1						Black fine SAND; wet, slight hydrocarbon-like odor.	
-4	2.6	9.7						Hydrocarbon-like sheen at 3.3 ft bgs.	
		1.2						Brown fine to medium SAND, trace silt; wet, slight hydrocarbon-like odor and sheen at 5.0-5.3 ft bgs.	
-6		0.7							
-8	2.4	0.2	SB56 (8-12)			ML		Grey SILT, little sand; wet. Grey SILT; moist, dense.	
-10		0.6						Lens of fine sand from 10.7-10.9 ft bgs.	
-12	1.6	0.7							
-14		0.0				SM		Brown fine SAND, trace silt; moist.	
-16	0.8	0.4				ML		Grey SILT, trace fine sand; moist.	
-18									
-20	1.0	0.5						Grey SILT; moist.	
-22								Lens of fine sand from 23.0-23.3 ft bgs.	
-24	1.3	0.4						Grey SILT, little fine sand, trace shells; moist.	
-26									
-28								Boring terminated at 28.0 ft bgs.	

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB56(2-4) and SB56(8-12) were analyzed for VOCs, SVOCs, PCBs, RCRA metals, and total cyanide.

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Boring ID: SB57

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 4, 2008
Boring Location: Intertidal zone south of the jetty
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): -0.21
Total Depth: 14.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks
0									
-2	0.6	8.0				ML		Black SILT, some gravel, little fine sand; wet, hydrocarbon-like odor.	
-4		175	SB57 (4-5)			SM		Black fine SAND, little silt; wet, trace brown non-viscous NAPL from 4-5 ft bgs, strong hydrocarbon-like odor.	
-6	3.1	14.1						Brown fine SAND, little silt; moist, strong hydrocarbon-like odor.	
-8		5.0							
-10						ML		Brown fine SILT, little sand; moist, strong hydrocarbon-like odor.	
-12	0.7	22.1							
-14								Boring terminated at 14.0 ft bgs.	

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample SB57(4-5) was analyzed for VOCs, SVOCs, PCBs, RCRA metals, and total cyanide.

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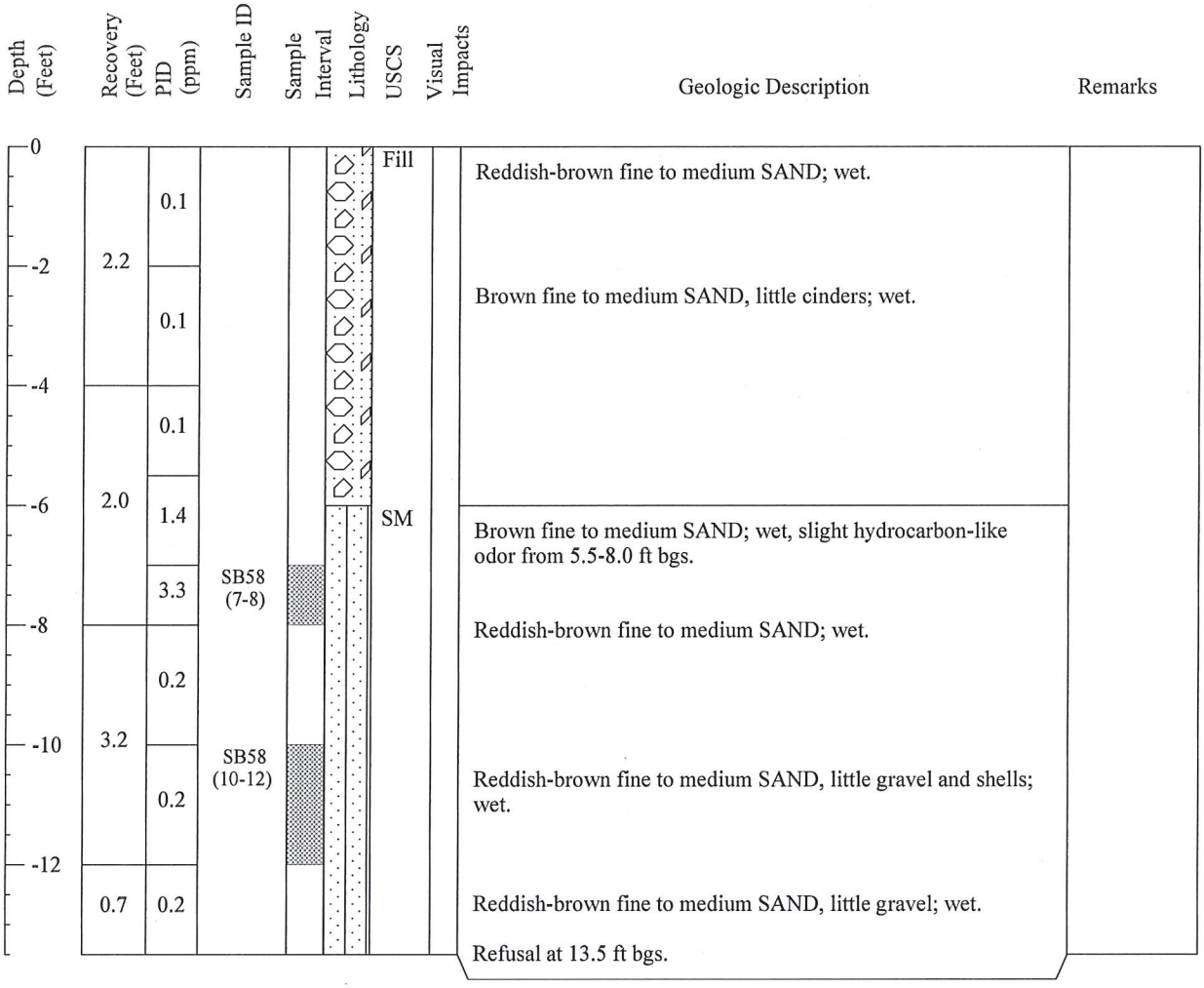
Boring ID: SB58

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: June 5, 2008
Boring Location: Intertidal zone near Boat Club Property
Drilling Company: Northstar Drilling, Ltd.

Drilling Method: Direct Push
Sampling Method: Macro-core
Ground Elevation (ft/msl): 3.30
Total Depth: 13.5 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples SB58(7-8) and SB58(10-12) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.

ThermoRetec
1001 West Seneca Street, Suite 204
Ithaca, New York 14850-3342

Well ID: MW10S

Project Name: Nyack MGP Site
Location: Onsite
Project Number: ORAN2-04301
Date Completed: 5-21-01
Drilling Company: Advanced
Drilling Method: Hollow Stem Auger
Sampling Method: Continuous Split Spoon

Boring Location: Onsite
Ground Elevation (ft/MSL): 9.36
PVC Elevation (ft/msl): 11.36
Total Depth (ft): 16.3
Auger/Casing ID (in): 4 1/4 ID
Water Level During Drilling (ft/bgs): 9.8
Logged By: Chris Doroski

Depth (Feet)	Recovery (feet)	Laboratory Sample ID	Blow Counts	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description	Well Construction	Well Dimension
2									Locking Protective Stickup
0							Silt with fine-medium sand and trace cobbles. Brown-red, damp, firm.		
-2	0.5		1-5-15-8	1.6	SM				Grouted Annulus
	1.0		7-6-9-8	1.8	SM				Bentonite Seal 2.0-3.0 ft.
-4							Fine gravel with fine-medium sand and trace silt. Black, saturated, firm.		
-6	1.0		10-12-12-13	2.2	GM				0.020 Slot 2" PVC Screen 5.0-15.0 ft.
-8	1.5		11-12-12-12	1.5			Seams of clinker-like material mixed with sand from 5-11.0 ft.		
-10	1.5		10-9-10-13	1.6	GM				# 1 Sand Pack 3.0-16.0 ft
-12	1.0		4-7-10-21	2.0					
-14	0.5	MW10S (12-14)	100/.4	14.3	GM		Hydrocarbon-like odor and sheen at 13.0 ft. Visible heavy sheen on drilling tools.		
-16	0.3		N/A		ROCK		Driller Reports bedrock at 15.0 ft.		1 ft DNAPL Sump 15.0-16.0
	N/A						Boring Complete at 16.0 ft.		Threaded End Plug
-18									
-20									

Remarks:
Laboratory Sample: MW10S (12-14)

ThermoRetec Corporation
1001 W. Seneca St., Suite 204
Ithaca, NY 14850-3342
(607) 277-5716 Phone
(607) 277-9057 Fax
www.thermoretec.com

WELL INSTALLATION LOG

ID: MW7D

Project Number: ORAN2-O4301	**Drilling Co.:** Maxim Technologies Inc.	**Surface Elevation: (MSL)** 8.37
Client: Orange and Rockland Utilities	**Driller:** Walt Ketter	**Water Level During Drilling:** 4.86
Site Location: Nyack MGP	**Casing ID:** 4" Steel Schedule 40	**Stickup:** 2.20
Start Date: 10/18/99	**Method:** HSA\HQ Rock Core	**MP Elevation: (MSL)** 10.50
Completion Date: 10/19/99	**Logged By:** James Edwards	**Total Depth:** 47
Location: Eastern Parcel - AST Area		

Depth (ft)	Sample Depth	Blow Counts\6"	Percent Recovery	PID (ppm)	Run Number	Rock Quality Designation	Lithology (symbol)	Description	Well Construction
1	0-2	1 2 4 3	50	4.4	NA	NA		**Fill** Fill: sand; brown; loose; trace roots; sandstone fragments; 0.1' lense of ash-like material; cinders; moist.	concrete surface seal
2									
3	2-4	13 9 7 9	80	2.0	NA	NA			
4								Sand; 10% granitic gravel.	
5	4-6	5 4 2 2	70	2.7	NA	NA		Fill; sand mixed with ash-like material; coal fragments; loose; moist.	
6									
7	6-8	1 1 2 3	90	11.3	NA	NA			
8								Fill; black sand; loose; 10% wood fragments; hydrocarbon-like odor.	
9	8-10	6 9 12 9	20	5.1	NA	NA			4" schedule 40 steel isolation casing
10									
11	10-12	26 53 33 19	60	11.1	NA	NA		Fill; wood fragments; trace sand; slight hydrocarbon-like odor.	
12									
13	12-14	5 8 6 9	70	28.3	NA	NA		**SM - Silty Sand** Reddish and grey in mottled pattern; loose; wet; slight hydrocarbon-like odor.	
14									
15	14-16	5 11 31 58	45	17.2	NA	NA		Sand; medium to coarse; poorly sorted; at bedrock surface - trace tar-like material mixed with rock fragments; trace sheen.	
16									

Remarks:

Laboratory Soil Sample
MW7D(14.0-16.0)
MGP Indicators

ThermoRetec Corporation
1001 W. Seneca St., Suite 204
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(607) 277-5716 Phone
(607) 277-9057 Fax
www.thermoretec.com

WELL INSTALLATION LOG

ID: MW7D

Project Number: ORAN2-O4301	**Drilling Co.:** Maxim Technologies Inc.	**Surface Elevation: (MSL)** 8.37
Client: Orange and Rockland Utilities	**Driller:** Walt Ketter	**Water Level During Drilling:** 4.86
Site Location: Nyack MGP	**Casing ID:** 4" Steel Schedule 40	**Stickup:** 2.20
Start Date: 10/18/99	**Method:** HSA\HQ Rock Core	**MP Elevation: (MSL)** 10.50
Completion Date: 10/19/99	**Logged By:** James Edwards	**Total Depth:** 47
Location: Eastern Parcel - AST Area		

Depth (ft)	Sample Depth	Blow Counts\6"	Percent Recovery	PID (ppm)	Run Number	Rock Quality Designation	Lithology (symbol)	Description	Well Construction
17	16-16.2	50\0.2	10	NA	NA	NA		**Sandstone Bedrock** Reddish; trace grey in mottled pattern; average hardness; broken; fractures 0 to 20 degrees; fractures open and slightly weathered.	
18									bottom of casing
19									bentonite seal
20	18-22	NA	73	NA	1	66		(trace spots of NAPL in circulation water during Run #1)	top of sand pack
21									
22									top of screen
23								Sandstone; reddish and grey in mottled pattern; average hardness; broken; fractures 0 to 20 deg.	
24									
25	22-27	NA	98	NA	2	87			
26									
27									
28									2" 20 slot PVC well screen
29								Sandstone becomes coarse.	
30	27-32	NA	100	NA	3	94			installed in open rock borehole
31								Mudstone; thinly bedded; broken; fractures weathered; driller reports loss of circulation water.	
32									

Remarks:

ThermoRetec
1001 West Seneca Street, Suite 204
Ithaca, New York 14850-3342

Well ID: MW10D

Project Name: Nyack MGP Site
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 5-24-01
Drilling Company: Advanced
Drilling Method: Hollow Stem Auger/ HX Core Barrel
Sampling Method: Continuous Split Spoon

Boring Location: Onsite
Ground Elevation (ft/MSL): 7.00
PVC Elevation (ft/msl): 9.48
Total Depth (ft): 40.0
Auger/Casing ID (in): 4 1-4 ID
Water Level During Drilling (ft/bgs): 6.6
Logged By: James Edwards

Depth (Feet)	Recovery (feet)	Laboratory Sample ID	Blow Counts	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description	Well Construction	Well Dimension
2									Locking Stickup Casing
0									Cement Pad
-2	1.2		4-13-9-10	0.1	FILL		Fine-medium sand with some fine-coarse gravel. Brown-black, moist, firm.		Grouted Isolation Casing 1-20 ft.
-4	1.2		18-14-9-8	0.1			Coal fragments 2.0 4.0 ft.		
-6	0.5		3-3-3-4	0.5	FILL		Sand mixed with clinker-like material, brick fragments, gravel 5.0 ft.		Grouted Annulus 1-18 ft.
-8	0.4		2-1-1-1	1.2					
-10	0.6		2-1-2-1	1.2	FILL				
-12	0.4		1-19-5-3	3.3			Hydrocarbon-like odor and blebs of NAPL at 11.5-12.5 ft.		
-14	0.5	MW10D (12-13)	4-4-4-3	28.6	FILL				2" PVC Riser +2.0-24 ft.
-16	0.8		2-2-6-8	5.2			Fine-medium sand with trace clay. Brown-gray, moist, firm.		
-18	0.5		37-100/.4	1.2	SM		Driller reports bedrock at 18.4 Augered to 20.0 ft.		
-20				2.1			Medium sandstone with calicum carbonate cement and interbedded mica flakes. Red, thick bedded.		Bentonite Seal 18-20 ft.

Remarks:
Laboratory Sample: MW10D (12-13)

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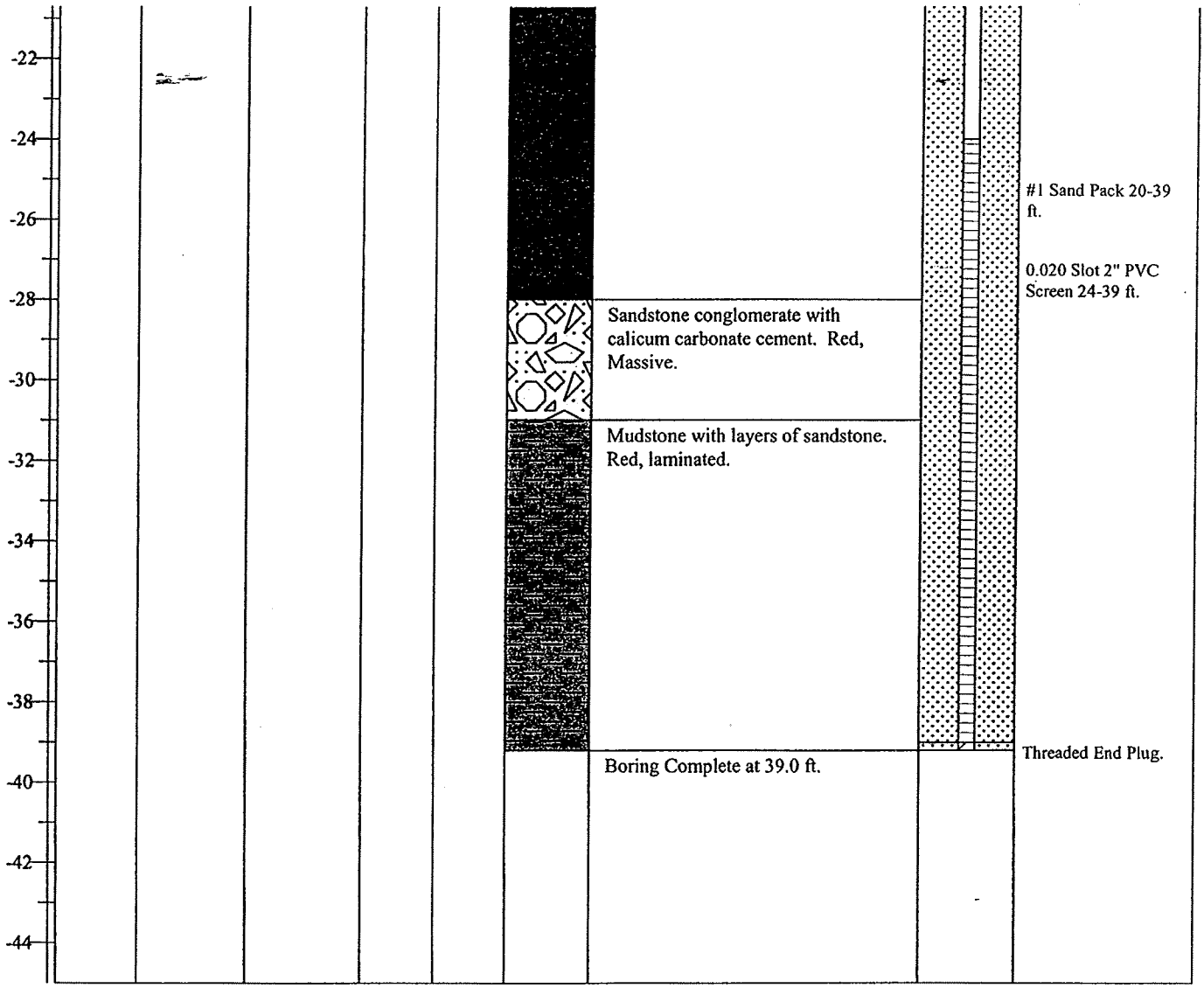
Ithaca, New York 14850-3342

Well ID: MW10D



Remarks:

Laboratory Sample: MW10D (12-13)

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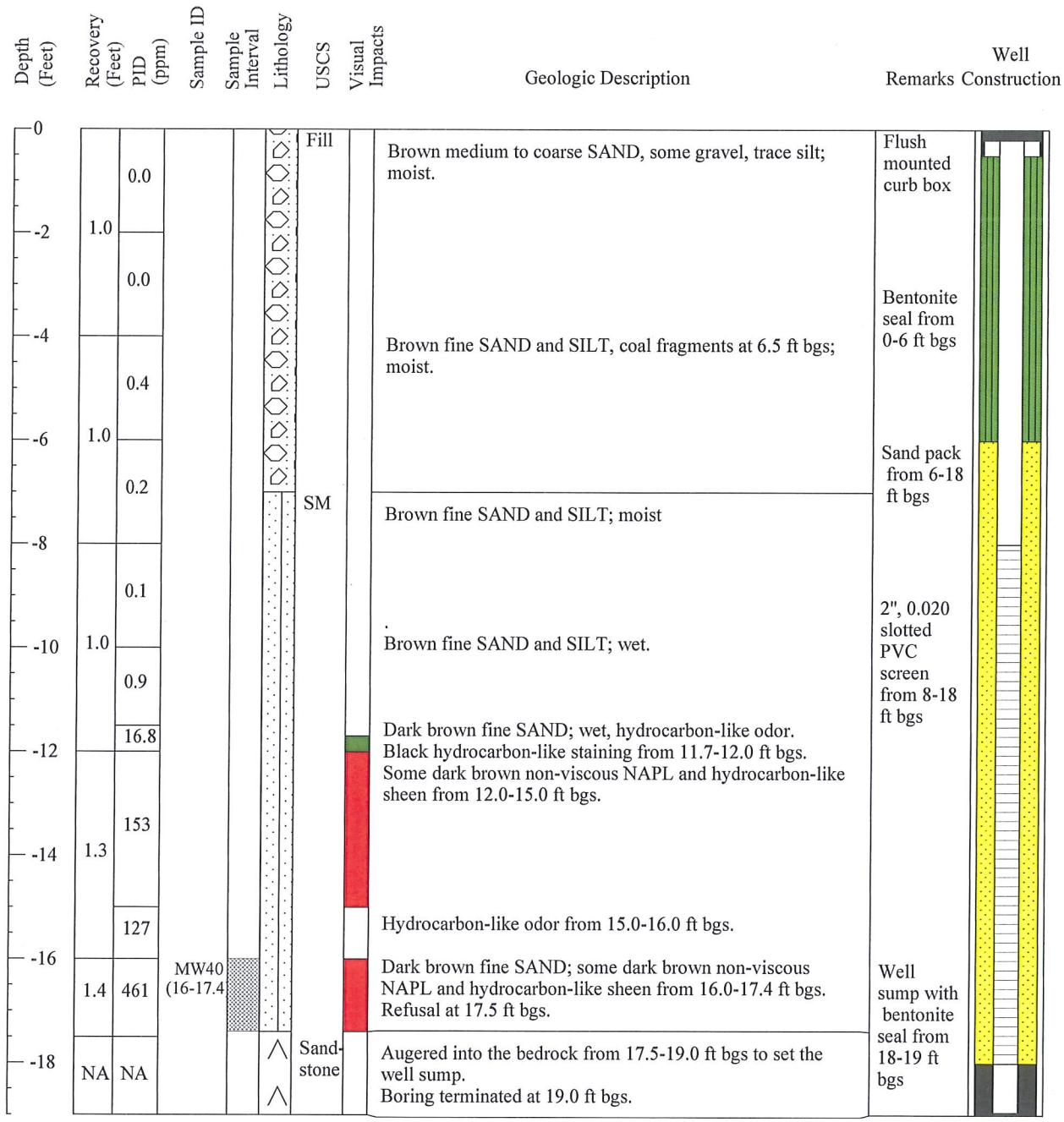
Well ID: MW40

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 21, 2008
Boring Location: Shoreline/Tar lagoon area
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Direct Push/Auger
Sampling Method: Macro-core
PVC/Ground Elevation (ft/msl): 7.53 / 7.82
Total Depth: 19.0 ft bgs
Logged By: Jesse Lloyd



Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil sample MW40(16-17.4) was analyzed for VOCs, SVOCs, RCRA metals, and total cyanide.
Soil sample MW40WC(8-17.4) was analyzed by a suite of analyses for waste characterization.

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Well ID: MW42

Project Name: Nyack OU2 MGP Investigation
Project Number: 05090-022
Date Started/Completed: May 28, 2008
Boring Location: Intertidal zone in the jetty area
Drilling Company: Northstar Drilling Ltd.

Drilling Method: Direct Push/Auger
Sampling Method: Macro-core
PVC/Ground Elevation (ft/msl): 6.17 / 3.91
Total Depth: 26.0 ft bgs
Logged By: Jesse Lloyd

Depth (Feet)	Recovery (Feet)	RQD (%)	Sample ID	Sample Interval	Lithology	USCS	Visual Impacts	Geologic Description	Remarks	Well Construction
0						Fill		Brown fine SAND, some silt; dry.	Stick-up protective well casing Bentonite seal from 0-1 ft bgs Sand pack from 1-12 ft bgs 2", 0.020 slotted PVC screen from 2-12 ft bgs Well sump with bentonite seal from 12-14 ft bgs	
-2	2.3	0.5	MW42 (2-4)					Hydrocarbon-like staining and strong hydrocarbon-like odor from 2.0-3.0 ft bgs.		
		28.2						CINDERS and ASHES, little fine sand; wet, hydrocarbon-like odor.		
-4								CINDERS, trace gravel and fine to medium sand; wet.		
		1.9								
-6	2.0							Hydrocarbon-like odor from 6.0-8.0 ft bgs.		
		3.0								
-8								CINDERS, trace gravel and fine to medium to coarse sand; wet.		
-10	1.0	3.5								
-12								Black CLAY and CINDERS; slight hydrocarbon-like odor; wet.		
	1.2	4.1								
-14			MW42 (14-16)			ML		Grey SILT, trace shells; moist, firm.		
		0.0						Lens of fine sand from 15.2-15.6 ft bgs.		
-16	1.3									
		0.5								
-18								Grey SILT; moist, firm.		
		0.7								
-20	1.1									
		0.3								
-22										
-24	0.4	0.4						Boring terminated at 26.0 ft bgs.		
-26										

Coal Tar or Coal Tar NAPL Saturated Soil

Hydrocarbon Staining, Hydrocarbon Sheen or NAPL Blebs

Comments: Soil samples MW42(2-4) and MW42(14-16) were analyzed for VOCs, SVOCs, RCRA metals, and total cyanide. Soil sample MW42WC(1-14) was analyzed by a suite of analyses for waste characterization.

SEDIMENT CORE LOGS

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SEDIMENT CORE LOG

ID: SD1

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 13:08 - 5.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 36.30
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML - Clayey Silt** 0-0.4 - Silty sand; reddish; loose. 0.4-0.8 - Clayey silt; grey; trace shells. 0.8-1.5 - Clayey silt; black; soft. 1.5-2.1 - Silty sand; reddish; medium; loose. 2.1 - Clayey Silt; trace sand; trace shells.	Laboratoy Samples SD1(0.0-0.2) SD1(0.4-1.4)
2						
3			0.0			
4					Whole shells; clayey silt; trace sand.	
5			0.0			
6						
7			0.0			
8						
9			0.0		Clayey Silt; olive grey; uniform; soft; moist; trace broken shells in random pattern.	
10	0-20	26				
11			0.0			
12						
13			0.0			
14						
15			0.0			
16						
17			0.0			
18					Clayey Silt; grey; uniform; trace shells; increasing sand content to 20%.	
19			0.0			
20						

Remarks:

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SEDIMENT CORE LOG

ID: SD1

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 13:08 - 5.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 36.30
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0			
22						
23			0.0		At 23' bgs - 0.3' lense of silty sand; reddish; firm.	
24						
25			0.0			
26						
27			0.0			
28	20-36.28	92				
29			0.0		Increasing sand content to 30%; trace mollusk shells.	
30						
31			0.0		**SM - Silty Sand** Sand; grey; fine to medium; trace rounded cobbles; whole and broken shells; trace wood fragments.	
32						
33			0.0			
34					Sand becomes reddish; 50% rounded and angular gravel; cobbles.	
35			0.0			
36					Driller reports refusal.	
37					**Sandstone Bedrock**	
38						
39						
40						

Remarks:

Sheet 2 of 2

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SEDIMENT CORE LOG

ID: SD2

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 08:30 - 5.30
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: ~~12/16~~/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 40
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML- Clayey Silt** Grey and black in mottled pattern; very loose; at 0.8 - becomes soft.	Laboratory Samples
2						SD2(0.0-0.2)
					Becomes grey; trace black staining in seams less than 1/4" thick.	
3			0.0			SD2(0.2-2.0)
4					Silt; trace reddish sand in nodules.	
5			0.0		Becomes black;	
6					Becomes grey; uniform; trace sand.	
7			0.0			
8						
9			0.0			
10	0-20	62				
11			0.0			
12						
13			0.0		Whole shells.	
14						
15			0.0			
16						
17			0.0		Trace shells in unsorted pattern.	
18						
19			0.0			
20						

Remarks:

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SEDIMENT CORE LOG

ID: SD2

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 08:30 - 5.30
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 40
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0			
22					Clayey Silt; olive grey; uniform; trace shells in unsorted pattern; soft.	
23			0.0			
24						
25			0.0			
26						
27			0.0			
28						
29			0.0			
30	20-40	77				
31			0.0			
32						
33			0.0			
34						
35			0.0			
36					Clayey Silt; trace nodules of yellowish silt.	
37			0.0			
38						
39			0.0		Clayey Silt; grey; uniform; whole and broken shells.	
40						Bottom of core.

Remarks:

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SEDIMENT CORE LOG

ID: SD3

Project Number: ORAN2-04301
Client: Orange and Rockland Utilities
Site Location: Nyack MGP
Start Date: 12/15/99
Completion Date: 12/15/99
Location: Submerged Portion of Eastern Parcel

Drilling Co.: Alpine Ocean Seismic Survey
Driller: Chuck Dill
Casing ID: NA
Method: Vibracore
Logged By: Coulombe\Edwards

Surface Elevation: (MSL) NA
Water Level During Drilling: 08:15 - 3.90
Stickup: NA
MP Elevation: (MSL) NA
Total Depth: 40

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		ML- Clayey Silt	Laboratory Samples
2					Black; loose; shell fragments; hydrocarbon-like odor; trace wood fragments.	SD3(0.0-0.2)
3			0.0		Lense of fine grained sand.	SD3(0.2-1.6)
4					From 2.6-2.8 - lense of fine sand mixed with NAPL.	
5			0.0		Clayey Silt; olive gray; soft; 10% fine reddish sand; trace nodules of peat-like material.	
6						
7			0.0			
8						
9			0.0			
10	0-20	55			Whole shells.	
11			0.0			
12						
13			0.0			
14						
15			0.0		Clayey Silt; olive grey; soft; 30% broken shells; trace nodules of peat-like material; soft.	
16						
17			0.0			
18						
19			0.0			
20						

Remarks:

Hydrocarbon Identification analyses completed on material collected from SD3(2.6-2.8)

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SEDIMENT CORE LOG

ID: SD3

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 08:15 - 3.90
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: ~~12~~/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 40
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0			
22					Clayey Silt; trace pockets of fine reddish sand.	
23			0.0			
24						
25			0.0			
26					Clayey Silt; 5% reddish fine sand.	
27			0.0			
28						
29			0.0			
30	20-40	57				
31			0.0			
32						
33			0.0			
34						
35			0.0			
36						
37			0.0		Clayey Silt; lense of fine reddish sand; trace rounded cobbles;	
38						
39			0.0		Clayey Silt; brown and grey; 30% peat-like material; wood fragments.	
40						Bottom of core.

Remarks:

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SEDIMENT CORE LOG

ID: SD4

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 09:42 - 3.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 28.5
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**SM - Silty Sand** Reddish; loose; becomes black; hydrocarbon-like odor; trace hydrocarbon-like sheen.	Laboratory Samples SD4(0.0-0.4)
2					Silty Sand; trace pebbles; trace shells.	SD4(0.4-1.4)
3			0.0			
4						
5			0.0		**ML - Clayey Silt** Olive grey; pockets of fine reddish sand (5%); trace shells; whole and broken.	
6						
7			0.0			
8						
9			0.0			
10	0-20	78			Clayey Silt; grey; 20% fine reddish sand; soft; trace shell fragments.	
11			0.0			
12						
13			0.0			
14						
15			0.0			
16						
17			0.0			
18					Clayey Silt; broken shell fragments in thin layers; trace reddish fine sand.	
19			0.0			
20						

Remarks:

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SEDIMENT CORE LOG

ID: SD4

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 09:42 - 3.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 28.5
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0		Clayey Silt; grey; uniform; increasing sand content to 20%.	
22						
23			0.0		Trace rounded to subrounded pebbles and cobbles.	
24	20-28.5	100				
25			0.0			
26						
27			0.0		Becomes; Clayey Silt; 50%; broken and whole shell fragments.	
28					**SM - Silty Sand** Reddish; fine to medium; trace rounded pebbles. Driller reports refusal at 28.5' bgs.	
29					**Sandstone Bedrock**	
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

Remarks:

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SEDIMENT CORE LOG

ID: SD5

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 12:00 - 4.50
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 27.6
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**SM - Silty Sand** Loose; black and grey in mottled pattern; 20% shells. At 1.2; becomes black; 40% shells.	Laboratory Samples SD5(0.0-0.2)
2						SD5(0.5-1.3)
3			0.0		**ML - Clayey Silt** Grey to olive; soft; 20% reddish sand; sandstone cobble; rounded; trace shells.	
4						
5			0.0			
6					Clayey Silt; grey; soft; 20% reddish sand; trace cobble; trace shells.	
7			0.0			
8						
9			0.0			
10	0-20	42				
11			0.0			
12						
13			0.0		Clayey Silt; olive grey; trace nodules of peat-like material; trace sand.	
14						
15			0.0			
16						
17			0.0			
18						
19			0.0			
20					0.5' thick lense of Sand; reddish; medium to fine; 20% broken shells.	

Remarks:

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SEDIMENT CORE LOG

ID: SD5

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 12:00 - 4.50
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 27.6
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0			
22					Clayey Silt; uniform; grey; soft; trace mollusk shells.	
23			0.0			
24	20-27.6	60				
25			0.0			
26						
27					**SM - Silty Sand** Reddish; 20% shells; 20% rounded gravel.	
28					**Sandstone Bedrock**	
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

Remarks:

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SEDIMENT CORE LOG

ID: SD6

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 10:20 - 2.90
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 33.65
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**SM - Silty Sand** Silty Sand; grey; 50% rounded gravel; at 0.4' bgs; becomes black hydrocarbon-like staining and odor; at 2.1 to 2.3; trace hydrocarbon-like sheen and odor.	Laboratory Samples
2						SD6(0.0-0.2)
3			0.0			SD6(2.1-2.3)
4						
5			0.0			
6					**ML- Clayey Silt** At 4.5' bgs; distinct boundary; Clayey Silt; firm; uniform; 20% reddish fine sand; sand is in horizontal seams up to 1/4" thick.	
7			0.0			
8						
9			0.0			
10	0-20	72			Clayey Silt; grey to olive; uniform; trace shells trace reddish sand in nodules up to 0.1' thick.	
11			0.0			
12					Becomes Silty Sand; in lense 0.6' thick.	
13			0.0			
14						
15			0.0		Clayey Silt; 1% broken shell fragments; 5% sand in mottled pattern; soft.	
16						
17			0.0			
18						
19			0.0			
20						

Remarks:

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SEDIMENT CORE LOG

ID: SD6

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 10:20 - 2.90
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 33.65
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0			
22						
23			0.0			
24					Clayey Silt; olive grey; uniform; soft; 10% broken shells.	
25			0.0			
26						
27	20-33.65	65	0.0			
28						
29			0.0			
30						
31			0.0		**SM - Silty Sand**	
32					Silty Sand; reddish and grey; fine; trace granitic pebbles; reddish sandstone rounded cobble; 50% broken shells. Driller reports refusal at 33.65.	
33			0.0			
34					**Sandstone Bedrock**	
35						
36						
37						
38						
39						
40						

Remarks:

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SEDIMENT CORE LOG

ID: SD7

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 13:00 - 7.50
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 40
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML - Clayey Silt** Olive grey and black in mottled pattern; loose; slight odor; becomes soft at 1.0' bgs.	Laboratory Analyses SD7(0.0-0.2)
2						
3			0.0			SD7(0.2-2.2)
4					Becomes black and grey in horizontal seams; pockets of reddish sand; trace shells.	
5			0.0			
6					Driller reports poor recovery due to core loss.	
7			NA			
8						
9			NA			
10	0-20	26				
11			NA			
12						
13			NA			
14						
15			NA			
16						
17			NA			
18						
19			NA			
20						

Remarks:

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SEDIMENT CORE LOG

ID: SD7

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 13:00 - 7.50
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/15/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/15/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 40
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0		Clayey Silt; olive grey; soft; trace broken shells; uniform; moist.	
22						
23			0.0			
24						
25			0.0		Clayey Silt; lense of broken shells (0.4' thick) sand content increases to 10%.	
26						
27			0.0			
28						
29			0.0			
30	20-40	98				
31			0.0			
32					Clayey Silt; olive grey; uniform; trace broken shells.	
33			0.0			
34						
35			0.0			
36					Clayey Silt; olive grey; trace shells; uniform; soft; trace wood debris.	
37			0.0			
38						
39			0.0			
40						Bottom of core

Remarks:

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SEDIMENT CORE LOG

ID: SD8

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 14:28 - 6.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/14/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/14/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 38.3
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML - Clayey Silt** Clayey Silt; black; loose; at 0.5 - lense of reddish sand.	Laboratory Analyses
2					Clayey Silt; grey; 20% fine reddish sand; hydrocarbon-like odor.	SD8(0.0-0.2)
3			0.0			SD8(0.5-2.0)
4						
5			0.0		Clayey Silt; olive grey; soft; moist; trace broken shells; 15% reddish sand; trace peat in nodules.	
6						
7			0.0			
8						
9			0.0			
10	0-20	41				
11			0.0			
12						
13			0.0			
14						
15			0.0			
16					Clayey Silt; olive grey; uniform; trace broken shells; trace peat-like material in 0.2' lense;	
17			0.0		5% reddish sand.	
18						
19			0.0			
20						

Remarks:

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SEDIMENT CORE LOG

ID: SD8

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 14:28 - 6.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/14/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: ~~12~~/14/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 38.3
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0			
22					Clayey Silt; olive grey; 20% fine reddish sand; trace whole and broken shells.	
23			0.0			
24						
25			0.0			
26						
27			0.0			
28						
29	20-38.3	49	0.0			
30						
31			0.0			
32						
33			0.0			
34					Clayey Silt; olive grey; trace shells; uniform; trace fine reddish sand in mottled pattern.	
35			0.0			
36						
37			0.0		**SM- Silty Sand** Silty Sand: fine to medium; reddish and grey in random pattern; trace rounded sandstone cobble; poorly sorted.	
38						
39						
40						

Remarks:

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SEDIMENT CORE LOG

ID: SD9

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 10:30 - 6.50
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 20
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML- Clayey Silt** Clayey Silt; grey and black in mottled pattern; loose; becomes black at 0.6' bgs; slight hydrocarbon-like odor.	Laboratory Samples SD9(0.0-0.2)
2					Silt; grey and black in horizontal lenses; slight hydrocarbon-like odor.	SD9(0.4-2.4)
3			0.0			
4						
5			0.0			
6						
7			0.0			
8						
9			0.0			
10	0-20	41				
11			0.0			
12					Clayey Silt; olive grey; uniform; trace broken and whole shells; trace wood debris.	
13			0.0			
14						
15			0.0			
16						
17			0.0			
18						
19			0.0			
20						Bottom of core

Remarks:

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SEDIMENT CORE LOG

ID: SD10

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 10:00 - 6.90
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 20
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML- Clayey Silt** Clayey Silt; olive grey; loose; at 0.9 - becomes black; slight hydrocarbon-like odor.	Laboratory Analyses SD10(0.0-0.2)
2						SD10(0.2-2.0)
3			0.0			
4						
5			0.0		Clayey Silt; olive grey; soft; uniform; whole and broken shells.	
6						
7			0.0			
8						
9			0.0			
10	0-20	58				
11			0.0			
12						
13			0.0			
14						
15			0.0			
16						
17			0.0		Clayey Silt; olive grey; uniform; moist; soft; trace peat-like material in nodules; trace whole and broken shells.	
18						
19			0.0			
20						Bottom of core

Remarks:

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SEDIMENT CORE LOG

ID: SD11

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 12:30 - 8.90
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/14/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/14/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 39.8
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML- Clayey Silt** Clayey Silt; black; loose; trace wood fragments; trace shells; slight hydrocarbon-like odor; at 0.7' - becomes soft.	Laboratory Analyses SD11(0.0-0.2)
2					Clayey Silt; becomes olive grey; uniform; soft.	SD11(0.5-2.0)
3			0.0			
4						
5			0.0			
6						
7			0.0			
8					Clayey Silt; olive grey; soft; uniform; moist; whole shells.	
9			0.0			
10	0-20	49				
11			0.0			
12						
13			0.0			
14						
15			0.0			
16						
17			0.0			
18					0.5' lense of broken and whole shells.	
19			0.0			
20						

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SEDIMENT CORE LOG

ID: SD11

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 12:30 - 8.90
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/14/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/14/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 39.8
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
21			0.0			
22						
23			0.0		Clayey Silt; olive grey; soft; uniform; 20% shell fragments; trace whole shells.	
24						
25			0.0			
26						
27			0.0			
28						
29			0.0			
30	20-39.5	79				
31			0.0			
32						
33			0.0			
34					Clayey Silt; olive grey; uniform; soft; trace shell fragments.	
35			0.0			
36						
37			0.0			
38						
39			0.0			Bottom of Core
40						

Remarks:

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SEDIMENT CORE LOG

ID: SD12

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 11:38 - 7.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 20
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML - Clayey Silt** Clayey Silt; black; loose; at 0.7 - becomes soft; black uniform; slight hydrocarbon-like odor.	Laboratory Analyses
2						SD12(0.0-0.7)
3			0.0		At 2.7' bgs - becomes layered - grey and black silt in horizontal seams; trace whole shells.	SD12(4.4-4.7)
4						
5			0.0		At 4.6' bgs - trace tar-like material in nodules; strong hydrocarbon-like odor.	
6					At 4.7' bgs - Clayey Silt; olive grey; soft; uniform; trace broken shells; slight hydrocarbon-like odor.	
7			0.0			
8						
9			0.0			
10	0-20	46				
11			0.0			
12						
13			0.0			
14						
15			0.0			
16						
17			0.0			
18					Clayey Silt; soft; olive grey; uniform; trace broken shells.	
19			0.0			
20						Bottom of Core

Remarks:

Sheet 1 of 1

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SEDIMENT CORE LOG

ID: SD13

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 12:05 - 8.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 20
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML - Clayey Silt** Clayey Silt; black; loose; slight hydrocarbon-like odor.	Laboratory Analyses SD13(0.0-0.2)
2						
3			0.0		Clayey Silt; black and grey in mottled pattern; slight hydrocarbon-like odor.	SD13(0.5-2.1)
4						
5			0.0		Distinct boundary; Clayey Silt; grey; soft; uniform.	
6						
7			0.0			
8						
9			0.0			
10	0-20	56				
11			0.0		0.4' lense of whole and broken shells mixed with silt.	
12						
13			0.0			
14						
15			0.0			
16						
17			0.0		1.0' lense of whole and broken shells.	
18						
19			0.0		Clayey Silt; uniform; soft; olive grey; trace shells.	
20						Bottom of Core

Remarks:

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SEDIMENT CORE LOG

ID: SD14

Project Number: ORAN2-04301	**Drilling Co.:** Alpine Ocean Seismic Survey	**Surface Elevation: (MSL)** NA
Client: Orange and Rockland Utilities	**Driller:** Chuck Dill	**Water Level During Drilling:** 12:36 - 6.00
Site Location: Nyack MGP	**Casing ID:** NA	**Stickup:** NA
Start Date: 12/16/99	**Method:** Vibracore	**MP Elevation: (MSL)** NA
Completion Date: 12/16/99	**Logged By:** Coulombe\Edwards	**Total Depth:** 20
Location: Submerged Portion of Eastern Parcel		

Depth (ft)	Sample Depth	Percent Recovery	PID Headspace Readings (ppm)	Lithology (symbol)	Description	Comments
1			0.0		**ML - Clayey Silt** Clayey Silt; black and grey in mottled pattern; loose; becomes black at 1.3' bgs; uniform.	Laboratory Analyses SD14(0.0-0.2)
2						SD14(0.7-2.1)
3			0.0			SD14(5.0-5.4)
4					Clayey Silt; black and grey in mottled pattern from 4.4-5.0 - increasing sand content to 30%.	
5			0.0			
6						
7			0.0			
8						
9			0.0		trace pockets of reddish fine sand.	
10	0-20	54				
11			0.0			
12						
13			0.0		Clayey Silt; olive grey; uniform; soft; lenses of whole and broken shells.	
14						
15			0.0			
16						
17			0.0			
18						
19			0.0			
20						Bottom of Core

Remarks:

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Boring ID: SD15

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 7.8
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD15 (0-2)	6.1	GM		Fine-coarse gravel with fine-medium sand. Black, Saturated.
-2						
-3		SD15 (2.8-3.3)	11.0			Clayey silt and trace fine sand. Gray,saturated.
-4						
-5			6.2	ML		
-6						
-7	7.8		5.2			
-8						Driller reports vibra core refusal, boring complete at 7.8 ft.
-9						
-10						
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 28.7537"N, 73 54' 51.6677" W

Laboratory Sample: SD15 (0-2), SD15 (2.8-3.3)

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Boring ID: SD16

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD16 (0-2)	7.6	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3		SD16 (3.5-4.5)	9.8			Clayey silt and trace fine sand. Gray-brown,saturated.
-4						
-5			9.8	ML		
-6						
-7			8.2			
-8						
-9	9.8		0.0	ML		
-10						Boring Complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 29.7385" N, 73 54' 51.8154" W

Laboratory Sample: SD16 (0-2), SD16 (3.5-4.5)

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Ithaca, New York 14850

Boring ID: SD17

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD17 (0-2)	6.4	SM		Fine-medium sand with fine gravel and trace silt. Brown, Saturated.
-2						
-3		SD17 (2-4)	11.6	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-4						Clayey silt and trace fine sand. Gray,saturated.
-5			1.5			Fine-medium sand with silt. Brown, Saturated.
-6						4 inch lens of coal fragments at 5.0 ft.
-7			7.3	ML		Fine-medium sand with silt. Brown, Saturated.
-8						
-9	10.0		4.2			Wood fragments at 9.0 ft.
-10						Boring Complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 30.0562" N, 73 54' 53.4657" W

Laboratory Sample: SD17 (0-2), SD17 (2-4)

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Boring ID: SD18

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD18 (0-2)	3.6	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			7.5			Clayey silt and trace fine sand. Gray,saturated.
-4						
-5		SD18 (4.3-4.5)	7.5	ML		
-6						
-7			4.1			Clayey silt and trace fine sand. Gray,saturated.
-8						
-9	10.0		0.0	ML		
-10						Boring completed at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 26.663" N, 73 54' 52.7789" W

Laboratory Sample: SD18 (0-2), SD18 (4.3-4.5)

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Boring ID: SD19

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD19 (0-2)	0.5	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			3.8			
-4						
-5			1.6	ML		Clayey silt and trace fine sand. Gray,saturated.
-6						
-7		SD19 (6.3-7.0)	1.6			Clayey silt and trace fine sand. Gray,saturated.
-8						
-9	10.0		1.3	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 26.5328" N, 73 54' 51.4505" W

Laboratory Sample: SD19 (0-2), SD19 (6.3-7.0)

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Boring ID: SD20

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD20 (0-2)	1.8	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			0.9			Clayey silt and trace fine sand. Gray,saturated.
-4						
-5		SD20 (5.2-6.3)	1.3	ML		
-6						
-7			0.5			
-8						Clayey silt and trace fine sand. Gray,saturated.
-9	9.5		0.7	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 26.1748" N, 73 54' 49.5344" W

Laboratory Sample: SD20 (0-2), SD20 (5.2-6.3)

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Boring ID: SD21

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD21 (0-2)	1.8	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			0.9			Clayey silt and trace fine sand. Gray-black,saturated.
-4						
-5			1.3	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-6						
-7		SD21 (6-7)	0.5			Clayey silt and trace fine sand. Gray,saturated.
-8						
-9	10.0		0.7	ML		Clayey silt and trace fine sand. Gray,saturated.
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 25.7702" N, 73 54' 53.0748" W

Laboratory Sample: SD21 (0-2) MS/MSD, SD21 (6-7)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD22

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD21 (0-2)	5.9	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			6.2			
-4						
-5		SD22 (4.9-6.0)	3.2	ML		Clayey silt and trace fine sand. Gray,saturated.
-6						
-7			6.0			Clayey silt and trace fine sand. Gray,saturated.
-8						
-9	10.0		0.9	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 25.5296" N, 73 54' 51.7513" W

Laboratory Sample: SD22 (0-2), SD22 (4.9-6.0)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD23

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD23 (0-2)	0.7	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3		SD23 (3-4)	1.1			Clayey silt and trace fine sand. Gray,saturated.
-4						
-5			0.7	ML		
-6						
-7			0.7			Clayey silt and trace fine sand. Gray,saturated.
-8						
-9	10.0		0.0	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 25.2233" N, 73 54' 49.8558" W

Laboratory Sample: SD23 (0-2), SD23 (3-4)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD24

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD24 (0-2)	0.7	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			1.1			Clayey silt and trace fine sand. Gray-black,saturated.
-4						
-5		SD24 (5.2-6.0)	0.7	ML		Trace of wood fragments at 5.0 ft.
-6						
-7			0.7			Clayey silt and trace fine sand. Gray-black,saturated.
-8						
-9	10.0		0.0	ML		Trace shell fragments at 9.0 ft.
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 30.5852" N, 73 54' 51.6381" W

Laboratory Sample: SD24 (0-2), SD24 (5.2-6.0)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD25

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD25 (0-2)	1.6	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			1.5			
-4						
-5		SD25 (5.3-6.0)	3.9	ML		Clayey silt and trace fine sand. Gray,saturated.
-6						
-7			8.4			
-8						
-9	10.0		10.3	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 30.3649" N, 73 54' 50.3357" W

Laboratory Sample: SD25 (0-2), SD25 (5.3-6.0)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD26

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD24 (0-2)	0.5	ML		Silt with clay and trace fine-medium sand. Black-gray, saturated.
-2						
-3			1.1			Clayey silt and trace fine sand. Gray,saturated.
-4						
-5		SD24 (5.2-6.0)	0.7	ML		
-6						
-7			0.5			Clayey silt and trace fine sand. Gray,saturated.
-8						
-9	10.0		0.0	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 30.0560" N, 73 54' 48.4709" W

Laboratory Sample: SD26 (0-2), SD26 (3.5-4.5)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD27

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-5-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD27 (0-2)	4.5	ML		Clayey silt and trace fine sand. Gray, saturated.
-2						
-3			5.4			
-4						
-5		SD27 (5.1-5.8)	3.5	ML		Trace hydrocarbon-like sheen and odor with tar-like blebs at 5.1-5.8.
-6						
-7		SD27 (6.4-6.9)	2.2			Clayey silt and trace fine sand. Gray-black,saturated.
-8						
-9	10.0		1.5	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 27.1479" N, 73 54' 44.2477" W

Laboratory Sample: SD27 (0-2), SD27 (5.1-5.8), SD27 (6.4-6.9)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD28

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-6-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						Clayey silt and trace fine sand. Gray-black,saturated.
-1		SD28 (0-2)	8.4	ML		
-2						
-3		SD28 (3-4.5)	1.3			
-4						
-5			1.3	ML		
-6						
-7			1.8			Clayey silt and trace fine sand. Gray, saturated.
-8						
-9	10.0		0.0	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 27.0560" N, 73 54' 48.6439" W

Laboratory Sample: SD27 (0-2), SD27(5.1-5.8), SD27 (6.4-6.9)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD29

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-6-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD29 (0-2)	0.7	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3		SD29 (2.8-3.4)	1.3			Clayey silt and trace fine sand. Gray, saturated.
-4						
-5			1.5	ML		
-6						
-7			1.8			Clayey silt and trace fine sand. Gray, saturated.
-8						
-9	10.0		1.5	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 28.5863" N, 73 54' 48.8330" W

Laboratory Sample: SD29 (0-2), SD29 (2.8-3.4)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD30

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-6-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD30 (0-2)	0.9	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						
-3			4.1			
-4						
-5		SD30 (4.6-5.6)	5.8	ML		Clayey silt and trace fine sand. Gray, saturated.
-6						
-7			4.5			Lens fine red sand with tace shell fragments 7.8-8.2 ft.
-8						
-9	9.8		2.6	ML		
-10						Boring complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 31.4266" N, 73 54' 50.7231" W

Laboratory Sample: SD30 (0-2), SD30 (4.6-5.6)

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Ithaca, New York 14850

Boring ID: SD31

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-6-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD31 (0-2)	6.2	ML		Clayey silt and trace fine sand, Gray-black,saturated.
-2						
-3		SD31 (2.6-3.6)	7.1			Clayey silt and trace fine sand. Gray, saturated.
-4						
-5			4.3	ML		
-6						Mixed shell fragments 5.0-10.0 ft.
-7			4.1			Clayey silt and trace fine sand. Gray, saturated.
-8						
-9	10.0		6.0	ML		
-10						Boring Complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 31.1116" N, 73 54' 48.78.17" W

Laboratory Sample: SD31 (0-2), SD31 (2.6-3.6)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD32

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-6-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						
-1		SD32 (0-2), SD320 (0-2)	4.5	ML		Clayey silt and trace fine sand. Gray-black,saturated.
-2						Clayey silt and trace fine sand. Gray, saturated.
-3		SD32 (3.5-4.2)	3.0			
-4						
-5			1.6	ML		Mixed shell fragments 4.5-10.0 ft.
-6						
-7			1.8			Clayey silt and trace fine sand. Gray, saturated.
-8						
-9	10.0		2.0	ML		
-10						Boring Complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 28.8554" N, 73 54' 49.4764" W

Laboratory Sample: SD32 (0-2), SD320 (0-2) Duplicate, SD32 (3.5-4.2)

ThermoRetec
1001 West Seneca St, Suite 204
Ithaca, New York 14850

Boring ID: SD33

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-6-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						Clayey silt and trace fine sand. Gray, saturated.
-1		SD33 (0-2)	0.9	ML		
-2						
-3		SD33 (2.6-3.5)	1.6			
-4						
-5			2.8	ML		Mixed shell fragments 4.5-10.0 ft.
-6						
-7			1.6			Clayey silt with trace fine sand. Gray, saturated.
-8						
-9	9.7		0.5	ML		
-10						Boring Complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 26.9506" N, 73 54' 48.0104" W

Laboratory Sample: SD33 (0-2), SD33 (2.6-3.5)

ThermoRetec
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Ithaca, New York 14850

Boring ID: SD34

Project Name: Nyack Former MGP
Location: Nyack, NY
Project Number: ORAN2-04301
Date Completed: 6-6-01
Drilling Company: Ocean Surveys, INC.
Drilling Method: Vibra Core
Sampling Method: 10 ft Continuous Vibra Core

Boring Location: Hudson River
Ground Elevation (ft/msl): N/A
Total Depth (ft): 10.0
Boring Diameter Outer/Inner (in): 4 inches
Logged By: Chris Doroski

Depth (Feet)	Recovery (Feet)	Laboratory Sample ID	PID (ppm)	USCS Symbol	Lithology Symbol	Geologic Description
0						Clayey silt with trace fine sand. Gray, saturated.
-1		SD34 (0-2)	1.6	ML		
-2						
-3		SD34 (2.7-3.3)	2.8			
-4						
-5			3.5	ML		Mixed shell fragments 4.5-10.0 ft.
-6						
-7			2.5			Clayey silt with trace fine sand. Gray, saturated.
-8						
-9	10.0		2.0	ML		Clayey silt with trace fine sand. Gray, saturated.
-10						Boring Complete at 10.0 ft.
-11						
-12						
-13						
-14						
-15						

Remarks: 41 05' 28.5080" N, 73 54' 48.1912" W

Laboratory Sample: SD34 (0-2), SD34 (2.7-3.3)

AECOM Environment
78 Main Street
Nyack, NY 10960
Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: SD35

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 823167.47 Easting: 653410.82 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -4'
Start Date: 10/17/2008	Total Water Depth (ft): 5.8' Total Penetration (ft): 5'	Logged by: M. Stepanova
End Date: 10/17/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
0.5'- 1.0'	5.8/10'	2.0	SP	0.0		(0.0-0.3) - Moderately dense to dense reddish brown coarse to medium SAND; no odor or visible impact
				0.5		(0.3-1.0) - Medium grained SAND and ORGANICS; slight HCLO, but no visible impact
			SM	1.0		(1.0-1.2) - Moderately dense to dense fine grained SILTY SAND; slight HCLO, but no visible impact
			SP	1.5		(1.2-1.4) - Black coarse grained SAND; strong HCLO and sheen
2.0'- 3.0'		1.0	SM	2.0		(1.4-5.8) - Dense reddish brow/gray medium to coarse grained SILTY SAND, shell fragments, moist; slight odor to 3', but no odor or visible impact below
				2.5		
				3.0		
				3.5		
		0.8		4.0		
				4.5		
				5.0		
				5.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: SD36

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 5.1'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 823135.50 Easting: 653434.81
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -8.8'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
0.5' - 1.0'	7/10'	1.7	SM	0.0 – 4.8		(0.0-1.0) - Semi-hard black SILTY SAND and large gravel; slight HCLO, no visible impact (1.0-2.0) - Semi-soft dark olive to black SILTY SAND, some organics, some shell fragments; slight HCLO, sheen (2.0-4.8) - Hard dark gray with some reddish brown SILTY SAND, some organics, some shells throughout; no odor or visible impact
3.0' - 4.0'		0.8		4.8 – 7.0		(4.8-7.0) - Semi-hard dark gray SANDY SILT, shell fragments throughout; no odor or visible impact
		1.4				

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Nyack, NY 10960
Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: SD37

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 5.7'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 823134.05 Easting: 653468.49
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): - 9.7'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	6.4/10'			0.0		
0.5' - 1.0'		2.0	GM	0.5		(0.0-1.0) - Loose large GRAVEL and black SILT with some sand, moist; slight organic odor, no visible impact
				1.0		(1.0-1.5) - Loose black SILTY SAND and GRAVEL, moist; slight HCLO, no visible impact
			ML	1.5		(1.5-2.4) - Soft black SILT; HCLO, no visible impact
				2.0		
				2.5		(2.4-3.4) - Stiff dark gray SILTY SAND with reddish brown sand layers, moist; slight HCLO, no visible impact
				3.0		
3.5' - 4.5'		0.2	SM	3.5		(3.4-6.4) - Dark gray, semi-soft SANDY SILT, moist; no odor or visible impact
				4.0		
				4.5		
				5.0		
				5.5		
				6.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Nyack, NY 10960
Phone: (845) 348-1520
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Boring Log

Boring ID: SD38

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 6.7'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 823122. Easting: 653494.12
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -10.5'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	6.4/10'			0.0		
0.5' - 1.0'		0.9	OL	0.5		(0.0-1.3) - Very soft black SILT, some fine Sand, some organics; slight HCLO, some burnt odor
				1.0		
			SP	1.5		(1.3-1.7) - Loose dark grayish black SAND; HCLO, sheen
				2.0		(1.7-2.9) - Dark grayish black SANDY SILT, occasional reddish brown Sand layers; some HCLO, no visible impact
				2.5		
3.0' - 4.0'		0.4	ML	3.0		(2.9-6.4) - Medium soft dark olive greenish gray SANDY SILT, some organics, moist, shell fragments throughout; no odor or visible impact
				3.5		
				4.0		
				4.5		
				5.0		
				5.5		
				6.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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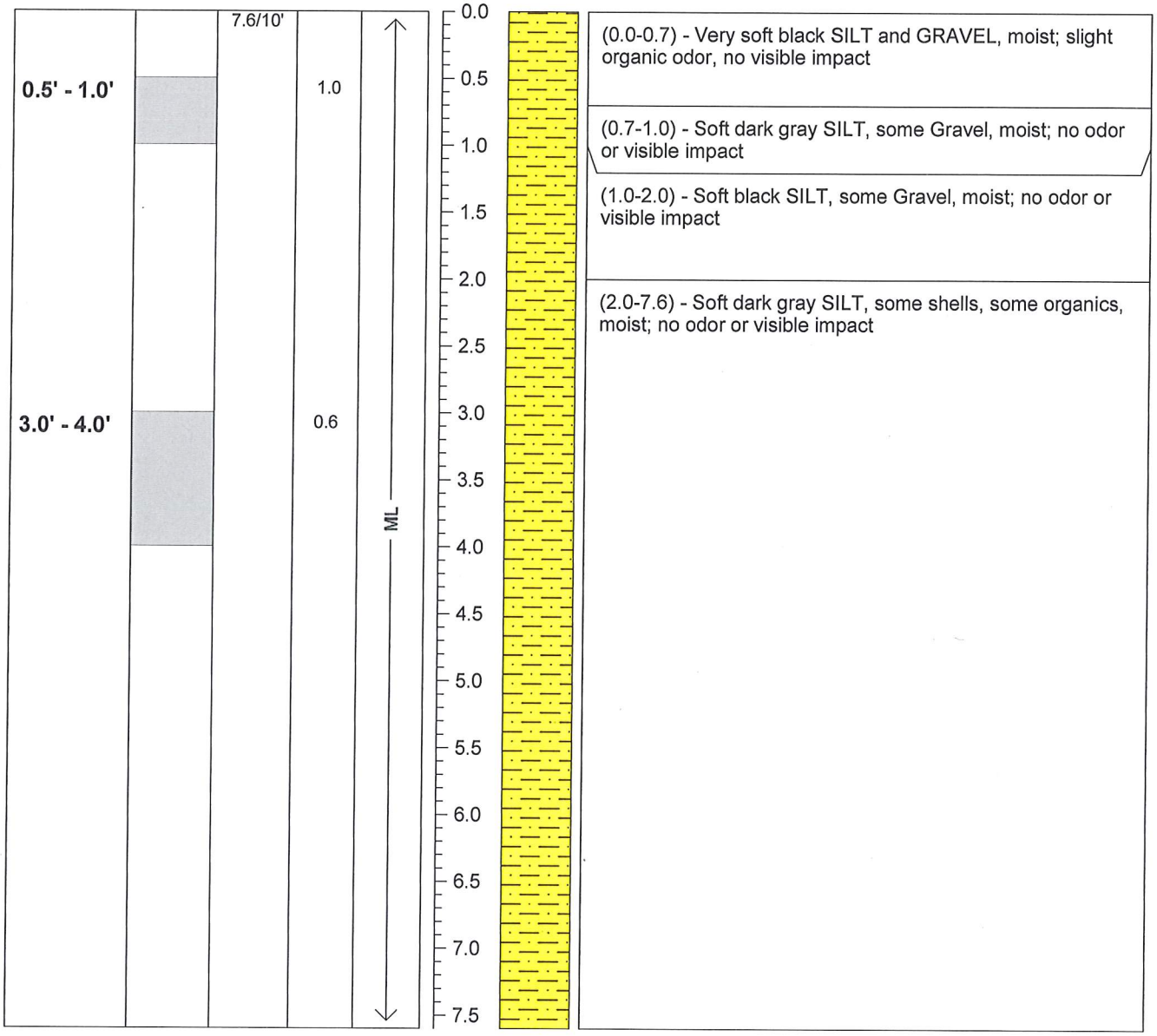
Boring Log

Boring ID: SD39

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 823104.25 Easting: 653538.89 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -11.1'
Start Date: 10/16/2008	Total Water Depth (ft): 7.2' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/16/2008		



HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring ID: SD40

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 653571.82 Easting: 823079.22 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -8.4'
Start Date: 10/15/2008	Total Water Depth (ft): 5.2' Total Penetration (ft): 7'	Logged by: M. Stepanova
End Date: 10/15/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	5.2/7'			0.0		(0.0-1.2) - Very soft dark grayish black SANDY SILT, shell fragments throughout; no odor or visible impact
0.5' - 1.0'		1.0	ML	0.5		
				1.0		
				1.5		(1.2-1.5) - Medium soft dark grayish black SANDY SILT, shell fragments throughout; no odor or visible impact
				2.0		(1.5-2.0) - Medium soft dark grayish black SANDY SILT, shell fragments throughout; mild HCLO, mild staining
				2.5		(2.0-5.2) - Medium soft dark grayish black SANDY SILT, shell fragments throughout; no odor or visible impact
3.0' - 4.0'		0.8		3.0		
				3.5		
				4.0		
				4.5		
				5.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring ID: SD41

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 823027.39 Easting: 653641.32 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -6.2'
Start Date: 10/15/2008	Total Water Depth (ft): 7.7' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/15/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	7.7/10'			0.0		(0.0-2.0) - Very soft dark grayish black SILT, trace organics, trace shell fragments throughout, wet; slight sheen, no odor
0.5'- 1.0'		0.8		0.5		
				1.0		
				1.5		
				2.0		(2.0-7.7) - Medium soft dark gray SILT, trace organics, trace shell fragments; no odor or visible impact
				2.5		
3.0' 4.0'		0.8		3.0		
				3.5		
				4.0		
				4.5		
				5.0		
				5.5		
				6.0		
				6.5		
		1.6		7.0		
				7.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD42

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 823010.65 Easting: 653710.71 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -10.6'
Start Date: 10/15/2008	Total Water Depth (ft): 8.0' Total Penetration (ft): 10.0'	Logged by: M. Stepanova
End Date: 10/15/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
0.5' - 1.0'	8/10'	1.1	ML	0.0 – 8.0		(0.0-0.5) - Soft dark olive gray SILT, moist; organic odor with slight HCLO, no visible impact (0.5-1.0) - Dark olive gray SILT with organics, some shell fragments; no odor or visible impact (1.0-8.0) - Dark gray SILT, some organics, some shell fragments
3.0' - 4.0'		1.0				
		1.1				

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring ID: SD43

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822993.14 Easting:653542.36 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -2.9'
Start Date: 10/15/2008	Total Water Depth (ft): 7.5' Total Penetration (ft): 9.5'	Logged by: M. Stepanova
End Date: 10/15/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	7.5/9.5'			0.0		(0.0-1.0) - Soft black SILT with Gravel, some coarse Sand, very moist; mild organic odor, no visible impact
1.0' - 2.0'		1.5		1.0		(1.0-1.5) - Soft black SILT with Gravel, some coarse Sand, coal fragments, very moist; mild organic odor, slight sheen
				1.5		(1.5-2.5) - Soft dark grayish black SILT with occasional layers of dark brown Sand, coal fragments, trace shell fragments throughout; medium HCLO
				2.0		
				2.5		(2.5-7.5) - Soft dark grayish black SILT with occasional layers of dark brown Sand, trace shell fragments throughout; medium HCLO
				3.0		
				3.5		
4.0' - 5.0'		0.7	ML	4.0		
				4.5		
				5.0		
				5.5		
				6.0		
				6.5		
				7.0		
				7.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD47

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/15/2008

End Date: 10/15/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 7.6'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 653480.78 Easting: 822971.73
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -1.8'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	7.6/10'		GW-GM	0.0		(0.0-0.5) - Black GRAVEL, some Silt and Sand, moist; HCLO, sheen
0.5' - 1.0'		284	SM	0.5		(0.5-1.0) - Medium soft black SILT with some Sand; some HCLO, no visible impact
			ML	1.0		(1.0-2.5) - Soft black SILT; HCLO, no visible impact
				1.5		
				2.0		
				2.5		(2.5-2.6) - Black medium SAND and CINDERS; strong HCLO, some sheen
			GM	2.6		(2.6-3.0) - Dark brown medium to coarse SAND and CINDERS, some shell fragments; strong HCLO, sheen
			SM	3.0		(3.0-3.9) - Reddish brown coarse SAND, some dark gray to black Silt ; HCLO, no visible impact
				3.5		
				3.9		(3.9-6.0) - Medium soft dark gray SILT, some shell fragments; slight HCLO, no visible impact
				4.0		
				4.5		
5.0' - 6.0'		>400	ML	5.0		
				5.5		
				6.0		(6.0-7.6) - Dark gray SILT, some shell fragments; no odor or visible impact
				6.5		
				7.0		
				7.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD48

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822969.02 Easting: 653529.28 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -5.7 '
Start Date: 10/15/2008	Total Water Depth (ft): 4.3' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/15/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	9.2/10'		SM	0.0		(0.0-0.5) - Black SANDY SILT, moist; slight organic odor, no visible impact
0.5' - 1.0'		1.6		0.5		
			ML	1.0		(0.5-3.0) - Medium soft black SILT, moist, intermitent reddish brown Sand layers; no odor or visible impact
				1.5		
				2.0		
				2.5		
				3.0		(3.0-7.2) - Dark grayish blaclk SANDY SILT, intermitent organics (shells); no odor or visible impact
				3.5		
4.0' - 5.0'		1.7		4.0		
				4.5		
				5.0		
				5.5		
			SM	6.0		
				6.5		
				7.0		
				7.5		(7.2-9.2) - Dark gray SILT with organics (shells); no odor or visible impact
		1.0		8.0		
				8.5		
				9.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD50A

Project: Nyack Former MGP Project #: 05090-022 Client: Orange and Rockland Start Date: 10/16/2008 End Date: 10/16/2008	Contractor: CR Environmental Operator: C. Ryder Drill Rig Type: Vibracore Method: Vibracore Total Water Depth (ft): 4.8' Total Penetration (ft): 10'	Location: Nyack, New York Northing: 822947.31 Easting: 653464.14 NY State Plane - Eastern New York Sediment Surface Elevation (ft NAVD88): -8.1' Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	3/10'	0.7	ML	0.0		(0.0-0.5) - Soft dark gray SILT; slight HCLO, sheen
			SM	0.5		(0.5-1.0) - Soft black coarse to medium SAND and gray SILT; slight HCLO, sheen
			ML	1.0		(1.0-2.0) - Soft gray SILT; slight HCLO, sheen
			SM	2.0		(2.0-3.0) - Semi-soft reddish brown coarse to medium SAND and gray SILT; slight HCLO, sheen
				2.5		
				3.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD52

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822946.62 Easting: 653446.77 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -9.1'
Start Date: 10/16/2008	Total Water Depth (ft): 5.6' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/16/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	7.5/10'		ML	0.0		(0.0-0.5) - Soft dark gray SILT, moist; slight HCLO, no visible impact
0.5' - 1.0'			SP	0.5		(0.5-1.0) - Black coarse to medium SAND; HCLO, sheen
			ML	1.0		(1.0-3.0) - Reddish brown coarse to medium SAND and gray SILT, some shells, some organics, moist; slight HCLO, no visible impact
3.0' - 4.0'			SM	3.0		(3.0-7.5) - Medium soft dark gray SANDY SILT, moist; no odor or visible impact
				7.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD53

Sheet 1 of 1

Project: Nyack Former MGP Project #: 05090-022 Client: Orange and Rockland Start Date: 10/15/2008 End Date: 10/15/2008	Contractor: CR Environmental Operator: C. Ryder Drill Rig Type: Vibracore Method: Vibracore Total Water Depth (ft): 6.0' Total Penetration (ft): 12'	Location: Nyack, New York Northing: 822940.94 Easting: 653484.84 NY State Plane - Eastern New York Sediment Surface Elevation (ft NAVD88): -9.8' Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
0.5' - 1.0'	10.6/12'	2.3	SM	0.0 – 3.0		(0.0-1.5) - Semi-soft reddish brown fine grain SAND and grayish balck SILT; slight MGP and burnt odor, slight sheen
2.0' - 3.0'		0.5				(1.5-3.0) - Semi-soft reddish brown fine grained SAND and grayish black SILT; some staining, no odor
			ML	3.0 – 10.5		(3.0-10.6) - Semi-soft grayish brown SILT, trace organic material, trace shell fragments throughout; no odor or visible impact

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD54

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822933.20 Easting: 653534.14 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -9.5'
Start Date: 10/15/2008	Total Water Depth (ft): 6.5'	Logged by: M. Stepanova
End Date: 10/15/2008	Total Penetration (ft): 10'	

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	8.7/10'			0.0		(0.0-3.6) - Semi-soft dark brown to gray to black SILT with occasional layers of reddish brown fine Sand, large piece of coal at 1.7', trace shell fragments, trace organic material throughout, moist; no odor, occasional staining
2.0' - 3.0'		1	ML	2.0		
4.0' - 5.0'		0.7		4.0		(3.6-8.7) - Semi-soft dark brown to gray to black SILT with occasional layers of reddish brown fine Sand, trace shell fragments, trace organic material throughout, moist; no odor or visible impact
		0.9		8.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD55

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/15/2008

End Date: 10/15/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 6.4'
Total Penetration (ft): 9.7'

Location: Nyack, New York

Northing: 822929.18 Easting: 653610.74
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -9.0'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	7.6/9.7'	1.7	ML	0.0 – 2.7		(0.0-2.7) - Dark brown SILT with thin layers of reddish brown Sand, some organics; slight HCLO, slight organic odor, no visible impact
		1.1		2.7 – 3.0		(2.7-3.0) - Dark brown SILT with thin layers of reddish brown Sand, some Clay, some organics; slight HCLO, slight organic odor, no visible impact
		0.7		3.0 – 7.5		(3.0-7.6) - Dark brown SILT with thin layers of reddish brown Sand, some Clay, some organics; slight organic odor, no visible impact

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD56

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/15/2008

End Date: 10/15/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 5.3'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing:822912.10 Easting: 653693.15
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -4.9 '

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	8/10'	>200	ML	0.0 – 8.0		(0.0-1.0) - Very soft black SILT, wet; no odor or visible impact (1.0-5.0) - Medium soft black SILT; no odor or visible impact (5.0-8.0) - Medium soft gray SILT, moist; no odor or visible impact
		30				
		10				

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD57

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 5.5'
Total Penetration (ft): 9'

Location: Nyack, New York

Northing: 822936.75 Easting: 653421.30
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -6.0 '

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	5.5/9'			0.0		(0.0-1.0) - Medium soft black SILTY SAND with large rock; strong HCLO, sheen
0.5' - 1.0'		37.7	SM	0.5		
				1.0		(1.0-1.3) - Soft black SILTY SAND; strong HCLO
				1.5		(1.3-1.8) - Dense dark gray SILTY SAND; some HCLO, no visible impact
				2.0		(1.8-1.9') - Soft black SILT + ORGANICS; strong HCLO, no visible impact
						(1.9-2.0) - Dense dark gray SILTY SAND, some shell fragments; no odor or visible impact
3.0' - 4.0'		3.1	ML	2.5		(2.0-5.5) - Stiff gray and brownish red SANDY SILT, some organics, some shell fragments; slight HCLO, no visible impact
				3.0		
				3.5		
				4.0		
				4.5		
				5.0		
				5.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD59

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822918.63 Easting: 653429.84 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88) : -8.7 '
Start Date: 10/16/2008	Total Water Depth (ft): 5.3'	Logged by: M. Stepanova
End Date: 10/16/2008	Total Penetration (ft): 10'	

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	8.7/10'		ML	0.0		(0.0-0.8) - Soft dark gray SILT, moist; no odor or visible impact
0.5' - 1.0'		2.4	SM	1.0		(0.8-1.0) - Semi-soft, reddish brown SILTY SAND, moist, large brick piece; no odor or visible impact
				1.5		(1.0-2.0) - Soft dark gray to black SANDY SILT, moist; HCLO, sheen
3.0' - 4.0'		1.3	SP	2.0		(2.0-6.0) - Hard reddish brown to dark gray SAND, with shell fragments throughout, moist; slight HCLO, no visible impact
		1.2	SM	6.0		(6.0-8.7) - Hard dark gray SANDY SILT and reddish brown SAND, moist; no odor or visible impact
				8.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: SD60

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 6.0'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 822898.81 Easting: 653424.56
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -9.9'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	6.7/10'		SM	0.0		(0.0-0.6) - Soft black SANDY SILT; no odor or visible impact
0.5' - 1.0'		1.2		0.5		
				1.0		(0.6-1.0) - Medium soft dark gray SILTY SAND, moist; slight HCLO, slight sheen
			SP	1.5		(1.0-2.0) - Medium soft reddish brown SAND, some shell fragments; no odor or visible impact
2.0' - 3.0'		0.6		2.0		
			ML	2.5		(2.0-3.2) - Soft dark gray SILT, some organics, some shells; no odor or visible impact
				3.0		
			SP	3.5		(3.2-4.0) - Medium soft intermittent dark gray SILT and reddish brown SAND layers, some shells, moist; slight HCLO, no visible impact
				4.0		(4.0-6.7) - Soft dark gray SILT, some reddish brown Sand, some shells; no odor or visible impact
			ML	4.5		
				5.0		
				5.5		
				6.0		
				6.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

AECOM Environment
78 Main Street
Nyack, NY 10960
Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: SD61

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 7.0'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 822844.86 Easting: 653681.63
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -8.6'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	6.8/10'		ML	0.0		(0.0-0.6) - Soft dark grayish black SILT, some shell fragments, trace organics; slight HCLO, no visible impact
0.5' - 1.0'		1.2		0.5		
				1.0		(0.6-3.3) - Medium soft dark grayish black SANDY SILT, shell fragments, trace organics; slight HCLO, no visible impact
				1.5		
				2.0		
				2.5		
				3.0		
			SM	3.5		(3.3-6.8) - Medium soft dark gray/olive SANDY SILT, shell fragments, trace organics; no odor or visible impact
				4.0		
				4.5		
5.0' - 6.0'		0.3		5.0		
				5.5		
				6.0		
				6.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: SD62B

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 823143.25 Easting: 653544.42 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -4.5'
Start Date: 10/16/2008	Total Water Depth (ft): 5.2'	Logged by: M. Stepanova
End Date: 10/16/2008	Total Penetration (ft): 10'	

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	9'/10'	0.8	ML	0.0 – 9.0		(0.0-1.0) - Soft black SILT, moist; HCLO, no visible impact (1.0-2.0) - Semi soft black SILT, shell fragments, moist; no odor or visible impact (2.0-4.0) - Semi soft dark gray SILT, some intermitent reddish brown Sand, moist; no odor or visible impact (4.0-9.0) - Soft gray SILT, some shell fragments throughout, some organics; no odor or visible impact
		0.2				
		0.3				

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Nyack, NY 10960
Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: E1

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822963.05 Easting: 653446.90 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -2.5'
Start Date: 10/15/2008	Total Water Depth (ft): 2' Total Penetration (ft): 2.75'	Logged by: M. Stepanova
End Date: 10/15/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	1.3/2.75'	3.1	GM	0.0		(0.0-0.4) - Large GRAVEL and SAND, wet; organic odor, no visible impact
			ML	0.5		(0.4-1.0) - Semi-soft dark gray SILT, moist; no odor or visible impact
				1.0		(1.0-1.3) - Very soft black SILT, moist, strong MGP odor, no visible impact

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Nyack, NY 10960
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Boring Log

Boring ID: E2

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/15/2008

End Date: 10/15/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 1.5'
Total Penetration (ft): 9.5'

Location: Nyack, New York

Northing: 822959.23 Easting: 653456.78
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -1.5 '

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	7.1/9.5'	9.4	SM	0.0–1.0		(0.0-1.1) - grayish black SiltySAND, moist; strong naphthalene odor at 0.5'
			SP	1.0–3.7		(1.1-1.5) - black SILTY SAND, runny NAPL; strong MGP odor, sheen (1.5-2.6) - black medium SAND; strong MGP smell, some runny NAPL (2.6-3.7) - reddish brown SAND; some HCLO odor, no visible impact
		>1000 1.5	ML	3.7–7.1		(3.7-7.1) - grayish black SANDY SILT; no odor or visible impact

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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AECOM Environment
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Nyack, NY 10960
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Fax: (845) 348-1190

Boring Log

Boring ID: E3

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 4.7'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 822863.68 Easting: 653407.84
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -6.9'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
0.5' - 1.0'	5/10'	1.1	ML	0.0 – 4.0		(0.0-1.0) - Soft black SILT, trace Gravel, wet; slight organic odor, slight sheen (1.0-4.0) - Soft dark brown SILT, wet; no odor or visible impact
4.0' - 5.0'		0.7	SP	4.0 – 5.0		(4.0-5.0) - Reddish brown SAND, some shell fragments, wet; no odor or visible impact

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: E4

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/16/2008

End Date: 10/16/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 5.2'
Total Penetration (ft): 10'

Location: Nyack, New York

Northing: 823097.34 Easting: 653636.46
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -5.6'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	5.2/10'	0.5	ML	0.0 – 0.5		(0.0-0.9) - Soft black SILT, moist; organic odor, no visible impact
				0.5 – 1.0		(0.9-1.1) - Soft dark gray SILT, shell fragments, moist; no odor or visible impact
				1.0 – 3.0		(1.1-3.0) - Semi soft dark gray to black SILT, some shell fragments, moist; no odor or visible impact
		0.6		3.0 – 4.0		(3.0-4.0) - Semi soft dark gray SILT, intermitent reddish brown Sand, shell fragments, some organics, moist; no odor or visible impact
				4.0 – 5.0		(3.0-5.2) - Semi soft dark gray SILT, intermitent reddish brown Sand, shell fragments throughout, moist; no odor or visible impact

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Nyack, NY 10960
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Boring Log

Boring ID: E5B

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822895.66 Easting: 653450.91 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -5.6'
Start Date: 10/17/2008	Total Water Depth (ft): 4' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/17/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	6.4/10'	1.0	ML	0.0 – 1.8		(0.0-0.9) - Soft olive green to gray SILT, some organics, moist; no odor or visible impact (0.9-1.8) - Soft black SILT, some organics, moist; no odor or visible impact
			SP	1.8 – 2.1		(1.8-2.1) - Semi-hard reddish brown coarse to medium SAND, moist; no odor or visible impact
		0.9 0.7	ML	2.1 – 6.0		(2.1-6.4) - Soft dark gray to black SILT with intermitent reddish brown Sand layers, shells throughout, moist; no odor or visible impact

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: E6B

Project: Nyack Former MGP Project #: 05090-022 Client: Orange and Rockland Start Date: 10/17/2008 End Date: 10/17/2008	Contractor: CR Environmental Operator: C. Ryder Drill Rig Type: Vibracore Method: Vibracore Total Water Depth (ft): 5.6' Total Penetration (ft): 10'	Location: Nyack, New York Northing: 822914.03 Easting: 653478.23 NY State Plane - Eastern New York Sediment Surface Elevation (ft NAVD88): -7.8' Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	6.7/10'	0.9 0.9 0.6	ML	0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5		(0.0-1.4) - Soft black SILT, organics, moist; no odor or visible impact (1.4-2.7) - Semi-soft dark gray sandy SILT, some reddish brown coarse to medium Sand layers, some shell fragments throughout, moist; no odor or visible impact (2.7-6.2) - Semi-soft dark gray SILT, shell fragments, some organics, moist; no odor or visible impact. (6.2-6.7) - Wooden piece

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Nyack, NY 10960
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Boring Log

Boring ID: E7

Project: Nyack Former MGP

Project #: 05090-022

Client: Orange and Rockland

Start Date: 10/17/2008

End Date: 10/17/2008

Contractor: CR Environmental
Operator: C. Ryder

Drill Rig Type: Vibracore

Method: Vibracore

Total Water Depth (ft): 11'
Total Penetration (ft): 8'

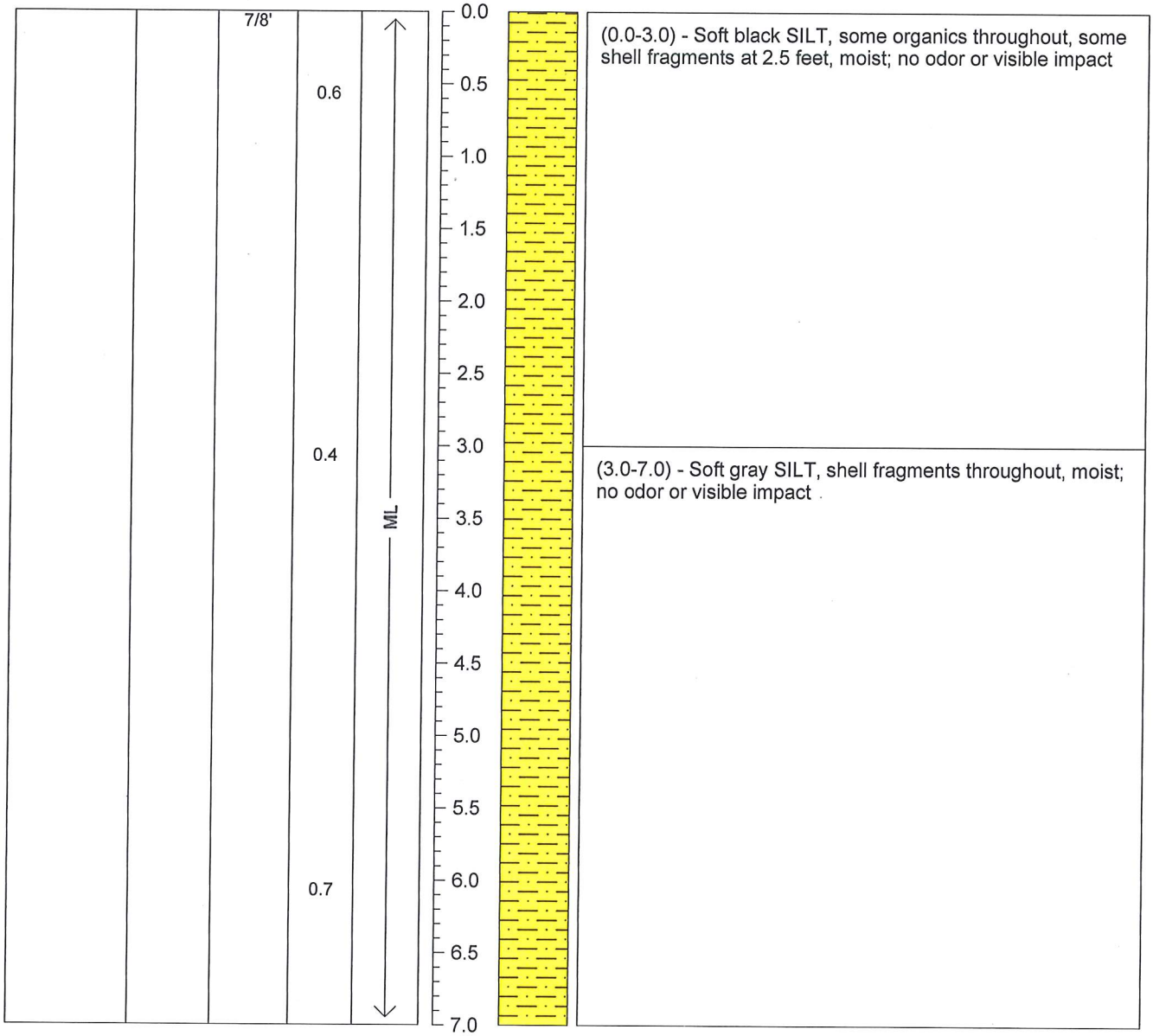
Location: Nyack, New York

Northing: 823125.98 Easting: 653726.62
NY State Plane - Eastern New York

Sediment Surface Elevation (ft NAVD88): -14'

Logged by: M. Stepanova

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	7/8'	0.6	ML	0.0 – 3.0		(0.0-3.0) - Soft black SILT, some organics throughout, some shell fragments at 2.5 feet, moist; no odor or visible impact
		0.4		3.0 – 7.0		(3.0-7.0) - Soft gray SILT, shell fragments throughout, moist; no odor or visible impact
		0.7				



HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

AECOM Environment
78 Main Street
Nyack, NY 10960
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Boring Log

Boring ID: E8

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing:823190.84 Easting: 653430.06 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -9.8 '
Start Date: 10/17/2008	Total Water Depth (ft): 6.2' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/17/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
0.5' - 1.0'	7.1/10'	0.5	SP	0.0		(0.0-0.5) - Soft reddish brown medium to coare SAND, some black Silt, moist; organic odor, no visible impact
			ML	0.5		(0.5-0.8) - Soft gray SILT, moist; no odor or visible impact
			SP			(0.8-1.0) - Hard dark brown medium SAND, some organics; very slight odor, no visible impact
			ML	1.0		(1.0-1.7) - Soft dark gray SILT, some organics, moist; slight HCLO, no visible impact
			SI	1.5		(1.7-1.8) - Semi-soft black SILTY SAND, shell fragments throughout, moist; slight HCLO, no visible impact
3.0' - 4.0'		0.5	SP	2.0		(1.8-4.2) - Hard reddish brown coarse to medium SAND, some gray Silt, organics, shell fragments throughout, moist; no odor or visible impact
				2.5		
				3.0		
				3.5		
				4.0		
		0.5	ML	4.5		(4.2-5.2) - Semi-soft gray SANDY SILT, some shell fragments, organics throughout; no odor or visible impact
				5.0		
				5.5		(5.2-7.1) - Soft gray SILT, shell fragments, moist; no odor or visible impact
				6.0		
				6.5		
				7.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

AECOM Environment
78 Main Street
Nyack, NY 10960
Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: E9

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 823162.07 Easting: 653485.50 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -10.6'
Start Date: 10/17/2008	Total Water Depth (ft): 6.9' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/17/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	3.5/10'		ML	0.0		(0.0-0.7) - Soft dark gray SILT, moist; no odor or visible impact
0.5' - 1.0'		1.4		0.5		
				1.0		(0.7-1.4) - Soft black SILT, some organics, some shell fragments throughout, moist; no odor or visible impact
				1.5		(1.4-2.4) - Black SILT, some reddish brown coarse to medium Sand; no odor or visible impact
2.0' - 3.0'		0.8		2.0		
				2.5		(2.4-3.5) - Soft gray SILT, moist; no odor or visible impact
				3.0		
				3.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Boring Log

Boring ID: E10

Sheet 1 of 1

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 822861.18 Easting: 653611.74 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -12'
Start Date: 10/17/2008	Total Water Depth (ft): 8.0' Total Penetration (ft): 10'	Logged by: M. Stepanova
End Date: 10/17/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	8.6/10'		ML	0.0		(0.0-1.6) - Soft black SILT, moist; no odor or visible impact
0.5' - 1.0'		1.2		0.5		
				1.0		
				1.5		
			S	1.6		(1.6-1.7)- Reddish brown medium SAND, some black Silt; no odor or visible impact
				1.7		(1.7-3.0) - Soft dark gray to black SILT, moist; no odor or visible impact
				2.0		
				2.5		
3.0' - 4.0'		0.2		3.0		(3.0-4.0) - Semi-hard dark gray SILT, moist; no odor or visible impact
				3.5		
				4.0		(4.0-6.0) - Dark gray SILT, intermitent reddish brown sand layers; no odor or visible impact
				4.5		
				5.0		
				5.5		
				6.0		(6.0-8.6) - Soft dark gray SILT, some shell fragments throughout, moist; no odor or visible impact
				6.5		
				7.0		
				7.5		
				8.0		
			ML	8.5		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

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Nyack, NY 10960
Phone: (845) 348-1520
Fax: (845) 348-1190

Boring Log

Boring ID: E11

Project: Nyack Former MGP	Contractor: CR Environmental Operator: C. Ryder	Location: Nyack, New York
Project #: 05090-022	Drill Rig Type: Vibracore	Northing: 823220.62 Easting: 653446.16 NY State Plane - Eastern New York
Client: Orange and Rockland	Method: Vibracore	Sediment Surface Elevation (ft NAVD88): -10.6'
Start Date: 10/17/2008	Total Water Depth (ft): 5.5' Total Penetration (ft): 5'	Logged by: M. Stepanova
End Date: 10/17/2008		

SAMPLE						
Sample Interval	Total Recovery	PID (ppm)	USCS	Depth (ft)	Lithology	Lithologic Description
	3.3/9.5'		SP	0.0		(0.0-0.3) - Soft reddish brown medium SAND, some black Silt, moist; no odor or visible impact
			ML	0.5		(0.3-0.9) - Soft dark gray to black SILT, some Sand, moist; no odor or visible impact
				1.0		(0.9-1.2) - Olive green to gray SILT, some organics fibers; slight HCLO, no visible impact
						(1.2-1.4) - Soft black SANDY SILT, some Gravel, moist; strong HCLO, sheen
			SM	1.5		(1.4-3.3) - Hard reddish brown medium SAND, some gray Silt; no odor or visible impact
				2.0		
				2.5		
				3.0		

HCLO - hydrocarbon-like odor
MGP - manufactured gas plant

Appendix B

Pre-Characterization Work Plan

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Appendix B

Pre-Characterization Work Plan

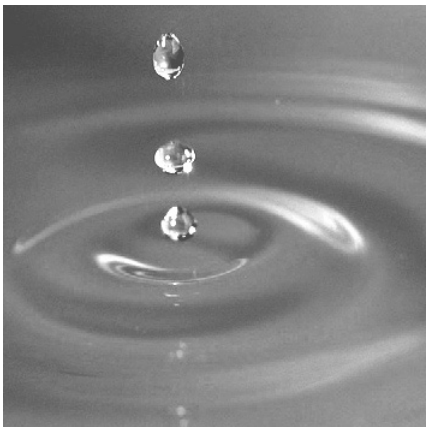
Nyack MGP Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

Submitted By:
GEI Consultants, Inc.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

March 2012
Project #: 121640-1001

James Edwards
Project Geologist



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Figures

Abbreviations and Acronyms

ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
bss	Below Sediment Surface
BTU	British Thermal Unit
EPA	United States Environmental Protection Agency
GEI	GEI Consultants, Inc.
HSA	Hollow-Stem Auger
MGP	Manufactured Gas Plant
NAPL	Non-Aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&R	Orange & Rockland Utilities, Inc.
OU2	Operable Unit 2
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PID	Photo-Ionization Detector
SVOC	Semi-Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compound

1. Soil and Sediment Pre-Characterization Sampling and Analyses

The purpose of the Pre-Characterization Sampling and Analysis Plan is to develop a waste characterization profile for soil and sediment in the remedial areas of Operable Unit 2 (OU2) of the Nyack Manufactured Gas Plant (MGP) site. The soil remedial areas are shown on Figure B1. The sediment remedial areas are shown on Figure B2.

1.1 Scope of Work

Soil Borings

Nine soil borings (PCSB1-PCSB9) will be advanced in Soil Removal Areas A, B, and C. The locations of the borings are shown on Figure B1. The number of soil borings has been determined from the sampling frequency required by several potential disposal facilities including:

- Bayshore Recycling – 75 Crows Mill Road, Keasby, NJ
- Clean Earth – 7 Steel Road, Morrisville, PA
- ESMI – 304 Towpath Road, Fort Edward, NY

While these boring locations coincide with some boring locations for the Pre-Design Investigation (PDI), separate borings are anticipated to enable the collection of sufficient sample material for the pre-characterization laboratory program.

The borings will be advanced using direct-push or hollow-stem auger drilling rig. Borings will be advanced to 7 feet below ground surface (bgs). If refusal is experienced prior to achieving the target depth, the boring will be offset slightly, and a new boring will be advanced. Each soil boring sample will be continuously logged for visual impacts and soil type, screened for volatile organic vapors with a photo-ionization detector (PID), and photographed.

A composite sample of soil sample will be collected from the 0 to 7 feet bgs interval. In addition to the composite sample, discrete (grab) samples will also be taken from each soil boring. If insufficient material is collected in the initial boring to accommodate all the sampling requirements, an additional boring will be advanced in the immediate vicinity, in order to collect the requisite amount of soil.

Sediment Vibracores

Twenty one vibracores (PCSD1-PCSD21) will be advanced in Sediment Removal Areas shown on Figure B2. The number of vibracore samples has been determined from the sampling frequency required by the potential disposal facilities (Bayshore Recycling, Clean Earth, and ESMI New York). The target depths of the vibracore samples will vary depending on which area is being sampled. The target depths for the sampling will be the same as the target depths for sediment removal. These depths are shown on Figure B2 and range from 2 feet to 7 feet below sediment surface (bss).

1.2 Laboratory Analyses

The samples will be analyzed by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (NYSDOH ELAP)-certified laboratory. As required by the disposal facilities, the samples will be analyzed for the following parameters:

- Total Petroleum Hydrocarbons (TPH) – U.S. Environmental Protection Agency (EPA) Method 8015 GRO/DRO
- Total Volatile Organic Compounds (VOCs) – EPA Method 8260B
- Total Semi-Volatile Organic Compounds (SVOCs) – EPA Method 8270C
- Total Polychlorinated Biphenyls (PCBs) – EPA Method 8082
- Total Metals – EPA Method 6010B
- Total Cyanide – EPA Method 9012A
- Percent Sulfur – American Society for Testing and Materials (ASTM) Method D129-64
- Mercury – EPA Method 7471
- Toxicity Characteristic Leaching Procedure (TCLP) VOC – EPA Method 1311/8260B
- TCLP SVOCs – EPA Method 1311/8270D
- TCLP Metals – EPA Method 1311/6010B
- Reactivity (Cyanides and Sulfides) – EPA Method SW846 Chapter 7.3
- Toxicity – EPA Method 9023B
- Ignitability – EPA Method 1010/1030
- Corrosivity – EPA Method 9040C/9045
- British Thermal Unit (BTU) – ASTM Method D240-87

Additional design-related physical testing will be conducted for the following parameters:

- Unit Weight
- Grain Size – ASTM D422/D1140
- Atterberg Limits – ASTM D4318, shrinkage, plastic, and liquid limits, index values
- Dewatering with 4% Portland Cement

- Moisture Content/Paint Filter Curve – ASTM D2216

A total of six grab (not composited) sediment samples will be collected for the design-related samples. Five samples will be collected from Area 1 and one sample will be collected from Area 2, which will represent the range of materials found in each area (PDI Work Plan cross sections A-A', C-C' and G-G'). These locations are indicated in Table B2 and coincide with locations for chemical pre-characterization, which are shown on Figure B2.

The goal of the Dewatering and Drainage Curve testing is to demonstrate under what conditions the sediments can be dewatered to pass the paint filter test, and achieve a water content of 18% or less (ESMI, NY applies a surcharge to soils above 18% water content). The test will be conducted as follows: The sample to be tested will be divided into four equivalent subsamples. The first subsample will be tested immediately for water content/paint filter and lab remolded unit weight to represent the initial, time zero undrained condition. The remaining three samples will be allowed to drain in flat pans for three different time periods before conducting water content/paint filter tests. The dewatered material left after paint filter test will be lab remolded for unit weight. This will result in a curve of water content and lab remolded unit weight as a function of drainage time. The free water removed from the pans will be weighed and observed for sheens or non-aqueous phase liquid (NAPL) blebs. Silty samples that do not drain rapidly will be tested for dewatering by the addition of 4% by weight of Portland Cement. A cure time of 2 hours will be allowed prior to final water content/paint filter testing and lab remolded unit weight.

1.3 Sampling Frequency

A summary of the types and numbers of samples required for each analysis is shown in Table B1. Additional detail for the design-related physical characterization is shown in Table B2.

1.4 Reporting

Borelogs and sediment core logs from the pre-characterization sampling will be prepared to show the results of the physical observations and integrated with those from the PDI. Tables will be prepared to summarize the results of the laboratory analyses. The results will be presented and discussed in the Remedial Design documents and, when appropriate, transmitted to the potential disposal facilities for review and approval.

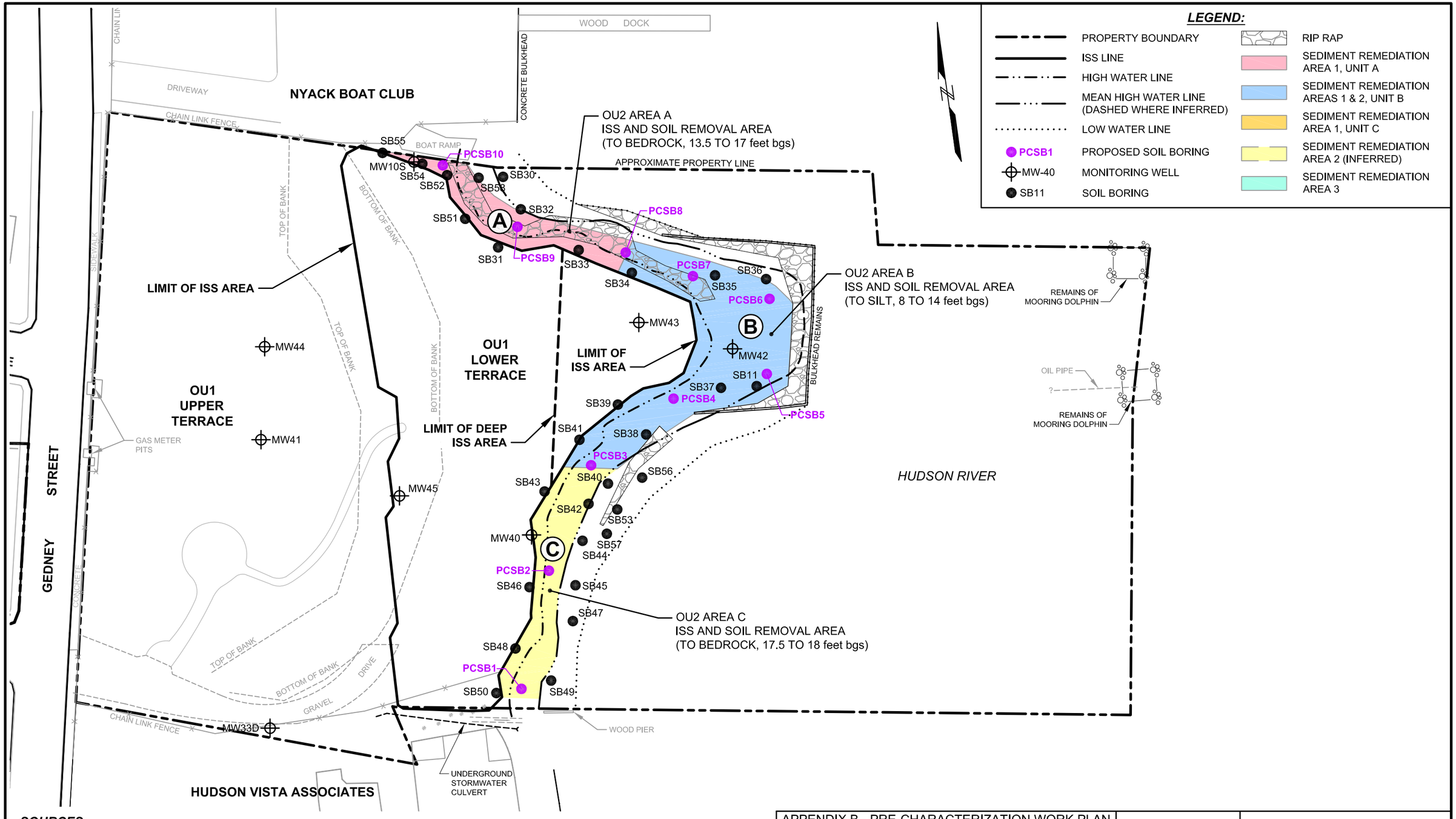
Table B1 Summary of Pre-Characterization Samples

Analysis	EPA Method	Number of Samples					
		Grab			Composite		
		Total	Soil	Sediments	Total	Soil	Sediments
Total VOCs	8260B	-	-	-	17	5	12
Total Metals	6010B	-	-	-	17	5	12
Total SVOCs	8270C	-	-	-	17	5	12
TPH	8015 GRO/DRO	31	10	21	17	5	12
TOX	9023B	31	10	21			
Total PCBs	8082	-	-	-	17	5	12
Ignitability	1010/1030	-	-	-	6	2	4
Corrosivity	9040C/9045	-	-	-	6	2	4
Reactivity (Cyanides & Sulfides)	SW846 Chapter 7.3	-	-	-	6	2	4
Total Cyanide	9012A	-	-	-	17	5	12
Sulfur	ASTM D129	-	-	-	15	5	10
Mercury	7471	-	-	-	15	5	10
TCLP VOC	1311/8260B	-	-	-	6	2	4
TCLP SVOCS	1311/8270D	-	-	-	6	2	4
TCLP Metals	1311 / 6010B	-	-	-	6	2	4
BTU	ASTM D240-87	-	-	-	17	5	12
Moisture Content	ASTM D2216	-	-	-	-	-	12
Unit Weight			-	-	-		12
Additional Physical Testing	See Table B2	-	-	6	-	-	-

Table B2 Physical Pre-Characterization Testing for Design

Area	Sample Location	Sample Depth Interval (feet bss)	Sample Size	Unit Weight	Grain Size ASTM D422	Grain Size ASTM D1140 (#200 Sieve)	Atterberg Limits ASTM D4318	Dewatering (Add 4% Portland Cement)	Water Content/Paint Filter SW846 9095B
1A Fill	PCSD10	0-4	32 oz	x	x		x	x	x
1A Silty Sand	PCSD10	4-7	32 oz	x	x		x	x	x
1B Silty Sand	PCSD7	0-3	32 oz	x	x		x	x	x
1C Silt	PCSD16	0-2	32 oz	x		x	x	x	x
1C Silt	PCSD19	0-2	32 oz	x		x	x	x	x
2 Silt	PCSD21	0-2	32 oz	x		x	x	x	x

Figures



SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 19: SOIL ALTERNATIVES S4* OF THE OU2 FEASIBILITY STUDY REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: AUGUST 2010.

APPENDIX B - PRE-CHARACTERIZATION WORK PLAN
PRE-DESIGN INVESTIGATION WORK PLAN
OPERABLE UNIT 2
NYACK FORMER MGP SITE
NYACK, NEW YORK

ORANGE AND ROCKLAND UTILITIES, INC.
SPRING VALLEY, NEW YORK

GEI Consultants

Project 121640-1001

SOIL SAMPLE LOCATIONS

March 2012 Figure B1

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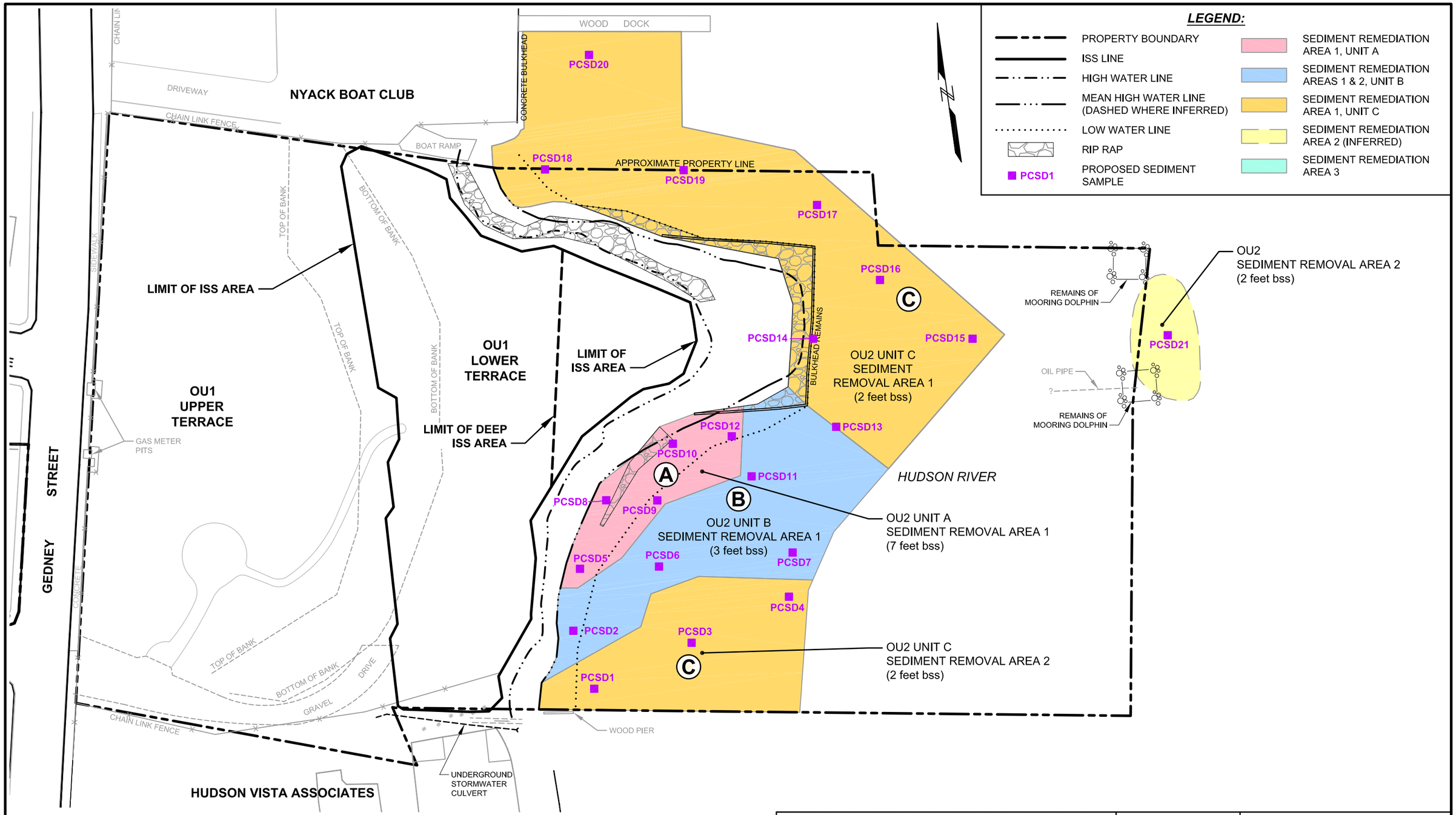

SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 22: SEDIMENT ALTERNATIVE SED4* OF THE OU2 FEASIBILITY STUDY REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: AUGUST 2010.

0 50 100

SCALE, FEET

APPENDIX B - PRE-CHARACTERIZATION WORK PLAN
PRE-DESIGN INVESTIGATION WORK PLAN
OPERABLE UNIT 2
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NYACK, NEW YORK

ORANGE AND ROCKLAND UTILITIES, INC.
SPRING VALLEY, NEW YORK

GEI Consultants

Project 121640-1001

SEDIMENT SAMPLE LOCATIONS

March 2012 Figure B2

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Appendix C

Field Sampling and Analytical Plan

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Appendix C

Field Sampling and Analytical Plan

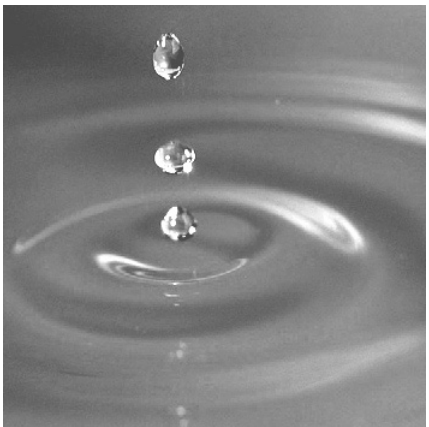
Nyack MGP Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

Submitted By:
GEI Consultants, Inc.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

March 2012
Project #: 121640-1001

James Edwards
Project Geologist



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Figures

Abbreviations and Acronyms

ASTM	American Society for Testing and Materials
CAMP	Community Air Monitoring Plan
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	United States Environmental Protection Agency
FSAP	Field Sampling and Analytical Plan
GEI	GEI Consultants, Inc.
GPS	Global Positioning System
HASP	Health and Safety Plan
HSA	Hollow-Stem Auger
ID	Inner Diameter
IDW	Investigation-Derived Waste
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
NTU	Nephelometric Turbidity Unit
NYSDEC	New York State Department of Environmental Conservation
O&R	Orange & Rockland Utilities, Inc.
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PFD	Personal Flotation Device
PID	Photo-ionization Detector
PPE	Personal Protection Equipment
QAPP	Quality Assurance Project Plan
RQD	Rock Quality Designation
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USCS	Unified Soil Classification System
VOC	Volatile Organic Compound

1. Introduction

This Field Sampling and Analytical Plan (FSAP) presents the methods and procedures to be used for performing the Pre-Design Investigation (PDI) at the Nyack Manufactured Gas Plant (MGP) site located in Nyack, New York.

1.1 Overview of Field Activities

The following field activities will be performed:

- **Reconnaissance** – A reconnaissance will be performed to observe site conditions.
- **Utility Locating** – Subsurface utilities will be identified and marked-out.
- **Soil Boring Advancement –** Soil borings will be advanced in the soil remedial areas.
- **Bedrock Coring** – Bedrock will be cored in the soil remedial areas.
- **Surface Sediment Sampling** – Surface sediment samples will be collected at locations adjacent to the site in the Hudson River.
- **Sediment Coring** – Sediment cores will be advanced at the Nyack Boat Club property and adjacent to the moorings in the Hudson River.
- **Surveying** – The locations and elevations of the PDI data points and important site features will be surveyed, and the shoreline area.

2. General Field Guidelines

2.1 Site Hazards

Potential on-site surface hazards, such as sharp objects, overhead power lines, energized areas, and building hazards will be identified prior to initiation of the field work. The potential hazards at the site will be identified during a site reconnaissance by the project team on the first day of the investigation field activities. Additional safety measures to be undertaken for the work performed during the investigation are described in the site-specific Health and Safety Plan (HASP).

2.2 Underground Utilities

Underground utilities, including electric lines, gas lines, storm and sanitary sewers, and communication lines will be identified prior to initiation of drilling and other subsurface work. Underground utility location will be accomplished as follows:

- All PDI data points will be flagged or marked-out with white paint.
- Dig Safely of New York 800-272-4480 will be contacted to initiate the locating activities. New York State law requires that Dig Safely of New York be notified at least two working days, and not more than 10 working days, before subsurface work is performed.
- Companies and municipalities with subsurface utilities present will locate and mark-out all subsurface utility lines.

2.3 Field Log Books

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

- Field books will be assigned a unique identification number.
- Field books will be bound with consecutively numbered pages.
- Field books will be controlled by the Site Manager while field work is in progress.
- Entries will be written with waterproof ink.
- Entries will be signed and dated at the conclusion of each day of field work.

- Erroneous entries made while field work is in progress will be corrected by the field person that made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction.
- Corrections necessary after departing the field will be made by the person who entered the original information. Corrections will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.

At a minimum, daily field book entries will include the following information:

- Location of field activity
- Date and time of entry
- Names and titles of field team members on site and site contacts
- Names, titles of any site visitors, as well as the date and time entering and leaving the site
- Weather information, for example: temperature, cloud coverage, wind speed, and direction
- Purpose of field activity
- A detailed description of the field work conducted
- Sample media (soil, sediment, groundwater, etc.)
- Sample collection method
- Number and volume of sample(s) taken
- Description of sampling point(s)
- Volume of groundwater removed before sampling
- Preservatives used
- Analytical parameters
- Date and time of collection
- Sample identification number(s)
- Sample distribution (e.g., laboratory)
- Field observations
- All field measurements made during soil screening with the photo-ionization detector (PID), and groundwater sampling (pH, temperature, conductivity, turbidity, etc.)
- References for all maps and photographs of the sampling site(s)
- Information pertaining to sample documentation such as:

- Dates and method of sample shipments
- Chain-of-custody record numbers
- Federal Express or UPS air bill numbers

3. Field Equipment Decontamination and Management of Investigation-Derived Residuals

3.1 Decontamination Area

A temporary decontamination area lined with polyethylene sheeting will be constructed for personal decontamination and for decontamination of the drilling and test pitting equipment. Wash water collected from the decontamination activities will be collected in 55-gallon drums or a bulk tank; and managed as described in Section 3.3.

3.2 Equipment Decontamination

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

- All drilling equipment including the backhoe bucket, and drilling rig; augers; bits; rods; tools; split-spoon samplers; and tremie pipes will be cleaned with a high-pressure washing unit before beginning work.
- Tools, drill rods, and augers will be placed on polyethylene plastic sheets following pressure washing. Direct contact with the ground will not be allowed.
- All augers, rods, and tools will be decontaminated between each drilling location.
- The back of the drill rig and all tools, augers, and rods will be decontaminated at the completion of the work and prior to leaving the site.

3.2.1 Sampling Equipment Decontamination

Suggested Materials

- Potable water
- Phosphate-free detergent (such as Alconox™ or Simple Green™)
- Dei-ionized water
- Aluminum foil
- Plastic/polyethylene sheeting
- Plastic buckets and brushes
- Personal protective equipment (PPE) in accordance with the HASP

Procedures

- Prior to sampling, all non-dedicated sampling equipment (bowls, spoons, interface probes, etc.) will be washed with potable water and a phosphate-free detergent (such as Alconox™). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, etc.
- The sampling equipment will then be rinsed with potable water followed by a de-ionized water rinse.
- Between rinses, equipment will be placed on polyethylene sheets or aluminum foil, if necessary. Washed equipment will not be placed directly on the ground.
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

3.3 Management of Investigation-Derived Residuals

3.3.1 Decontamination Fluids and Development and Purge Water

Hot-water pressure wash, decontamination, and development and purge water will be collected in 55-gallon drums or a bulk tank. The storage drums or tank will be labeled as "pending analysis – investigation-derived residual decontamination water" and temporarily stored on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

3.3.2 Drill Cuttings

Drill cuttings will be contained in 55-gallon drums or in a covered roll-off container. The drums or covered roll-off container will be labeled as "pending analysis – investigation-derived residual – soil from drill cuttings". If drums are used, they will be temporarily stored on wooden pallets in a plastic-lined containment area pending characterization and proper disposal.

3.3.3 Personal Protective Equipment

All PPE will be placed in 55-gallon drums, a lined cardboard yard box, or the covered roll-off container for proper disposal.

3.3.4 Dedicated Sampling Equipment

All used groundwater sampling equipment (e.g., disposable polyethylene bailer and polypropylene tubing) will be placed in the 55-gallon drums or cardboard yard boxes for disposal.

4. Subsurface Soil Sampling Procedures

4.1 Introduction

Subsurface investigation activities to be conducted at the site consist of:

- The advancement of overburden soil borings
- Sediment probing and sampling

Procedures for these activities are described in the following sections.

4.2 Soil Borings and Subsurface Soil Sampling

The following methods will be used during installation of the soil borings:

Required Equipment

- Field book
- Project plans
- PPE in accordance with the HASP
- Stakes, flagging and marking paint
- Plastic bags for soil screening samples
- Tape measure
- Decontamination supplies
- Water level indicator
- PID with a 10.2 or 10.6 eV lamp
- Camera
- Clear tape, duct tape
- Laboratory sample bottles
- Coolers and ice
- Shipping supplies

4.4.1 Overburden Drilling and Geologic Logging Methods

- Soil borings will be sampled with the hollow-stem auger (HSA) method. The use of these drilling methods will also allow for a more accurate determination of the depths and thicknesses of geologic units.
- Soil samples will be collected continuously from the ground surface to the bottom of the borings using 2-foot long by 2-inch diameter split-spoon samplers.
- Soil samples retrieved from the borehole will be visually described for: 1) percent recovery, 2) soil type, 3) color, 4) moisture content, 5) texture, 6) grain size and shape, 7) consistency, 8) visible evidence of staining or other hydrocarbon-related impacts, and 9) any other relevant observations. The descriptions will be in accordance with the Unified Soil Classification System (USCS) and the American Society for Testing and Materials (ASTM) guidelines as shown in Figure 2.
- Immediately after describing the core, a representative portion of the sample will be placed in a re-sealable plastic (e.g., "ziplock") bag filled approximately half full. The bag will be labeled with the boring number and interval sampled.
- After allowing the bagged soil to warm, the tip of the sample probe attached to the PID will be inserted into the bag to measure the headspace for organic vapors.
- Soil remaining after completion of sample description, collection, and field screening will be disposed of properly.
- All borings will be sealed with bentonite hole plug or cement/bentonite grout following completion.
- All drilling equipment will be decontaminated between each boring in accordance with methods specified in Section 3.2.
- The field geologist will log borehole geology and headspace measurements in the field book and the Drilling Record shown in Figure 1, or similar form and any other observations (e.g., coal tar-impacted soil; coal tar non-aqueous phase liquid (NAPL)-impacted soil, and hydrocarbon odors, staining, or sheen, etc.).

4.4.2 Overburden Soil Sampling

- The number and frequency of samples to be collected from each boring and the associated analytical parameters are summarized on Table 1 in the PDI Work Plan.
- Samples for laboratory analyses will be collected directly from the acetate liners, split-spoons, or sonic core liners and placed into appropriate containers, and compacted to minimize headspace and pore space.
- The sample containers will be labeled, placed in a laboratory-supplied cooler, and packed with ice. The coolers will then be shipped to the laboratory for analysis.

- If there is a delay of sample shipment due to insufficient samples to warrant overnight delivery, the samples will be stored in a cool, secure place with sufficient ice to maintain a temperature of 4˚ C.
- Chain-of-custody procedures will be followed as outlined in the Quality Assurance Project Plan (QAPP) using the chain-of-custody form as shown in Figure 5.
- The sampling equipment will be decontaminated between samples in accordance with procedures described in Section 3.
- Soil remaining after completion of sample description, collection, and field screening will be disposed of properly.
- The sample locations, descriptions, and depths will be recorded on the borelogs in the field book.

4.4.3 Bedrock Drilling and Logging Method

Bedrock coring is specified at four locations in the PDI Work Plan.

- Similar to the overburden soil sampling, soil at the location of each bedrock core location will be sampled with split-spoon samplers inside of a larger diameter (8 ¼-inch inner diameter [ID]) HSA auger. The augers will be advanced to the bedrock surface, and the rock surface will be confirmed by attempting to drive a split-spoon sampler or the sonic core barrel sampler. When the core barrel or split-spoon sampler meets with refusal, augers or the sonic drill head will be used to advance the borehole 2-feet into the bedrock unit (bedrock rock socket).
- A Schedule 40, 4-inch diameter steel isolation casing will then be inserted into the borehole to prevent any potential migration of dense non-aqueous phase liquid (DNAPL) into the bedrock cores or wells from the overburden soils, and to allow water to be circulated for completing the rock coring. Alternatively, cores may be collected inside of the HSAs if significant NAPL impacts are not identified in the overburden soil.
- After the curing process is complete, a 3 ⅞-inch diameter HQ rock core barrel equipped with a diamond cutting bit will be inserted into the borehole and used to advance the borehole into the bedrock unit.
- The core barrel will be advanced in depth intervals ("runs") of up to 5 feet in length by a drill rod. After each run is complete, the core will be extracted from the borehole via a wire line tool and the core will be placed into a wooden core storage box. The field geologist will then photograph the core, and log the core for: 1) length of rock recovered, 2) the percent of the run recovered, 3) the rock quality designation (RQD), 4) the rock type (USCS), 5) evidence of weathering and the

presence and orientation of fractures and voids, and 6) any visible or olfactory evidence of MGP-related residuals.

- Core samples retrieved from the borehole will be visually described for: 1) percent recovery, 2) soil type, 3) color, 4) moisture content, 5) texture, 6) grain size and shape, 7) consistency, 8) visible evidence of staining or other hydrocarbon-related impacts, and 9) any other relevant observations. The descriptions will be in accordance with the USCS and the ASTM guidelines (Figure 2).
- All corings not finished as a monitoring well will be sealed with bentonite or cement/bentonite grout following completion.
- All drilling equipment will be decontaminated between each boring in accordance with methods specified in Section 3.2.
- The field geologist will log borehole geology and headspace measurements in the field book and the Drilling Record shown in Figure 1, or similar form and any other observations regarding the presence of MGP-related residuals.

4.4.4 Borehole Abandonment

All auger soil borings and bedrock cores will be filled with bentonite hole plug or grouted to the ground surface following the completion of the soil sampling to prevent cross-contamination of permeable zones. If the grouting method is used, borings will be filled using a cement/bentonite grout mixture with the following specifications:

- Bentonite will be powdered sodium montmorillonite furnished in moisture resistant sacks without additives.
- Cement shall be a low-alkaline Portland cement, Type I in conformance with ASTM C-150 and without additives.
- The cement/bentonite grout mixture shall be to the following proportion:
  - Three sacks (94 pounds) of Type I Portland cement
  - 14 pounds of granular bentonite (5% mix)
  - 25 gallons of water

The cement will be mechanically mixed, above ground, with water from a potable water source. Bentonite will be added to ensure a lump-free consistency. The mixture will be pumped through a tremie pipe as the drill is being withdrawn.

5. Sediment Investigation

5.1 Sediment Sampling

Sediment samples will be collected at the locations described in the PDI Work Plan.

- Sediment sampling locations will be finalized in consultation with the New York State Department of Environmental Conservation (NYSDEC).
- Sample locations not accessible by wading will be sampled using a boat. While collecting the sediments at each station, the boat will be anchored. The vessel will be mobilized in such a way as to minimize the potential for disturbance of the sediment and surface water.
- A global positioning system (GPS) unit will be used to position the sampling personnel at the sample station coordinates. If obstructions such as boulders or cobbles are encountered at a specific station, the location of the station may be changed to collect fine-grained (< 4 mm) sediments required by the laboratory tests. In the case that cobbles or boulders are encountered, samples will be collected as close as possible to the specified sample location.
- Upon arrival at each sampling station, a depth-to-sediment measurement will be collected to record the water depth. Measurements will be taken with the boat's navigational depth finder or a hand held depth-to-water meter. The water depth will be recorded with an accuracy of 0.1 feet.
- A ponar grab sampler (standard size) will be used for collecting sediments. The ponar grab sampler is suitable for collecting soft sediments and also for harder sediments containing significant quantities of sand, gravel, and firm clay. The sample depth for this device is from 0 to 6 inches. The ponar grab sampler will be lowered and raised from the sediment surface, by hand.
- Field personnel will record observations of the physical characteristics of the sediment encountered at each sampling station and also important observations regarding the physical characteristics of the study area. Information recorded will include: 1) sample station designation; 2) presence of fill material, coal or coke, or asphalt- or tar-like materials at the shoreline; 3) apparent depositional and erosional environment at the station; 4) presence or absence of aquatic vegetation; 5) sediment color, texture, and particle size; and 6) odor and presence of sheens or NAPL. The information will be recorded on the sediment sample log and core logs included as Figures 3 and 4.

- After each sample is collected, the station will be located so that the site may be re-sampled in the future. The mapping will include the following: 1) the location (latitude and longitude) identified using a GPS receiver; 2) a hand-plotted estimate of the location on a field map of the study area; 3) where possible, significant features on the shore will be photographed as location references; and 4) notes will also be added to the field map showing any important site features that may have bearing on the sediment condition (e.g., pipe outfalls or subsurface debris). The locations of the important site features, if not previously mapped, will be located using the GPS unit.
- Sediments collected at each station will be placed into clean, laboratory-supplied glassware for analysis and archiving.
- Samples will be carefully packed to avoid breakage during shipment. The cooler will be shipped overnight or delivered to the laboratory for analysis.
- Chain-of-custody procedures will be followed as outlined in the QAPP using the chain-of-custody form shown in Figure 5.
- All measurements and observations discussed above for both the field sampling and field processing of the sediments will be recorded in a field book.

5.2 Sediment Coring

Required Equipment

- Core Log Form
- Core storage racks to hold cores vertical and cold during temporary storage on-board coring vessel
- Assorted nautical equipment (e.g., anchors, lines, personal flotation devices [PFDs])
- Waterproof logbooks, pens, and labels
- Permanent marker or grease pencil
- Echo sounder with a resolution of 0.1 foot
- Depth measuring plate
- Tape measure and ruler
- Submersible pump and hose
- Decontaminated core tube caps
- Electrical or duct tape
- Camera
- Decontamination equipment/supplies

Decontamination of Equipment

- Decontamination of the polybutyrate core tubes, core caps, stainless steel core cutter/catcher, hack saw blades, drill bits, and assemblies will be performed prior to vessel departure. The core liners, caps, core cutter, hack saw blades, drill bits, and any other equipment which may come into contact with sediments will be decontaminated. The decontamination activities will occur on shore and will be conducted with enough time before vessel departure to allow for the decontamination activities to be completed (including drying of decontaminated equipment). A sufficient amount of decontamination equipment and supplies will be brought on the coring vessel to accommodate the need for miscellaneous, unforeseen decontamination.

Coring Procedures

- The vibracoring vessel will be positioned at a coring location in accordance with the PDI Work Plan.
- Initiate the Core Description Form shown in Figure 4.
- Don PPE as required by the HASP.
- Activate the submersible pump in preparation for cleaning the vibracore and coring tube, upon retrieval.
- At the start of the coring program, two attempts will be made at coring without the use of a core catcher. If the sediment cannot be retained in the core tube, then core catchers will be used for the remainder of the program at stations with similar materials.
- Slowly winch the vibracore into its deployment orientation.
- Obtain water depth (to nearest 0.1 foot) from the echo sounder and record on Sediment Core Description Form shown on Figure 4.
- Slowly lower the vibracore into the water using the winch or other deployment equipment.
- Slowly lower the vibracore through the water column to the sediment surface using the water depth reading.
- Record the "zero" mark on the winch cable.
- Turn motor of vibracorer on. Slowly lower vibracore into sediment to penetrate the sediment to the target depth or to refusal. Record the start time on the Sediment Core Description Form shown in Figure 4.

- Lower vibracore approximately 1 foot more to obtain a "plug" at the bottom of the core (i.e., to minimize loss of sediment from core). Record the end time on the Sediment Core Description Form shown in Figure 4.
- On completion of the required penetration, or upon vibracore refusal, de-energize the vibracore and allow the core to stabilize. Record the vibracore penetration depth on Figure 4.
- Record the final core location coordinates on the Sediment Core Description Form.
- Slowly raise the vibracore, while maintaining the core in a vertical position as field conditions allow.
- Bring vibracore to sampling vessel deck while maintaining the core in a vertical position. Remove core cutter and core catcher, replace with cap, and secure cap with duct tape.
- Clean the vibracore barrel and coring assembly by hosing down the equipment with river water.
- Remove the core tube from the vibracore barrel and place a cap on bottom of the coring tube, keeping the core tube in an upright position, as field conditions allow.
- Return the vibracore device to its onboard, deck storage location.
- Clean the core tube by hosing it down with river water. Care should be taken not to direct water into the open end of the core tube.
- Keeping the core tube upright, as field conditions allow, use a hacksaw with a decontaminated blade or drill with a decontaminated drill bit to make a cut/hole in the core tube approximately 1 to 2 inches below the water level and allow the excess water to drain out. Continue to lower the water level in 1 or 2 inch increments until 3 to 4 inches of water remain above the sediment.
- Cap the cut end of the tube, secure cap with duct tape, and draw an arrow toward the cap. Draw an arrow on the coring tube with permanent marker and label "top" to indicate the top of the core. Label the core with the location, date, and time, and record this information on the Sediment Core Description Form.
- Mark the side of the core to indicate the sediment-water interface. Measure the recovered length of the sediment in the core tube (to the nearest 0.1 foot to the extent possible) and record it on the Core Log Form. The distance between the top of the sediment in the coring tube and the bottom of the coring tube corresponds to the recovered length. Apparent gaps should be noted on the Core Log Form and the length and location(s) of the gap(s) should be noted. The total gap length will be subtracted from the total recovery length.
- Store the core vertically in a core storage rack and transport the core to the sample processing area. Cores greater than 5.5 feet will be segmented on the vessel to allow

for storage and transportation. Cut these cores at the location of a planned sample segmentation using a hacksaw with a decontaminated blade and recap the exposed ends. Add appropriate markings to indicate the location and unique identification of each segment. (Segments will be identified as AB, BC, CD, etc., with the first letter marked just below the upper cut, and the second letter marked just above the lower cut.)

- Calculate penetration percentage using the following equation:

$$\text{Penetration (\%)} = \frac{\text{actual penetration (feet)}}{\text{target penetration (feet)}} \text{ x } 100$$

- Actual penetration is the depth advanced into the sediment not including the depth advanced to form a plug.
- Record penetration percentage on the Sediment Core Description Form.
- Containerize excess sediment on the vessel. The field crew will make reasonable attempts to containerize "gross" sediment material produced from coring. Sediment residuals generated from rinsing operations will not be included in such containerization. Dispose of with the investigation-derived waste (IDW) soil from the drilling task.
- Verify that the lengths of the core tubes, water depth, and positioning data have been recorded on the Sediment Core Description Form.
- Prior to transit to the next coring location or return to the marina, decontaminate the coring equipment and sampling vessel.
- Proceed to next core location specified for that day and repeat above procedures.

6. Air Monitoring

6.1 Introduction

Two types of air monitoring will be performed during the site investigation: 1) work zone monitoring for protection of the workers performing the site investigation, and 2) community air monitoring at the perimeter of the work site for protection of the local community.

6.2 Breathing Zone Air Monitoring During Drilling and Sampling

Monitoring of air in the breathing zone within the work site will be conducted periodically during all drilling and sampling activities.

- A PID will be used to monitor for volatile organic compounds (VOCs) or other organic vapors in the breathing zone and borehole, and to screen the samples.
- Additional air monitoring may be required as specified in the site-specific HASP.
- The PID readings will be recorded in the field book and on the boring log during drilling activities. The procedure for the PID operation and calibration is included in the HASP. Note that equipment calibration will be performed as often as needed to account for changing conditions or instrument readings. The minimum frequency of calibration is specified in the HASP; more frequent calibration will be performed if spurious readings are observed or there are other problems with the instruments.

6.3 Community Air Monitoring

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

The procedures and action levels for community air monitoring are presented in the Community Air Monitoring Plan (CAMP) that has been prepared for the PDI at the Nyack MGP Site.

7. Field Instruments and Calibration

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

The following field instruments will be used during the investigation:

- PID
- Particulate monitors
- pH, specific conductivity, oxidation-reduction potential and temperature meter
- Turbidity meter

7.1 Portable Photo-Ionization Analyzer

- The photo-ionization analyzer will be equipped with either a 10.2 or a 10.6 eV lamp. The PID is capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the VOCs on the United States Environmental Protection Agency (EPA) Target Compound List (TCL).
- Calibration must be performed at the beginning of each day of use with a standard calibration gas having a concentration of 100 parts per million of isobutylene. If the unit experiences abnormal perturbation or erratic readings, more frequent or additional calibration will be required.
- All calibration data must be recorded in the project field notebooks.
- A battery check must be completed at the beginning and end of each working day.
- All changes to the PID will be noted in the field notes (such as lamp or filter cleaning or replacement or change of instrument).

7.2 pH Meter

- Calibration of the pH meter must be performed at the start of each day of use, and after very high or low readings as required by this Plan, according to manufacturer's instructions.
- National Institute of Standards and Technology - traceable standard buffer solutions which bracket the expected pH range will be used. The standards will be pH of 4.0, 7.0, and 10.0 standard units.
- The use of the pH calibration must be used to set the meter to display the value of the standard being checked.
- The calibration data must be recorded in the project field book.

7.3 Specific Conductivity Meter and Temperature Probe

- Calibration checks using the conductivity standard must be performed at the start of each day of use, after five to 10 readings or after very high or low readings as required by this Plan, according to manufacturer's instructions.
- The portable conductivity meter must be calibrated using a reference solution of 200 µohms/cm (or the manufacturer’s specified concentration) on a daily basis. The date and lot number of the reference solution must be recorded. Readings must be within 5% to be acceptable.
- The thermometer of the meter must be calibrated against the field thermometer on a weekly basis.

7.4 Turbidity Meter

- The turbidity meter must be checked at the start of each day of use according to manufacturer’s instructions.

8. Analytical Program

8.1 Environmental Sample Analyses

The number and types of analyses to be performed for the PDI soil and sediment tasks are identified in the PDI Work Plan and QAPP (attached).

8.2 Field Quality Control Samples

Field quality control samples will be collected and analyzed to document the accuracy and precision of the samples. The quality control samples are described as follows:

- **Trip Blank**: One trip blank will accompany each shipment of samples for VOC analysis sent to the laboratory. The trip blank will be analyzed to test for any contaminants introduced while samples are being stored or transported to the laboratory. The trip blanks will be analyzed for volatiles only.
- **Field Equipment Blanks**: The purpose of the equipment blank is to detect any contamination from sampling equipment, cross-contamination from previously sampled locations, and contamination caused by conditions at sampling locations (e.g., airborne contaminants). One equipment blank will be collected for every 20 samples collected during sampling. The samples will be collected by pouring analyte-free water, prepared in the laboratory, over decontaminated sampling equipment and collecting it in sample jars. The blanks will be collected in the vicinity of a sample location. This field blank will be analyzed for VOCs, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), total cyanide, and Target Analyte List (TAL) metals. An equipment blank will not be collected if sampling is conducted with dedicated sampling equipment.
- **Field Duplicates**: Field duplicates are collected to determine the precision of the soil samples collected. This is achieved by compositing soil and splitting it evenly between separate sample jars. Duplicate samples will be collected and analyzed for VOC, SVOCs, PCBs, total cyanide, and TAL metals. The minimum required number of field duplicates is one for every 20 samples.
- **Matrix Spikes (MS), and Matrix Spike Duplicates (MSD)**: These samples are laboratory quality control samples and will be completed as part of the laboratory analytical batch quality control. These samples will be collected in the same manner as the field duplicates and at a frequency of one MS/MSD sample per 20 field samples. Both the MS and MSD will be collected at the same sample location.

8.3 Sample Location Numbering System

- Surface soil samples will be numbered consecutively beginning with SS1.
- Subsurface soil borings will be numbered consecutively beginning with SB1 (soil borings) or MW1 (monitoring well borings). Individual samples will also be designated with a depth code (see below).
- Monitoring wells will be numbered consecutively beginning with MW1.
- Sediment samples will be numbered consecutively beginning with SD1.

8.4 Sample Identification

Each sample will be given a unique alphanumeric identifier in accordance with the following classification system:

SAMPLE IDENTIFICATION

LL* Sample Type	NN* Sample Number	N-N Depth Code	LL QC Identifier

	Solid	Water
Sample Type:	MW – Monitoring Well Boring SB – Soil Boring BSS – Background Surface Sediment SD – Surface Sediment (0-6 inches) SDC – Deeper Sediment (>6 inches)	MW – Monitoring Well
Sample Number:	Number referenced to a sample location map.	
Depth Code:	Depth in feet of sample interval (0-0.5, 2-4, 10-12, etc.)	
QC Identifier:	TB – Trip Blank EB – Equipment Blank	MS – Matrix Spike MSD–Matrix Spike Duplicate MB – Matrix Blank

* L = Letter
* N = Number

Field duplicate samples will be assigned identifiers that do not allow the laboratory to distinguish them as field duplicates. Each sample container will be labeled prior to packing for shipment. The sample identifier, site name, date and time of sampling, and analytical parameters will be written on the label in waterproof ink and recorded in the field book.

8.5 Chain-of-Custody

- A chain-of-custody record (Figure 5 or similar) will accompany the sample containers during selection and preparation at the laboratory, during shipment to the field, and during return shipment to the laboratory.

- The chain-of-custody will include the sample identities of each sample container and the analytical parameters for each, and will list the field personnel that collected the samples, preservation method, the project name and number, the name of the analytical laboratory that will receive the samples, and the method of sample shipment.
- If samples are split and sent to different laboratories, such as to a specialty laboratory for fingerprint analysis, a copy of the chain-of-custody record will be sent with each sample shipment.
- The chain-of-custody will be completed by field personnel as samples are collected and packed for shipment.
- Erroneous markings will be crossed-out with a single line and initialed by the author.
- The REMARKS space will be used to indicate if the sample is an MS, MSD, or matrix duplicate.
- Trip and field blanks will be listed on separate rows.
- After the samples have been collected and sample information has been listed on the chain-of-custody form, the method of shipment, the shipping cooler identification number(s), and the shipper airbill number will be entered on the chain-of-custody.
- Finally, a member of the sampling team will write his/her signature, the date, and time on the first RELINQUISHED BY space.
- One copy of the chain-of-custody will be retained by sampling personnel. The other copy and the original will be sealed in a plastic bag and taped inside the lid of the shipping cooler.
- Sample shipments will be refrigerated at 4˚C, typically by packing with bagged ice, to preserve the samples during shipment.
- After the shipping cooler is closed, custody seals provided by the laboratory will be affixed to the latch and across the front and back of the cooler lid, and signed by the person relinquishing the samples to the shipper.
- The seal will be covered with clear tape, and the cooler lid will be secured by wrapping with packing tape.
- The cooler will be relinquished to the shipper, typically an overnight carrier.
- The chain-of-custody seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the samples will not be analyzed until directed to do so.
- The samples must be delivered to the laboratory within 48 hours of collection.

8.6 Sample Documentation

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

- Sample identifier
- Identification of sampled media (e.g., soil, sediment, groundwater)
- Sample location with respect to known reference point
- Physical description of sample location
- Field measurements, (e.g., pH, temperature, conductivity, and water levels)
- Date and time of collection
- Sample collection method
- Volume of groundwater purged before sampling
- Number of sample containers
- Analytical parameters
- Preservatives used
- Shipping information:
  - Dates and method of sample shipments
  - Chain-of-custody Record numbers
  - Federal Express Air Bill numbers
  - Sample recipient (e.g., laboratory name)

Figures

Boring Location _____ Date Start/Finish _____

Ground El., Datum _____ Driller _____

Rig Type _____ Casing Type/Size _____

Groundwater El. _____ Date _____ GEI Rep. _____ Total Depth (ft) _____

Pg. of

Depth ft	Sample Type and No.	Sample Blows per 6 in.	Sample Pen in.	Sample Rec in.	PID Jar HS / Remarks	Layer Name	Soil and Rock Descriptions

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, %

PID - Photo Ionization Detector (Jar Headspace), ppm

S - Sample C - Core Sample

U - Undisturbed Sample ▽ Groundwater

Notes:

Project Name:

GEI Project No.:

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DRILLING RECORD

March 2012

Figure 1

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COARSE-GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS

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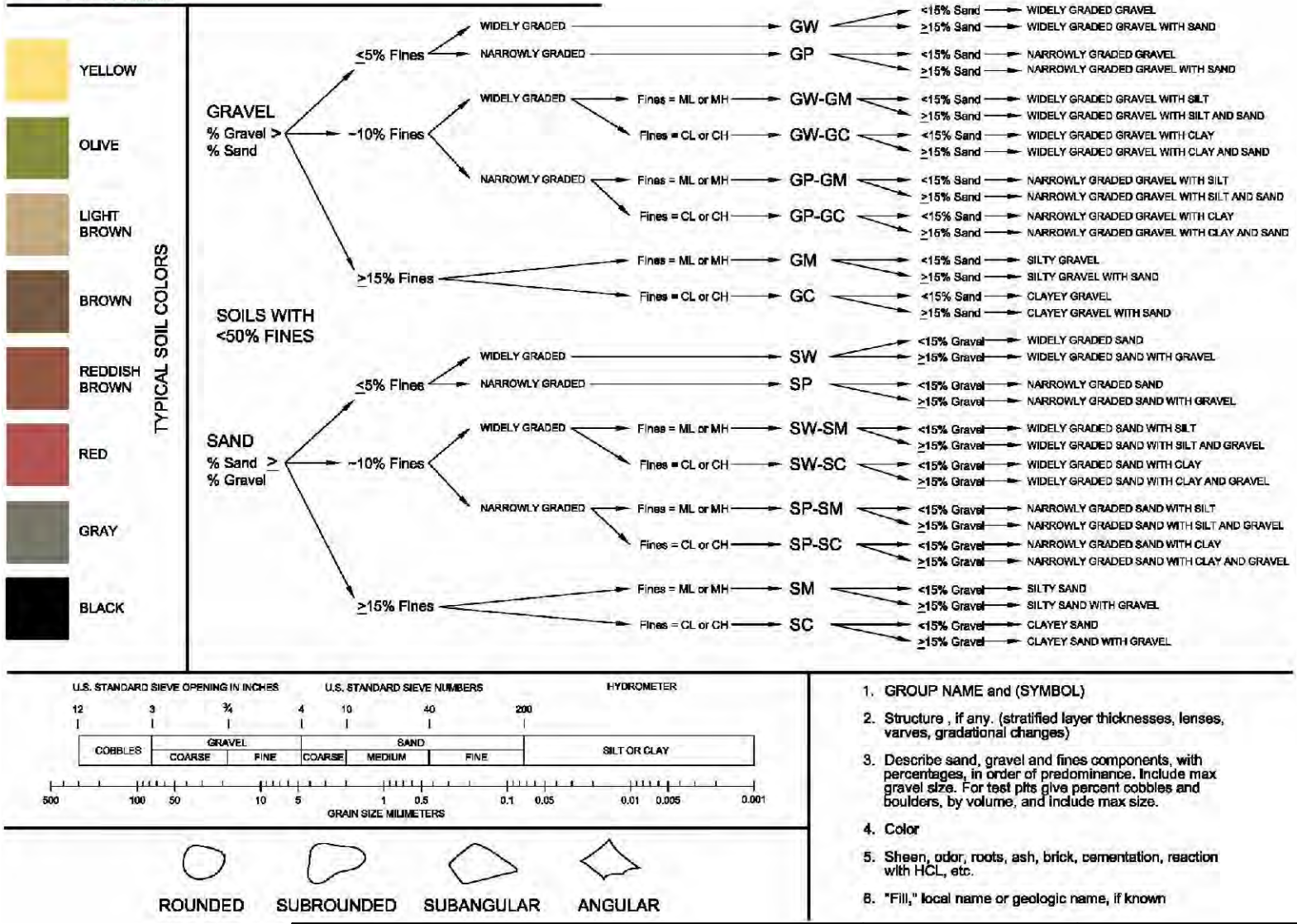

1. GROUP NAME and (SYMBOL)
2. Structure , if any. (stratified layer thicknesses, lenses, varves, gradational changes)
3. Describe sand, gravel and fines components, with percentages, in order of predominance. Include max gravel size. For test pits give percent cobbles and boulders, by volume, and include max size.
4. Color
5. Sheen, odor, roots, ash, brick, cementation, reaction with HCL, etc.
6. "Fill," local name or geologic name, if known

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SOIL DESCRIPTIONS
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Project 121640-1001 | March 2012 | Figure 2

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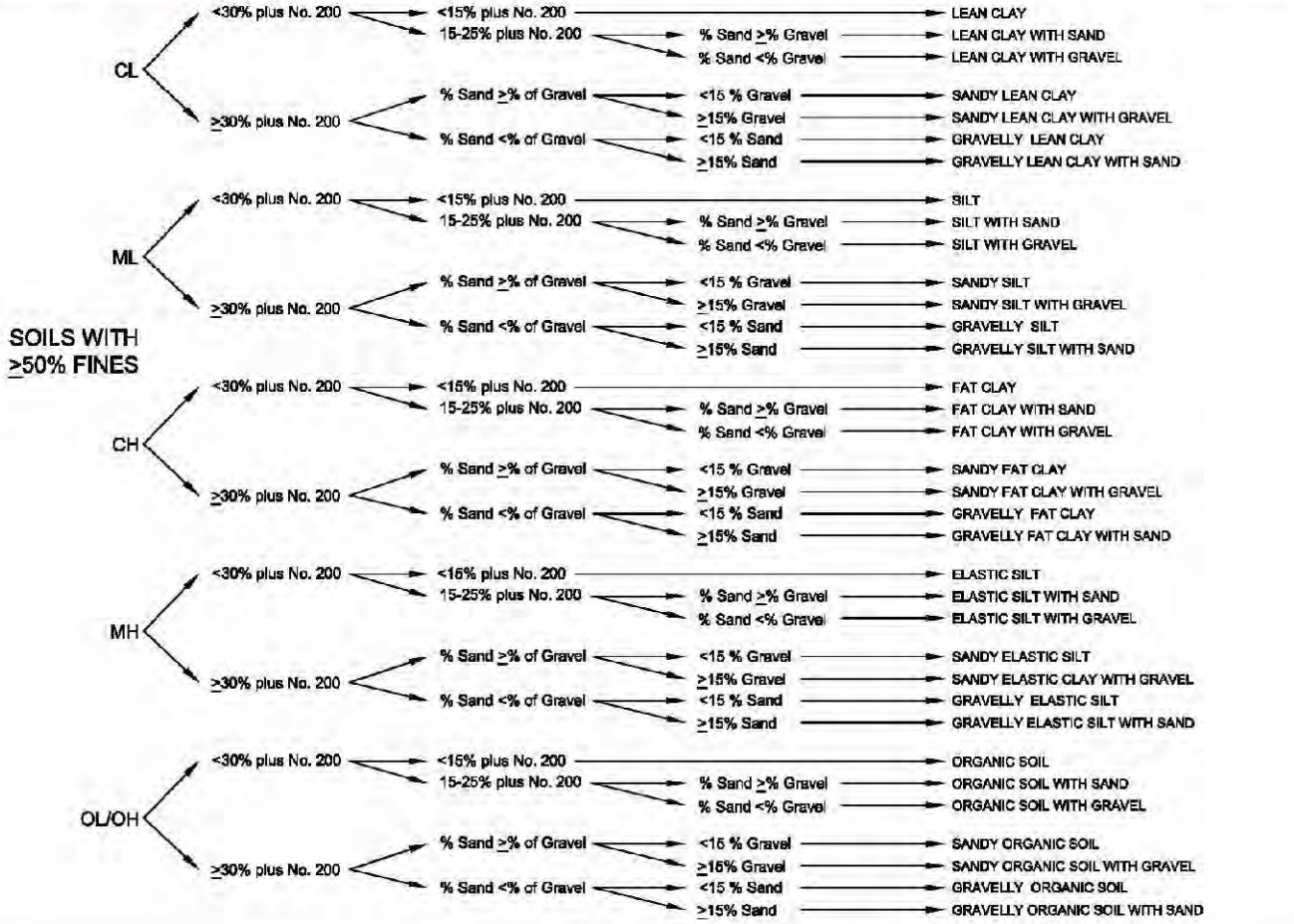
FINE-GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS



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.

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SOIL DESCRIPTIONS
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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
	0						FILL	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	S2	7-7 11-13	24	8	hard drilling 3 to 4 ft, possible boulder 2.0 ppm	FILL	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	FILL	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	ORGANICS	
	15					hard drilling at 15.5 ft	ORGANICS	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						ROCK	C1: SCHIST, hard, slight weathering at joint surfaces, joints at ~30 degrees from horizontal and generally parallel to foliation, gray. Marlborough Formation.
	22.5	C1	RQD 70%	60	54	lost ~10 gallons drill fluid from 23 to 25 ft	ROCK	
	25						ROCK	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.
	27.5							
	30							

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.

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DATE

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SOIL DESCRIPTIONS
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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 spherical 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.

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Sediment Sampling Field Form

Sample Site:		Station Identification:	
Project Number		Sediment Sample:	
Project Name:		Time of Collection:	
Date Sample Collection:		Sampling Personnel:	
Weather:		Sampling Personnel:	

Study Area Observations:

Depositional and Erosional Areas:	
Zones of Sediment Transport:	
Currents or Tides:	
On Shore Adjacent Facilities:	
Adjacent Storm Water Outfalls:	

GPS Station Coordinates

Latitude (N):	
Longitude (W):	

Photographic Record

Photograph Description:		Photograph Description:	
Photograph Description:		Photograph Description:	

Field Measurements

Depth of Water (feet to nearest 0.1)	
Type of Sediment Sampler Used:	

Water Quality Measurements

Top Measurement (30 cm below water surface)		Bottom Measurement (30 cm above sediment)	
Temperature (Celsius)		Temperature (Celsius)	
Salinity (ppt)		Salinity (ppt)	
Dissolved Oxygen (mg/L)		Dissolved Oxygen (mg/L)	
Conductivity (uS/sec)		Conductivity (uS/sec) or (µmhos/cm)	
pH		pH	
Turbidity		ORP (mv)	

Field Instrument Calibration Completed?

Other Observations or Notes:

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SEDIMENT SAMPLING FORM

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Location			Date/Time		Pg. of
Northing			Weather		
Easting			Water Depth (ft)		
Core Number			Sampling Equipment		Diameter (inch)
Segment ID			Contractor		
Segement Depth (ft)			Recovery (%)		

Depth (ft)	Sample Type and No.	USCS	Pen (inch)	Rec (%)	PID Jar Headspace / Remarks	Description

Pen - Penetration length
Rec - Recovery precentage of sample
PID - Photo ionization detector (jar headspace), ppm
USCS - Unified Soil Classification System

Notes:

GEI Project Name:

GEI Project Number:

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SEDIMENT CORE COLLECTION LOG

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Chain-of-Custody Record FIGURE 5

Laboratory:

Laboratory Job # (Lab use only)

GEI Consultants

1301 Trumansburg Rd., Suite N
Ithaca, NY 14850
TEL: (607) 216-8955
FAX: (607) 274-7577

Project Information

Project Name:

Project Number:

Project Location:

Project Manager:

Send Report to: Paul Silva

Send Faxed Results to:

Send EDD to: labdata @geiconsultants.com

Page ____ of ____

Preservative

Analysis

Sample Handling

Sample Field Filtered
YES NO NA

Sampled Shipped With Ice
YES NO

MCP PRESUMPTIVE CERTAINTY REQUIRED -- YES NO

If Yes, Are MCP Analytical Methods Required? YES NO

If Yes, Are Drinking Water Samples Submitted? YES NO

If Yes, Have You Met Minimum Field QC Requirements? YES NO

Lab Sample Number	GEI Sample ID	Collection Date	Collection Time	Matrix	No. of Bottles	Sampler(s) Initials								Sample Specific Remarks

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

MCP Level Needed: GEI requires the most stringent Method 1 MCP standard be met for all analytes whenever possible.

Additional Requirements/Comments/Remarks:

Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)

14 MCP Metals = Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium (total), Lead, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc.

Appendix D

Quality Assurance Project Plan

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Appendix D

Quality Assurance Project Plan

Nyack MGP Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
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Submitted By:
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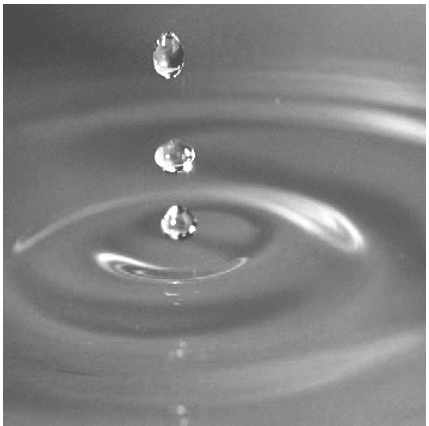
March 2012
Project #: 121640-1001

James Edwards
Project Geologist



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Abbreviations and Acronyms

ASP	Analytical Service Protocols
ASTM	ASTM International (formerly American Society for Testing and Materials)
CAR	Corrective Action Request
CERCLA	Comprehensive Environmental Response, Compensations and Liability Act
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limits
DO	Dissolved Oxygen
DQO	Data Quality Objective
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
EIMS	Environmental Information Management System
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
FSAP	Field Sampling and Analytical Plan
GS/MS	Gas Chromatography/Mass Spectroscopy
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NIST	National Institute of Standards and Technology
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&R	Orange & Rockland Utilities, Inc.
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PAH34	PAHs defined by EPA for Sediment Toxicity Evaluation
PDI	Pre-Design Investigation
PQL	Practical Quantitation Level
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RD	Remedial Design
RPD	Relative Percent Difference
SA	Spiked Analyte
SIM	Select Ion Monitoring
SR	Sample Result
SSR	Spike sample result
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound

Abbreviations and Acronyms (cont'd.)

TOC	Total Organic Carbon
VOC	Volatile Organic Compound

Quality Assurance Glossary

"Analytical Services Protocol" or "ASP" means the New York State Department of Environmental Conservation's (NYSDEC) compendium of approved United States Environmental Protection Agency (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 Comprehensive Environmental Response, Compensations and Liability Act (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 New York State Department of Health (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 8270C.

"Quality assurance" or "QA" 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" or "QC" means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

"Semi-volatile organic compound" or "SVOC" means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semi-volatiles 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.

"Tentatively identified compound" or "TIC" means a non-targeted compound detected in a sample using a Gas Chromatography/Mass Spectroscopy (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 8260B 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.

1. Project Description

This purpose of this project is to assess the sediment quality for determination of dredging limits at the Orange & Rockland Utilities, Inc. (O&R) former Manufactured Gas Plant (MGP) site in Nyack, New York. This Quality Assurance Project Plan (QAPP) specifies the quality control and quality assurance procedures to ensure the generation of statistically valid data. All procedures are equivalent to those specified in the *United States Environmental Protection Agency's QA/R-5 "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," "Test Methods for Evaluating Solid Waste," EPA SW-846, Third Edition* [EPA, 1986] and its promulgated updates, and New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP). These procedures are to be followed to ensure that data from the Nyack MGP investigation are precise, accurate, representative, comparable, and complete. An ELAP-certified laboratory will be used for the analysis of the samples.

1.1 Introduction

O&R is performing a Pre-Design Investigation (PDI) to obtain the data necessary for completing a Remedial Design (RD) for Operable Unit 2 (OU2) of the Nyack former MGP site. A description of the Nyack MGP site is included in the Pre-Design Investigation (PDI) Work Plan (attached). Additional investigation is required to complete the delineation of MGP-related impacts in the sediment remedial areas.

1.2 Scope of Work

The scope of work for the PDI is described in the project Work Plan (attached). Sediment samples will be collected during the PDI. These samples will be analyzed using EPA SW-846 Methods with NYSDEC ASP Category B laboratory data deliverables.

Data generated for the evaluation of the sediments must be technically sound and legally defensible, and supported by defined and verified limits of confidence. This document specifies the quality control and quality assurance (QA/QC) procedures to ensure the generation of valid data for the evaluation of bioavailability and toxicity of PAHs.

1.3 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements to ensure that data of known and appropriate quality are obtained during sampling and analysis activities. Data developed during the site investigation will be used to fulfill the overall objectives of the program.

1.3.1 Data Quality Levels

There are five analytical levels of data quality which may be used to accomplish these site objectives. They are typically designated as follows:

- Level I - field screening or analysis using portable instruments, calibrated to non-compound specific standards
- Level II - field analysis using portable instruments, calibrated to specific compounds
- Level III - non-Contract Laboratory Program (ASP-CLP) laboratory methods
- Level IV - ASP-CLP Routine Analytical Services methods
- Level V - non-standard analytical methods

To meet the specific objectives of this project, Levels I, IV, and V DQOs will be utilized.

Level I - Field Screening Methods

Level I screening will be performed for health and safety purposes according to procedures provided in the site-specific Health and Safety Plan (HASP) as well as to qualitatively assess the presence of volatile organic compounds (VOCs) in soil at the site. Field data water quality data will also be collected at locations where surface sediment samples are obtained.

Level IV - CLP/ASP Methodologies

Sediment will be analyzed according to the EPA SW-846 Methods following procedures specified in the most recent edition of the NYSDEC ASP [NYSDEC, 2005]. Analytical reports will be prepared in accordance with NYSDEC ASP Category B laboratory data deliverable specifications. This level of data quality will ensure the generation of legally, and technically defensible data for project use.

Level V - Non-Standard Analytical Methods

Samples may be analyzed using non-standard analytical methods should forensic analyses be needed. If these analyses are proposed for the PDI, the analyses to be performed and the methods to be used will be discussed with, and approved by the NYSDEC prior to sample collection.

2. Project Organization

This PDI will be performed for O&R by GEI Consultants, Inc. (GEI), an environmental consultant (the Consultant). GEI will arrange for the sediment sampling and analytical services, and provide on-site field representatives to perform the sediment sampling. The Consultant will also perform the data interpretation and reporting tasks.

Key contacts for this project are as follows:

<u>O&R's Project Manager:</u>

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Consultant Field Team Leader (GEI):

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Glastonbury, Connecticut 06033
Telephone: (860) 368-5300
Fax: (860) 368-5307

Laboratory Representative (TestAmerica):

Laboratory to be determined.

3. Quality Assurance/Quality Control Objectives for Measurement of Data

3.1 Introduction

The QA/QC objectives for all quantitative measurement data include precision, accuracy, representativeness, completeness, and comparability. These objectives are defined in the following subsections. They are formulated to meet the requirements of the NYSDEC ASP and EPA SW-846. The analytical methods and Contract Required Quantitation Limits (CRQLs) are provided in Section 7.

3.2 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value [EPA, 1987]. Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates (MSD). The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD = Relative percent difference.
V1, V2 = The two values to be compared.

|V1 - V2| = The absolute value of the difference between the two values.
(V1 + V2)/2 = The average of the two values.

The DQOs for analytical precision, calculated as the RPD between duplicate analyses, are presented in Table 1.

3.3 Accuracy

Accuracy is a measure of the degree of agreement between a measured value and the true or expected value of the quantity of concern [Taylor, 1987], or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike (MS) compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

%R = Percent recovery.

SSR = Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.
SR = Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample.
SA = Spiked analyte: concentration of the analyte spike added to the sample.

The acceptance limits for accuracy for each parameter are presented in Table 1.

3.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program [EPA, 1987]. Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices will be performed between samples as outlined in the Field Sampling and Analytical Plan (FSAP). Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow EPA-approved procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate, and chain-of-custody procedures are presented in Sections 4 and 5.

3.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid [EPA, 1987]. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.
V = Number of measurements judged valid.
T = Total number of measurements.

3.6 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another [EPA, 1987]. The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project.
- Requiring traceability of all analytical standards and/or source materials to the EPA or National Institute of Standards and Technology (NIST).
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable).
- Using standard reporting units and reporting formats including the reporting of QC data.
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate.
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

4. Sampling Program

4.1 Introduction

The sampling program was developed to provide analytical and field data that can be used to satisfy the project objectives (as outlined in Section 1.2). This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. The sampling procedures are presented in the FSAP.

4.2 Analytical Methods

The laboratory samples for each media and the chemical analyses to be performed, including the QA/QC samples, are included in Table 3. These analyses are summarized below.

4.2.1 Sediment Analyses

The following parameters have been designated for field measurement or laboratory analysis.

- Surface Water Field Tests:
  - pH
  - temperature
  - conductivity
  - salinity
  - dissolved oxygen (DO)
  - turbidity

- Sediment Laboratory Analysis:
  - Total parent and alkylated PAH determinations (PAH34) by EPA Method 8270C
  - Total Organic Carbon (TOC) by the Lloyd Kahn Method
  - Percent solids

The exact number, locations, and rationale for each sample and analytical parameters selected are provided in the Work Plan.

A laboratory, capable of providing reliable data that meets the DQOs stated in the site-specific work plan, shall perform all analyses. The specific analytical procedures and the

modifications required are described in Table 3. Where applicable, analyses shall be performed using the following EPA-approved and/or nationally recognized analytical references:

- "Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), EPA Office of Solid Waste and Emergency Response, Third Edition," 1992, and subsequent updates.
- ASTM International (ASTM), "Soil and Rock," Volume 04.08, Philadelphia, PA, 1994.
- "Standard Methods for the Examination of Water and Wastewater," 19th edition, Eaton, A.D. Clesceri, L.S. Greenberg, A. E. American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington D.C., 1995.
- "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates," Second Edition, EPA Office of Research and Development, Duluth, MN, EPA 600/R-99/064, March 2000.
- EPA Contract Laboratory Program Statement of Work (CLP SOW), OLM04.2/4.3 and ILM05.2.
- "Method for Chemical Analysis of Water and Wastes," EPA EPA-600/4-79-020, revised March 1983.

The Project Manager shall ensure that laboratories generating data in support of the PAH evaluation maintain the relevant government regulatory accreditations, certifications, and/or registrations to perform the required analyses.

4.2.2 Forensic Analysis

Samples may be analyzed for forensic purposes to evaluate the potential sources of PAHs in sediments at the site. At locations where forensic analysis may be necessary, EPA Method 8270 analysis will be performed in select ion monitoring (SIM) mode, and the PAH34 analyte list will be expanded to include dibenzothiophenes (parent and alkylated, C0, C1, C2, C3, and C4), carbozoles, and dibenzofuran. These compounds may be used to assess source attribution using diagnostic PAH ratios. The samples will be classified as:

- Background
- Coal tar/MGP related
- Mixed (petrogenic and pyrogenic)

If forensic analyses are needed for this project, the final scope of the sampling and analyses will be determined in consultation with the NYSDEC.

4.3 Sample Container Preparation and Sample Preservation

Sample containers delivered to the field will be new and certified clean by the vendor. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged, and the appropriate chemical preservatives will be added. The types of containers are shown in Table 4.

Samples shall be preserved according to the preservation techniques listed in Table 4. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4° ± 2° C with ice, and delivered to the laboratory within 48 hours of collection under chain-of-custody. Chain-of-custody procedures are described in Section 5.

4.4 Sample Holding Times

The sample holding times for organic and inorganic parameters are listed in Table 4 and are in accordance with the NYSDEC ASP requirements. The NYSDEC ASP holding times must be strictly adhered to by the field and laboratory personnel.

4.5 Field Quality Control Samples

Field QC samples will consist of a series of blanks and duplicates that will be collected to assess field sampling and decontamination performance. Two types of blanks to assess the collection of field samples will be collected and submitted to the laboratory for analyses (trip and equipment blanks). In addition, the precision of the laboratory analytical procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

a. **Trip blanks** - A Trip Blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of one or more 40-ml VOA vials containing EPA Type 2 water, that accompanies all water sample bottles into the field and back to the laboratory. A trip blank will be included in each shipping container of water samples for volatiles analysis. The trip blank will be analyzed for VOCs to assess any contamination from sampling, storage, transport, and internal laboratory procedures.

b. **Equipment blanks** - Equipment blanks are collected to determine the effectiveness of the decontamination procedures for sampling equipment. Equipment blanks are collected by passing EPA Type 2 water provided by the laboratory through decontaminated sampling equipment. It is usually collected as a last step in the

decontamination procedure, prior to taking an environmental sample. The equipment blank will be analyzed for all of the parameters of interest.

The duplicates will consist of:

a. **Coded field duplicate** - To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are duplicate samples. This will eliminate any possible bias that could arise. The coded field duplicates will be taken at a frequency of one duplicate per 20 field samples.

b. **Matrix spike/matrix spike duplicate** - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are listed in Table 1.

5. Sample Tracking and Custody

5.1 Introduction

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the chain-of-custody and transfer of samples will be trained on the purpose of the chain-of-custody and specific procedures prior to implementation.

Evidence of sample traceability and integrity is developed by implementation of, and adherence to, the chain-of-custody procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is presented in Figure 1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession
- Maintained in view after possession is accepted and documented
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody
- In a secured area which is restricted to authorized personnel

5.2 Field Sample Custody

A chain-of-custody record (Figure 2 or equivalent) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the chain-of-custody must be completed for each sample set collected.

The chain-of-custody lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The chain-of-custody also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the chain-of-custody record will be sent with each sample.

The REMARKS space on the chain-of-custody is used to indicate if the sample is an MS/MSD, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and equipment blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper air bill number on the top of the chain-of-custody. Errors will be crossed out with a single line in ink and initialed and dated by the author.

One copy of the chain-of-custody is retained by sampling personnel and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The chain-of-custody seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample(s) will not be analyzed.

5.3 Laboratory Sample Custody

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the chain-of-custody record and record the date and time received.
- Care will be exercised to annotate any labeling or description errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as

broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.

- The samples will be stored in a secured area and, if required, stored at a temperature of 4°± 2° C.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis and final storage for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

6. Calibration Procedures

6.1 Field Instruments

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the FSAP. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader in a notebook. Copies of all the instrument manuals will be maintained on site by the Field Team Leader. Calibration procedures for instruments used for monitoring health and safety hazards (e.g., photo-ionization detector and explosimeter) are provided in the HASP. More frequent calibration may be needed depending on conditions encountered in the field.

6.2 Laboratory Instruments

The laboratory will follow all calibration procedures and schedules as specified in the sections of the EPA SW-846 and NYSDEC ASP and subsequent updates as they apply to the instruments used for the analytical methods listed in Section 7.

7. Analytical Procedures

7.1 Introduction

Samples will be analyzed according to methods approved by the NYSDEC ASP program or EPA SW-846 "*Test Methods for Evaluating Solid Waste,*" November 1986, 3rd edition [EPA, 1986] and subsequent updates. The methods to be used for the laboratory analysis of sediment samples are listed in Table 3. These methods were selected because they attain the DQOs required for the project, and the quantitation limits that are listed in Table 5.

Should an analytical method be required that is outside the scope to the references cited above, the method used will be published by a nationally recognized authority (e.g., EPA, API) and approved for use by the regulatory agency.

The Project Manager shall ensure that laboratories (primary or subcontracted) generating data in support of O&R remediation and investigative projects maintain the relevant state and federal government regulatory accreditations, certifications, and/or registrations to perform the required analyses.

8. Data Reduction, Assessment, and Reporting

8.1 Data Reduction

Data collected during the field investigation will be reduced in accordance with NYSDEC ASP protocols. The procedures for identification and quantification of the analytes will be specified in the NYSDEC ASP or EPA SW-846 *"Test Methods for Evaluating Solid Waste,"* November 1986, 3rd edition and subsequent updates and peer reviewed by laboratory supervising personnel.

8.2 Data Quality Assessment

NYSDEC generally recommends two levels of data review for data collected during site investigations. The basic review is a Data Usability Summary Report (DUSR). Current NYSDEC policy is to require a DUSR for data collected during investigations on most sites. The more rigorous full data validation procedure is called for at sites where the data will be used in litigation. The laboratory deliverables (i.e., NYSDEC ASP Category B) are the same in both cases, and a DUSR can be upgraded to full validation at a later time if necessary. For this investigation, a DUSR will be generated.

Based on the results of data assessment, the validated analytical results reported by the laboratory will be assigned one of the following usability flags by the data validator:

- U The analyte was analyzed for, but was not detected above the level of the reported samples 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 result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
- J- (Inorganics) The result is an estimated quantity, likely to be biased low. The associated numerical value is the approximate concentration of the analyte in the sample.
- J+ (Inorganics) The result is an estimated quantity, likely to be biased high. The associated numerical value is the approximate concentration of the analyte in the sample.
- N Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling events.

- NJ Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity.
- R The data are unusable. The sample results are rejected due to serious deficiencies in the ability to meet QC criteria. The presence or absence of the analyte cannot be verified.

Trained and experienced data assessors, who meet NYSDEC approval criteria, will perform the data assessment. Resumes of people performing data assessments and generating DUSRs will be provided to NYSDEC for review and approval.

8.2.1 Data Usability Summary Report

Data for this investigation will be evaluated in accordance with the "*EPA National Functional Guidelines for Organic Data Review*," October 1999 and "*EPA Validation Functional Guidelines for Inorganic Data Review*," October 2004. A DUSR will be generated in accordance with the NYSDEC guidelines.

A DUSR will be prepared which will include a review and an evaluation of all the analytical results. To ensure compliance with the analytical method protocols the following will be reviewed:

- Chain-of-custody forms
- Holding times
- Initial and continuing calibrations
- Blanks
- Laboratory control standards and matrix spikes
- Surrogate recoveries
- Matrix interference checks
- Field and laboratory duplicates
- Sample data

The DUSR will contain a description of the samples and parameters reviewed. Any deficiencies identified during the review will be noted and the effect on the generated data will be discussed. Any re-sampling or re-analysis recommendations will then be made to the investigation's Project Manager. The results of the evaluation will be incorporated into the final investigative report.

8.2.2 Data Validation

The determination to validate data will be made based on the presence of data anomalies, suspect data, or laboratory issues. Unless required to address anomalies, the data will be subject to the DUSR process and will not be subject to full validation. Where necessary, data will be validated in accordance with the "*EPA National Functional Guidelines for Organic Data Review*," October 1999 and "*EPA Validation Functional Guidelines for Inorganic Data Review*," October 2004. If applicable, a data validation report will be prepared and reviewed by the Quality Assurance Officer (QAO) before issuance. The data validation report will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each sample delivery group will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times
- Instrument tuning
- Instrument calibrations
- Blank results
- System monitoring compounds or surrogate recovery compounds (as applicable)
- Internal standard recovery results
- MS and MSD results
- Field duplicate results
- Target compound identification
- Result calculations
- Pesticide cleanup (if applicable)
- Compound quantitation and reported detection limits
- System performance
- Results verification

For each of the inorganic compounds, the following will be assessed:

- Holding times
- Calibrations
- Blank results
- Interference check sample

- Laboratory check samples
- Duplicates
- Matrix spike(s)
- Furnace atomic absorption analysis QC
- ICP serial dilutions
- Results verification and reported detection limits
- Result calculations

8.3 Data Reporting

The data package provided by the laboratory will contain all items discussed above in a "CLP-equivalent" format. Data quality issues will be discussed in a case narrative included with the data report. The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

One copy of the analytical data packages in an electronic disk deliverable format will be provided by the laboratory approximately 30 days after receipt of a complete sample delivery group. The Project Manager will immediately arrange for filing of the package, the data validation, the preparation of the DUSR, and the preparation of the data summary tables. These tables will form the database for the assessment of the extent of the MGP-related impacts at the site.

8.3.1 NYSDEC Data Submittal

The NYSDEC has implemented an Environmental Information Management System (EIMS). The EIMS uses the database software application EQuIS™ from EarthSoft® Inc.

The data submitted to the Division of Environmental Remediation will be in the NYSDEC-approved Electronic Data Deliverable (EDD). New data will be submitted on a continuous basis immediately after data validation occurs but in no event more than 90 days after the data has been submitted to the Consultant. The EDD format will be provided by the NYSDEC.

9. Internal Quality Control Checks and Frequency

9.1 Quality Assurance Batching

Each set of up to 20 samples submitted to the laboratory will be analyzed concurrently with associated calibration standards, method blanks, MS/MSD or laboratory duplicates, and QC check samples (if required by the protocol). Note that the MS/MSD samples will be provided with the field samples and identified by the field personnel.

9.2 Calibration Standards and Surrogates

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the EPA or NIST, or other similar nationally-recognized program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard working solutions are replaced monthly or more frequently, based upon data indicating deterioration. No stock or working standard will be used past the manufacturer's expiration date.

9.3 Organic Blanks and Matrix Spike

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives". The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing $KMnO^4$. The matrix spike is generated by addition of analyte and surrogate standards to a designated field sample.

9.4 Trip and Field Blanks

Trip blanks and equipment blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and to evaluate the possibility of atmospheric or cross-contamination of the samples.

10. Quality Assurance Performance Audits and System Audits

10.1 Introduction

QA audits may be performed by the project quality assurance group under the direction and approval of the project QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate QA management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2 System Audits

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory QC procedures and associated documentation may be audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

10.3 Performance Audits

The laboratory is required to perform periodic analyses of Performance Evaluation samples to maintain ELAP accreditation and/or state regulatory certifications. Performance Evaluation samples obtained from an EPA-approved vendor or a state agency must be analyzed by the laboratory at least semi-annually.

10.4 Formal Audits

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that QA requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be out of compliance shall be identified at exit interviews conducted with the involved management. Compliance deviation will be logged, and documented through audit findings which are attached to and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within 15 days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

11. Preventive Maintenance Procedures and Schedules

11.1 Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce downtime, if any. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2 Schedules

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3 Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

12. Corrective Action

12.1 Introduction

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2 Procedure Description

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader, and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained
- When procedure or data compiled are determined to be deficient
- When equipment or instrumentation is found to be faulty
- When samples and analytical test results are not clearly traceable
- When QA requirements have been violated
- When designated approvals have been circumvented
- As a result of system and performance audits
- As a result of a management assessment
- As a result of laboratory/field comparison studies
- As required by EPA SW-846, and subsequent updates, or by the NYSDEC ASP

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites, laboratories, or contractor

locations. Activities, or documents ascertained to be noncompliant with QA requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to QA functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 3 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions were implemented and effective, documented, and approved.

References

EPA, 1986. SW-846 "Test Method for Evaluating Solid Waste," dated November 1986 and subsequent updates. U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1987. Data Quality Objectives for Remedial Response Actions Activities: Development Process, EPA/540/G-87/003, OSWER Directive 9355.0-7B U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2001. CLP Organics Data Review and Preliminary Review based on CLP/SOW OLM04.2. SOP No. HW-6, Revision 12 dated September 2005. EPA Region II.

EPA, 2005. Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW - ILM05.3. SOP No. HW-2, Revision 13, dated January 1992. EPA Region II.

NYSDEC, 2005. New York State Department of Environmental Conservation, Analytical Services Protocol, July 2005.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan.

Tables

Table 1
Quality Control Limits for Soil Samples
Nyack MGP Site

		Laboratory Accuracy and Precision					
Analytical Parameter	**Analytical Method [a]**	**Matrix Spike (MS) Compounds**	**MS/MSD [b] % Recovery**	**MS/MSD RPD [c]**	**LCS [d] % Recovery**	**Surrogate Compounds**	**Surrogate % Recovery**
SVOCs (f)	8270C	Phenol	36-110	25	36-110	Nitrobenzene-d5	35-113
		2-Chlorophenol	38-104	26	38-104	2-Fluorobiphenyl	43-119
		1,4-Dichlorobenzene	34-120	30	34-120	p-Terphenyl-d14	51-125
		N-Nitroso-di-n-propylamine	46-120	20	46-120	Phenol-d5	36-116
		1,2,4-Trichlorobenzene	39-105	24	39-105	2-Fluorophenol	30-107
		4-Chloro-3-methylphenol	49-125	20	49-125	2,4,6-Tribromophenol	46-129
		Acenaphthene	53-119	16	53-119		
		4-Nitrophenol	44-137	25	44-137		
		2,4-Dinitrotoluene	55-125	19	55-125		
		Pentachlorophenol	33-136	27	33-136		
		Pyrene	51-133	25	51-133		
PCBs	8082	PCB 1016	59-154	50	59-154	Decachlorobiphenyl	34-148
		PCB 1260	51-179	50	51-179	Tetrachloro-m-xylene	35-134

(a) Analytical Methods: NYSDEC ASP-CLP Methods with Category B data deliverables, NYSDEC, 2000 and EPA SW-846, 3rd edition, Revision 1, November 1990,

(b) Matrix Spike/Matrix Spike Duplicate
(c) Relative Percent Difference
(d) Laboratory Control Sample
(e) Target Compound List Volatile Organic Compounds
(f) Target Compound List Semi-volatile Organic Compounds
(g) Limits are advisory only
(h) Target Analyte List Inorganics (metals and cyanide)
(i) Matrix spike only
(j) Laboratory duplicate RPD
NA - Not Applicable

Table 2
Summary of Sampling and Analytical Program
Nyack MGP Site

Matrix	Parameter	Analytical Method	Field Samples				QC Blanks		Total
			Field Samples	Field Duplicate	MS/MSD[(a)] (Total)	Sub-Total	Trip Blank	Equip-ment Blank	
Sediment Samples	SVOC/NOAA PAHs	EPA SW 8270C	18	1	1	20	NA	1	21
	TOC	Lloyd Kahn	18	1	1	20	NA	1	21

(a) Matrix spike / matrix spike duplicate for organic analyses; matrix spike and laboratory duplicate for inorganic analysis.
* The number of duplicates, MS/MSD, and field QC samples can be reduced if these samples are obtained in conjunction with the sampling of other media during the sampling event.
+ Rinse blanks not required if dedicated sampling equipment is used.
TBD To be determined

Table 3
Laboratory Method References
Nyack MGP Site

Parameter	Method	Method Reference(s)	Laboratory[1]
Total PAH34	EPA Method 8270C	SW-846 - EPA Method 8270C Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	TA
Total Organic Carbon (TOC)	Lloyd Kahn	***Determination of Total Organic Carbon in Sediment,*** (Lloyd Kahn Method) July 27, 1988(1988) Lloyd Kahn, Quality Assurance Specialist, U.S. Environmental Protection Agency, Region II Environmental Services Division Monitoring Management Branch Edison, New Jersey 08837	TA
Percent Solids	STL SOP IN623	Method for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised March 1983, CLP SOW, OLM04.2/4.3 and ILM05.2	TA

[1]Laboratories:

TA - TestAmerica Laboratories, Burlington, VT

Table 4
Sample Handling Requirements
Nyack MGP Site

Sample Type	Sample Matrix	Parameter	Quantity	Container Type[1]	Minimum Volume	Preservation[3]	Holding Time from Sample Date	Laboratory[4]
Surface Water	Surface Water	pH, Temperature, Conductivity, Salinity, DO, Turbidity	TBD	Field	Field	Field	15 min.	YSI 6900 or Equivalent
Chemical/ Physical Characterization	Sediment	Total Organic Carbon	TBD	glass	8 oz.	Cool to 4° C	28 days[3]	TA
		Total Sediment PAH34 (parent and alkylated compounds)	TBD				28 days[2]	
		Percent Solids	TBD		2 oz.	Cool to 4° C	28 days[2]	

Notes:

1. All glass jars must have Teflon-lined lids.
2. Test to be initiated within 28 days of sample collection.
3. Samples requiring thermal preservation must be maintained at 2º - 6ºC.
4. TA - TestAmerica Laboratories, Burlington, VT

* Note that all 10 of the reference location samples are included in the 40 samples to be analyzed.

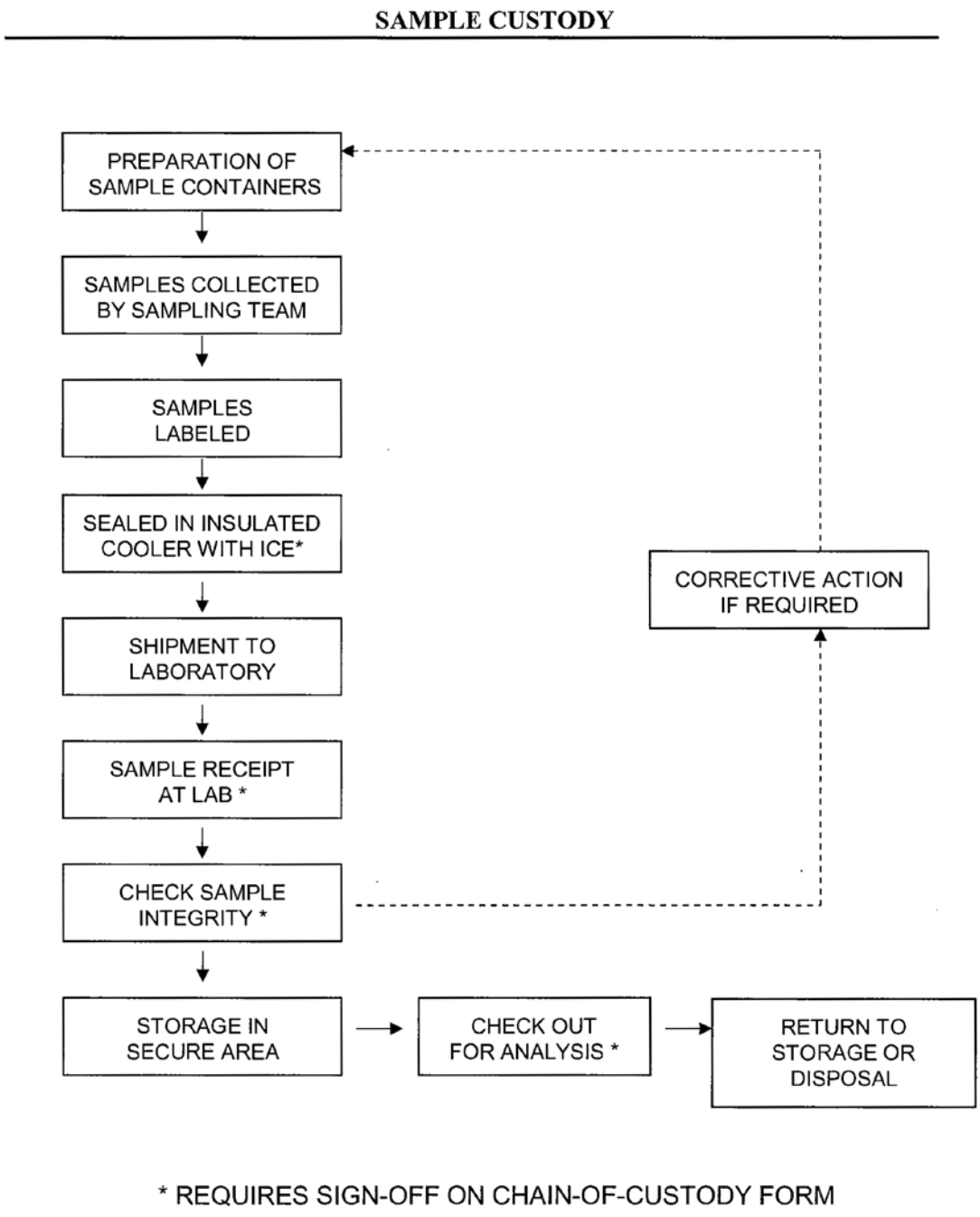
Table 5
Project Quantitation Limits
Sediment SVOC
Nyack MGP Site

		Quantitation Limits
Analysis/Compound	**Method**	**Sediment (ug/Kg)**
Semi-Volatile Organics		
1-Methylnapthalene	8270C	330
1,1'-Biphenyl	8270C	330
2,2'-oxybis(1-chloropropane)	8270C	330
2,3,5-Trimethylnaphthalene	8270C	330
2,4,5-Trichlorophenol	8270C	330
2,4,6-Trichlorophenol	8270C	330
2,4-Dichlorophenol	8270C	330
2,4-Dimethylphenol	8270C	330
2,4-Dinitrophenol	8270C	1600
2,4-Dinitrotoluene	8270C	330
2,6-Dimethylnapthalene	8270C	330
2,6-Dinitrotoluene	8270C	330
2-Chloronaphthalene	8270C	330
2-Chlorophenol	8270C	330
2-Methylnaphthalene	8270C	330
2-Methylphenol	8270C	330
2-Nitrolaniline	8270C	1600
2-Nitrophenol	8270C	330
3,3'-Dichlorobenzidine	8270C	1600
3-Nitroaniline	8270C	1600
4-Bromophenyl-phenyl ether	8270C	330
4-Chloro-3-methylphenol	8270C	330
4-Chloroaniline	8270C	330
4-Chlorophenyl phenyl ether	8270C	330
4-Methylphenol	8270C	330
4-Nitroaniline	8270C	1600
4-Nitrophenol	8270C	1600
4,6-Dinitro-2-methylphenol	8270C	1600
Acenaphthene	8270C	330
Acenaphthylene	8270C	330
Acetophenone	8270C	330
Anthracene	8270C	330
Atrazine	8270C	330
Benzo(a)anthracene	8270C	330
Benzo(a)pyrene	8270C	330
Benzo(b)fluoranthene	8270C	330
Benzo(e)pyrene	8270C	330
Benzo(g,h,i)perylene	8270C	330
Benzo(k)fluoranthene	8270C	330
Benzaldehyde	8270C	330
bis(2-Chloroethoxy) methane	8270C	330
bis(2-Chloroethyl) ether	8270C	330
bis(2-ethylhexyl)phthalate	8270C	330
Butyl benzyl phthalate	8270C	330
C1-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C2-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C3-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C4-Chrysenes/benz(a)anthracenes (Note 2)	8270C	330
C1-Dibenzothiophene	8270C	330
C2-Dibenzothiophene	8270C	330
C3-Dibenzothiophene	8270C	330
C4-Dibenzothiophene	8270C	330
C1-Fluoranthenes/pyrenes (Note 2)	8270C	330
C1-Fluorenes (Note 2)	8270C	330
C2-Fluorenes (Note 2)	8270C	330
C3-Fluorenes (Note 2)	8270C	330
C2-Naphthalenes (Note 2)	8270C	330
C3-Naphthalenes (Note 2)	8270C	330
C4-Naphthalenes (Note 2)	8270C	330
C1-Phenanthrenes/anthracenes (Note 2)	8270C	330
C2-Phenanthrenes/anthracenes (Note 2)	8270C	330
C3-Phenanthrenes/anthracenes (Note 2)	8270C	330
C4-Phenanthrenes/anthracenes (Note 2)	8270C	330
Caprolactum	8270C	330
Carbazole	8270C	330
Chrysene	8270C	330
Dibenzothiophene	8270C	330
Di-n-butyl phthalate	8270C	330
Di-n-octyl phthalate	8270C	330
Dibenz(a,h)anthracene	8270C	330
Dibenzofuran	8270C	330
Diethyl phthalate	8270C	330
Dimethyl phthalate	8270C	330
Fluoranthene	8270C	330
Fluorene	8270C	330
Hexachlorobenzene	8270C	330
Hexachlorobutadiene	8270C	330
Hexachlorocyclopentadiene	8270C	1600
Hexachloroethane	8270C	330
Indeno(1,2,3-cd)pyrene	8270C	330
Isophorone	8270C	330
N-Nitroso-n-propylamine	8270C	330
N-nitrosodiphenylamine	8270C	330
Naphthalene	8270C	330
Nitrobenzene	8270C	330
Pentachlorophenol	8270C	1600
Phenanthrene	8270C	330
Phenol	8270C	330
Pyrene	8270C	330

Analysis will be by Method 8270C - Full Scan.
Note 1: RLs and MDLs are subject to change due to % moisture, matrix interference, and dilution factors
Note 2: All Alkylated PAH results will be estimates due to lack of sufficient analytical standards availiability

Figures

FIGURE 1


SAMPLE CUSTODY
PREPARATION OF SAMPLE CONTAINERS
SAMPLES COLLECTED BY SAMPLING TEAM
SAMPLES LABELED
SEALED IN INSULATED COOLER WITH ICE*
SHIPMENT TO LABORATORY
SAMPLE RECEIPT AT LAB *
CHECK SAMPLE INTEGRITY *
STORAGE IN SECURE AREA
CHECK OUT FOR ANALYSIS *
RETURN TO STORAGE OR DISPOSAL
CORRECTIVE ACTION IF REQUIRED
* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Chain-of-Custody Record FIGURE 2

Laboratory:

Laboratory Job # (Lab use only)

GEI Consultants

1301 Trumansburg Road, Suite N
Ithaca, New York
TEL: 607-216-8955

Project Information

Project Name:

Project Number:

Project Location:

Project Manager:

Send Report to:

Send Faxed Results to:

Send EDD to:

Page ____ of ____

Preservative

Analysis

Sample Handling

Sample Field Filtered
YES NO NA

Sampled Shipped With Ice
YES NO

MCP PRESUMPTIVE CERTAINTY REQUIRED -- YES NO

If Yes, Are MCP Analytical Methods Required? YES NO

If Yes, Are Drinking Water Samples Submitted? YES NO

If Yes, Have You Met Minimum Field QC Requirements? YES NO

Lab Sample Number	GEI Sample ID	Collection Date	Collection Time	Matrix	No. of Bottles	Sampler(s) Initials	Sample Specific Remarks

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

MCP Level Needed: GEI requires the most stringent Method 1 MCP standard be met for all analytes whenever possible.

Additional Requirements/Comments/Remarks:

Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)
Relinquished by: (signature)	Date :	Time:	Received by: (signature)

14 MCP Metals = Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium (total), Lead, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc.

FIGURE 3 Corrective Action Request

CORRECTIVE ACTION REQUEST
Number: _____ Date: _____
TO: _____ You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _____
CONDITION:
REFERENCE DOCUMENTS:
RECOMMENDED CORRECTIVE ACTIONS:
_____ _____ _____ _____ _____ _____ Originator Date Approval Date Approval Date
RESPONSE
CAUSE OF CONDITION
CORRECTIVE ACTION (A) RESOLUTION (B) PREVENTION (C) AFFECTED DOCUMENTS
C.A. FOLLOWUP: CORRECTIVE ACTION VERIFIED BY: _____ DATE:_____

GEI Consultants

Appendix E

Community Air Monitoring Plan

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Appendix E

Community Air Monitoring Plan

Nyack MGP Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

Submitted By:
GEI Consultants, Inc.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

March 2012
Project #: 121640-1001

James Edwards
Project Geologist

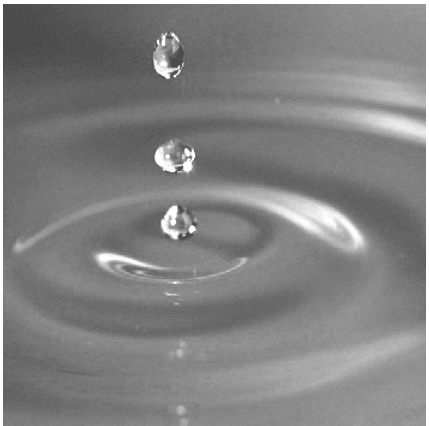


Table of Contents

Tables

Attachments

Abbreviations and Acronyms

CAMP	Community Air Monitoring Plan
COC	Compounds of Concern
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
MGP	Manufactured Gas Plant
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&R	Orange & Rockland Utilities, Inc.
PAH	Polycyclic Aromatic Hydrocarbons
PDI	Pre-Design Investigation
PID	Photo-ionization Detector
ppm	Parts per Million
SVOC	Semi-Volatile Organic Compounds
VOC	Volatile Organic Compounds
$\mu g/m^3$	Micrograms per cubic meter

1. Introduction

This Community Air Monitoring Plan (CAMP) will be implemented during the Pre-Design Investigation (PDI) of the Orange & Rockland Utilities, Inc. (O&R) Nyack Manufactured Gas Plant (MGP) site, located in Nyack, New York. A CAMP is required by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) at sites where ground-intrusive activities may result in airborne release of compounds of concern (COC). Towards that end, community air monitoring will be performed for total volatile organic vapors (VOCs), and for particulates (dust).

The Nyack MGP site is located between Gedney Street and the Hudson River in Nyack, New York. This CAMP applies to the PDI phase of work for the Nyack MGP site. The PDI field work is scheduled to be performed in the spring of 2012. The PDI field work involves the advancement of subsurface soil borings, and sediment sampling. Community air monitoring will be performed during the drilling of soil borings.

The objectives of this CAMP are to:

- Ensure that the airborne concentrations of COC are minimized to protect the community.
- Provide an early warning system so that potential emissions can be controlled on site at the source.
- Measure and document the concentrations of airborne COC to confirm compliance with the specified limits.

This CAMP is a companion document to GEI's site-specific Health and Safety Plan (HASP). The HASP is a separate document and is directed primarily toward protection of on-site workers within the designated work zones.

2. Air Monitoring Equipment, Methods, and Action Levels

This section provides instructions for performing the CAMP activities. Discussed are the COC to be monitored, the equipment to be used, where sampling is to be performed, and the action limits. For the Nyack MGP site, community air monitoring will be performed for total VOCs and particulates (dust) during the drilling of soil borings.

In addition to the community air monitoring, work/exclusion zone monitoring will be performed during work activities where impacted soil or groundwater may be encountered. The exclusion zone air monitoring requirements, equipment, and action levels are described in the site-specific HASP for this project. Note, however, that the work zone air monitoring and the community air monitoring are conducted as part of the overall site control program. When work zone VOC or particulate readings are found to exceed the downwind CAMP limits, the field staff will check the upwind and downwind air monitoring instruments to assess whether control measures will be required.

2.1 Monitoring Locations

Two community air monitoring locations will be established at the start of each workday – one upwind of the work area, and one downwind of the work area/exclusion zone. The purpose of the upwind station will be to determine the background concentration of VOCs and particulates at the worksite. The downwind monitoring station will be used to assess compliance with the NYSDEC/NYSDOH specified action limits for VOCs and particulates. The upwind VOC and dust measurements will be subtracted from the downwind measurements in order to compare the downwind instrument readings to the CAMP action levels.

The location of the each monitoring station will be noted on the ***Community Air Monitoring Daily Data Sheet*** (Daily Data Sheet) [Attachment A]. The locations of the instruments may be changed during the day to adapt to changing wind directions. Each location will be noted on the Data Sheet, along with the start and stop time at each location. Field personnel will be prepared to move the equipment to multiple locations in the event that there is little wind, if the wind direction changes frequently, or if there is a change to the location of the most sensitive downwind receptor location.

Where the work area is less than 20 feet from the nearest occupied building, the downwind air monitoring station will be positioned at the air intake for the building or at the most sensitive exposure point for the downwind receptors. Background measurements inside the building will be made prior to the start of work. If exceedances of the action levels are

measured at the outside wall of the building, additional measurements will be made inside the building using portable meters.

If necessary, precautions to minimize the release of VOCs and particulates will be taken at the work zone, and engineering or work controls used to protect the downwind receptor. These controls for minimizing releases from the work zone are discussed in Section 3.

2.2 Air Monitoring Equipment

The monitoring instruments will be calibrated at the start of each workday, and again during the day if the performance of an instrument is in question. The time and method of calibration will be noted on the Daily Data Sheet. Both the photo-ionization detectors (PIDs) and particulate meters will be mounted on a tripod in a vented protective case, and programmed to record 15-minute averages. A monitoring technician will check the instrumentation at each of these locations regularly during the work-day to check that they are operating properly.

2.2.1 VOC Monitoring Equipment

VOC monitoring will be performed using PIDs (RAE Systems MiniRAE™ or equivalent) equipped with a 10.2 or 10.6 eV bulb. The instruments will be set to record 15-minute running average concentrations. The PIDs will be equipped with an audible alarm to indicate an exceedance of the action level of 5 ppm total VOCs.

2.2.2 Particulate (Dust) Monitoring Equipment

Particulate monitoring will be performed using meters set to measure 10 micron and finer particulates (PM-10). Particulates will be monitored using an MIE DataRAM DR-2000l, TSI DustTrak™, or equivalent. The equipment used will be set to record 15-minute running average concentrations, for comparison to the action levels.

In addition to the instrument readings, fugitive dust migration will be visually assessed during all work activities, and the observations recorded. Per NYSDEC requirements, visible dust migration will not be allowed. If visible dust is observed to be migrating from the work zone, the work will be stopped and dust control measures implemented.

2.3 Monitoring Action Levels and Responses

The action levels and responses for VOCs and particulates are presented in Table 1.

Table 1. Air Monitoring Response Levels and Actions

VOCs	
Response Level	**Actions**
>1 ppm at the wall of an occupied structure or at an air intake	▪ Check the indoor air concentration and compare with background measurements taken previously
>5 ppm above background for 15-minute average	▪ Temporarily halt work activities ▪ Continue monitoring, especially inside of occupied structures ▪ If VOC levels decrease (per instantaneous readings) below 5 ppm over background, work activities can resume
Persistent levels >5 ppm over background but <25 ppm	▪ Halt work activities ▪ Identify source of vapors ▪ Corrective action to abate emissions ▪ Continue monitoring ▪ Resume work activities if VOC levels 200 feet downwind of the property boundary or half the distance to the nearest potential receptor is <5 ppm for a 15-minute average
>25 ppm at the perimeter of the work area	▪ Shut down work

Particulates	
Response Level	**Actions**
>100 µg/m^3 above background for 15-minute average or visual dust observed leaving the site	▪ Apply dust suppression ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site
>150 µg/m^3 above background for 15-minute average	▪ Stop work ▪ Re-evaluate activities ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site

Sources:

- NYSDOH Community Air Monitoring Plan, December 2009, as published in NYSDEC DER-10, Appendix 1A, 2010.
- Fugitive Dust and Particulate Monitoring, NYSDEC DER-10, Appendix 1B, 2010.
- Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures, NYSDOH.

All data will be downloaded to a computer on a daily basis and saved for review. The data will be provided to the NYSDEC and/or the NYSDOH upon request at any stage of the project.

If VOC or particulate action levels are observed to be exceeded during the work day, the event, the source, and corrective actions taken will be recorded on the Daily Data Sheet and reported to the on-site NYSDEC representative. If an on-site representative is not present,

exceedances will be noted in the daily report to the NYSDEC project manager within one business day.

Table 2. Emergency Contacts and Telephone Numbers

Fire, Police, Ambulance		911
NYSDEC Contact	Elizabeth Lukowski – Project Manager	(518) 402-9564 (office)
GEI Contacts	James Edwards – Project Geologist Garrett Schmidt – Field Team Leader	(607) 592-6786 (cell) (607) 793-3463 (cell)
O&R Contact	Maribeth McCormick – Project Manager	(845) 783-5534 (office) (914) 557-1361 (cell)

2.4 Odor Monitoring

The field investigation personnel will record observations of odors generated during the RI field activities. When odors attributable to the exposing of impacted media are generated in the work area during intrusive activities, such as soil borings or excavation of test pits, observations will also be made at the downwind limit of the MGP site. The observations will be made to assess the potential for significant odors reaching on-site receptors or being transmitted off site. The downwind odor monitoring will be performed in conjunction with the PID and dust monitoring program described in this CAMP.

Upon detection of odors at the site perimeter, site controls, starting in the work area, will be implemented. The site controls described in Section 3 will be used to assist with odor mitigation. Note that the goal of the Odor Mitigation Plan is to minimize and to prevent, where practicable, the off-site migration of odors. Due to the short distances between any work area at the site and the on-site receptors property line, site controls will be implemented proactively when odors are detected in the breathing zone at any work area.

There are no action levels specified for odors. In the event that odors persist at the downwind receptors or property line after control measures are carried-out, the odor conditions will be discussed with the O&R and NYSDEC project managers.

3. Control Procedures

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

3.1 Potential Sources of Odors and VOCs

Generally, the residuals encountered at former MGP sites are well defined. They are related to residual coal tar-like materials and petroleum, and principally contain VOCs, polycyclic aromatic hydrocarbons (PAHs), and a number of inorganic constituents, including metal-complexed cyanide compounds, and metals. Constituents of MGP tar or petroleum products can produce odor emissions during investigation activities when they are unearthed during backhoe test pits and soil borings. When this occurs, VOCs and light-end semi-volatile organic compounds (SVOCs) can volatilize into the ambient air. Some MGP residuals can cause distinctive odors that are similar to mothballs, roofing tar, or asphalt driveway sealer. It is important to note that the CAMP will provide for continual monitoring of VOCs and particulates during the field work to monitor for any potential release of constituents which may exceed the exposure limits for downwind receptors.

3.2 General Site Controls

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

- Every effort will be made to minimize the amount of time that impacted material is exposed to ambient air at the site.
- Drill cuttings from the hollow-stem auger borings will be containerized as soon as possible during completion of each soil boring.
- Meteorological conditions are also a factor in the generation and migration of odors. Some site activities may be limited to times when specific meteorological conditions prevail, such as when winds are blowing away from a specific receptor.

4. Documentation and Reporting

The attached Daily Data Sheet will be filled-out each day to record all of the details of the CAMP work. The form will be used to record the following information:

- Date and weather, with significant changes noted which may affect the positioning of the meters or recording of the data.
- Calibration results for the instruments.
- Locations of the upwind and downwind monitoring stations, and any changes made to the locations during the day to adjust for changing work locations or wind directions.
- Any significant readings made during the day, such as exceedances which occur and their causes.

Additional information will be noted in the project field book(s), as necessary.

The electronic measurements from the PIDs and dust meters will be downloaded each day, reviewed, and archived. Exceedances of the action levels, if any, and the actions to be taken to mitigate the situations, will be discussed immediately with the on-site representatives, or reported within one business day to the NYSDEC project manager (if on-site NYSDEC oversight is not provided). The results of the daily CAMP monitoring will also be discussed in the daily written report to the NYSDEC project manager. Summaries of all air monitoring data will be provided to the NYSDEC or the NYSDOH upon request.

CAMP odor monitoring results will be recorded in the field log book and/or the Daily Data Sheet, and will also be available for review by the state agencies.

ATTACHMENT A

Community Air Monitoring Daily Data Sheet

Community Air Monitoring Daily Data Sheet

Date:

Site:

Project Number:

Weather:

Monitoring Start Time:

End Time:

Monitoring Station Location	Time (24 hour)	CAMP PID (ppm)	CAMP Particulate (mg/m3)	Wind Direction	Work Zone PID (ppm)	Work Zone Particulate (mg/m3)	Activity	Comments

Notes:

INSTRUMENT INFORMATION **Time** **Span and Agent**

PID Model: **Serial Number:** **Calibration:**

PID Model: **Serial Number:** **Calibration:**

Dust meter model: **Serial Number:** **Calibration:**

Dust meter model: **Serial Number:** **Calibration:**

Notes for Map on Reverse Side:

Circle Work Area. Show start and end times if there are multiple work areas.

↗ wind direction | **U** Upwind Station | **D** Downwind Station

Monitoring Completed By (print and sign): _____

NYACK BOAT CLUB

CHAIN LINK FENCE

BOAT RAMP

APPROXIMATE PROPERTY LINE

SB55 MW10S SB54 SB52 SB73 SB58 SB30 SB32 SB51 SB72 SB31 SB33 SB71 SB70 SB34 SB35 SB36 SB69 SB67 MW43 SB68 MW42 SB66 SB11 SB37 SB65 SB39 SB64 SB38 SB41 SB63 SB40 SB56 SB43 SB62 SB42 SB53 MW40 SB57 SB44 SB61 SB45 SB46 SB47 SB60 SB48 SB59 SB49 SB50

TOP OF BANK

BOTTOM OF BANK

SIDEWALK

LIMIT OF ISS AREA

OU1 UPPER TERRACE

OU1 LOWER TERRACE

LIMIT OF ISS AREA

LIMIT OF DEEP ISS AREA

BULKHEAD REMAINS

REMAINS OF MOORING DOLPHIN

OIL PIPE

?

REMAINS OF MOORING DOLPHIN

GAS METER PITS

GEDNEY STREET

CONCRETE

TOP OF BANK

BOTTOM OF BANK

DRIVE

GRAVEL

CHAIN LINK FENCE

MW33D

HUDSON RIVER

WOOD PIER

N

LEGEND:

- PROPERTY BOUNDARY
- ISS LINE
- HIGH WATER LINE
- MEAN HIGH WATER LINE (DASHED WHERE INFERRED)
- LOW WATER LINE
- RIP RAP
- SB59 — PROPOSED SOIL BORING
- MW42 — MONITORING WELL
- SB11 — SOIL BORING
- COAL TAR OR NAPL-SATURATED SOIL
- MEDIUM TO HEAVY STAIN, SHEEN OR NAPL BLEBS
- SLIGHT HYDROCARBON-LIKE ODOR, HYDROCARBON STAINING, SLIGHT SHEEN

SOURCES:

1. *FIGURE 4-1: VISIBLE IMPACTS, NYACK FORMER MGP* OF THE OU2 RI REPORT, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY AECOM, SCALE: 1" = 50', DATE: 04/22/09.
2. *FIGURE 2: PROPOSED SOIL BORING LOCATIONS* OF THE OU2 PRE-DESIGN INVESTIGATION WORK PLAN, PREPARED FOR ORANGE AND ROCKLAND UTILITIES, PREPARED BY ARCADIS, SCALE: 1" = 50', DATE: 2011.

0 40 80

SCALE, FEET

PRE-DESIGN INVESTIGATION WORK PLAN
OPERABLE UNIT 2
NYACK FORMER MGP SITE
NYACK, NEW YORK

ORANGE AND ROCKLAND UTILITIES, INC.
SPRING VALLEY, NEW YORK

GEI Consultants

PREVIOUS AND PROPOSED SOIL BORING LOCATIONS

Project 121640-1001 | March 2012 | Figure 3

I:\Project\ORANGE & ROCKLAND\Nyack\PDI Work Plan\Drawings\2012-03\Nyack-PDIWP Figures.dwg

Appendix F

Health and Safety Plan

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Appendix F

Health and Safety Plan

Nyack Manufactured Gas Plant Site
Nyack, New York
NYSDEC Site # 3-44-046

Submitted To:
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

Submitted By:
GEI Consultants, Inc.
1301 Trumansburg Road, Suite N
Ithaca, NY 14850

March 2012
Project #: 121640-1001

James Edwards
Project Geologist

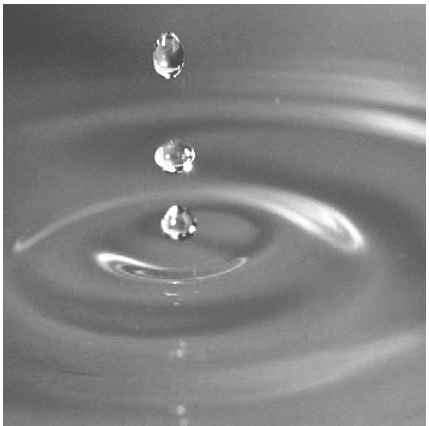


Table of Contents

Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
BTEX	Benzene, Toluene, Ethylbenzene, Total Xylenes
CHSO	Corporate Health and Safety Officer
CMS	Chip Measurement System
CNS	Central Nervous System
COC	Compounds of Concern
CRZ	Contamination Reduction Zone
CSO	Combined Sewer Overflow
EPA	United States Environmental Protection Agency
EZ	Exclusion Zone
GEI	GEI Consultants, Inc.
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
LEL	Lower Explosive Limit
MGP	Manufactured Gas Plant
MSDS	Material Safety Data Sheet
NAPL	Non-aqueous Phase Liquid
NFPA	National Fire Protection Association
NYSDEC	New York State Department of Environmental Conservation
O&R	Orange & Rockland Utilities, Inc.
OSHA	Occupational Health and Safety Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated bipenyls
PEL	Permissible Exposure Level
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
SZ	Support Zone
USCG	United States Coast Guard
VOC	Volatile Organic Compounds
WNV	West Nile Virus

1.0 Background Information

1.1 General

Consultant

GEI Consultants, Inc.
1301 Trumansburg Road
Suite N
Ithaca, NY 14850
607.216.8955

Project Name

Pre-Design Investigation
Nyack MGP Site
Village of Nyack, Rockland County, 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 former manufactured gas plant (MGP) located on Orange & Rockland Utilities, Inc. (O&R) property and adjacent areas in the Village of Nyack, New York. Reading of the HASP is required of all on-site GEI personnel and GEI subcontractors. GEI subcontractors are required to develop their own site-specific HASP and may use this as a guide. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions. In addition to GEI's HASP, all site personnel and subcontractor staff must have read and adhere to O&R's site-specific EHASP.

1.2 Project Description

The work scope is described in the Pre-Design Investigation (PDI) Work Plan. The activities for the investigation are summarized as follows:

- Subsurface utilities will be located by calling Dig Safely New York and a site meeting held with any companies or municipalities with subsurface utilities present.
- Subsurface soil borings will be advanced in order to obtain additional information regarding the thickness and composition of fill beneath the site; to determine the depth to the water table; to observe and screen subsurface soil in order to identify conditions that may be indicative of impacts by MGP or other residuals; to obtain additional information to map the surface of the bedrock unit; and to obtain geotechnical data for the PDI.
- Sediment sampling will be performed using the vibracore method in adjacent areas of the Hudson River.

- A survey will be performed for all the investigation sample points and the shoreline area.
- A bathymetric survey and magnetometer survey will be performed in the Hudson River area.

1.3 Site Description

The Nyack MGP site is located between Gedney Street and the Hudson River in the Village of Nyack, New York. The site covers a total of approximately 4.02 acres, of which approximately 1.7 acres is submerged land in the Hudson River. The site is located in an urban setting where land surrounding the site is used for residential and commercial purposes. The PDI will be performed in the OU2 Area of the site. OU2 is defined as the terrestrial portion of the site outside of the soils which were subjected to in-situ solidification (ISS), and the adjacent portion of the Hudson River which shows indications of impact by MGP residuals.

2.0 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.

3.0 Hazard/Risk Analysis

Physical hazards associated with heavy equipment operations are present. The heavy equipment associated with this project will include drilling equipment, manual soil sampling equipment, excavation equipment, and vibra-core sediment sampling equipment mounted on a small boat. Some of the hazards associated with this equipment include crushing of limbs, slipping, tripping, or falling, heavy lifting, and drowning.

The Drilling Contractor will verify that all electric, gas, water, steam, sewer, and other services lines should be shut off, capped, or otherwise controlled, at or outside the work areas before work is started. In each case, any utility company that is involved will be notified in advance by the Drilling Contractor, and its approval or services, if necessary, shall be obtained.

The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

3.1 Personal Safety

Field activities have the potential to take site workers into areas which may pose a risk to personal safety. The following websites (sources) have been researched to identify potential crime activity in the area of the project:

- www.crimereports.com
- www.cityrating.com/crimestatistics.asp
- www.crimemapping.com

South Nyack, New York is listed on the City Rating website as having a crime rate (total incidents) of 47 in 2009, of which 8 were violent crimes. The Crime Reports website lists 0 criminal reports for fourth quarter 2011.

To protect yourself, take the following precautions:

- 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
- 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

Site workers must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If site workers 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 and site worker safety will be confirmed at the start, mid-point, and near the end of each working day.

3.2 Activity Hazard Analysis

The potential hazards for this project have been categorized into site and activity hazards. Site hazards are those hazards associated with site conditions, and activity hazards are associated with GEI on-site activities. The potential hazards and control measures established to reduce the risk of injury or illness are identified in the following tables. Safe operating procedures established for routine hazards and common site conditions are included in the table below, or contained in the GEI Corporate Health and Safety Manual.

3.2.1 Activity Hazard Analysis Table

SITE HAZARDS	
Potential Hazard	**Control Measures**
Construction Safety	▪ 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 vest when working near equipment or motor vehicle traffic. ▪ Position yourself in a safe location when filling out logs and 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.
Physical Injury	▪ Wear steel toe/steel shank safety boots in good condition with non-slip soles. ▪ Maintain good visibility of the work area. ▪ Avoid walking on uneven or debris ridden ground surfaces.
Noise	▪ Wear hearing protection when near loud noises. ▪ Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection.
Heat/Cold Stress	▪ 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/cold stress and fatigue. ▪ In the event of heat stroke, bring the victim to a cool environment, call for help, and initiate first aid procedures. ▪ See Heat Stress/Cold Stress Guidelines in Appendix C.
Vehicular Traffic	▪ Wear traffic safety vest at all times. ▪ Use cones, flags, barricades, and caution tape to define work area. ▪ Use a "spotter" to locate oncoming vehicles. ▪ Use vehicle to block work area. ▪ Engage police detail if needed.
Boating Safety	▪ Use caution when boarding the boat. ▪ Establish a safe area for boarding and de-boarding. ▪ Do not stand in the boat. Avoid sudden movements. ▪ Stay away from the edge of the boat. ▪ Wear a PDF at all times when on the water or working near water where there is a potential for falling in.

Utilities	▪ Check that contractor has cleared underground utilities before any intrusive activities, and that contractor has coordinated with utility locating services, property owner(s) or utility companies. ▪ Utilities are to be considered live or active until documented otherwise. ▪ For overhead utilities within 50 feet, have contractor determine with the utility company the appropriate safe distance. Minimum distance for clearance is based on voltage of the line. ▪ An observer will be established when operating drilling rigs near overhead utilities. ▪ Several subsurface soil borings will be advanced inside of the active O&R electrical substation fenced area. All GEI staff assigned to the site and all GEI subcontractor staff will have completed O&R's substation work training class before mobilization. The GEI Site Manager will document attendance for the training. No GEI or subcontractor staff will enter the substation area without a O&R substation oversight staff present, without exceptions.

ACTIVITY HAZARDS

Activity	Potential Hazards	Protective Equipment / Controls
Entering Construction Site	Heavy equipment, dust, noise.	Hard hat, orange safety vest, steel-toed, steel-shank boots, safety glasses, and nitrile/neoprene gloves.
Drilling	Heavy equipment, dust, noise.	In addition to the PPE listed above for "Entering Construction Site" hearing protection (ear plugs or ear muffs) will be utilized.
Soil Excavation and Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hat, safety glasses, and hearing protection. Maintain eye contact with equipment operator.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing from noise, hearing protection.
	Traffic Hazards	Use traffic cones, signage, and traffic safety vests in accordance with Traffic Regulations. Use a traffic spotter.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Excavation	Maintain proper distance from edge of excavation; be alert for unstable soil conditions/wall collapse. Do not enter excavations.

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment / Controls**
	Contaminant Contact	Wear protective coveralls (e.g., Tyvek™) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling samples. Dispose of gloves after sampling. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photo-ionization detector and multiple gas meter (that monitors % oxygen, and lower explosive limit), and dust monitor to monitor the work zone as specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then engineering controls will be implemented. If excursions of the action levels persist, then upgrade to full face respirator with HEPA/organic vapor cartridge as indicated in Section 4.0 of the HASP. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with Appendix D.
Subsurface Boring/ Sample Collection	Heavy Equipment / Proximity to Heavy Equipment	Distancing, safe work practices, inspections, wear hard hat, safety glasses, and hearing protection. Maintain eye contact with equipment operator.
	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
	Noise	Distancing from noise, hearing protection.
	Traffic Hazards	Use traffic cones, signage, and traffic safety vests in accordance with Traffic Regulations. Use a traffic spotter.
	Tool Use	Use proper guarding, inspections, wear safety glasses with side shields, hearing protection.
	Contaminant Contact	Wear protective coveralls (e.g., Tyvek™) (if needed) with shoe covers, nitrile gloves, and safety glasses when handling samples. Dispose of gloves after sampling. Personal protective equipment will be decontaminated and disposed of in general accordance with Section 10 of this HASP.
	Exposure to vapors from contaminated soils	Use work zone air monitoring equipment including photo-ionization detector and multiple gas meter (that monitors % oxygen, lower explosive limit, hydrogen sulfide and hydrogen cyanide), and dust monitor to monitor the work zone as

ACTIVITY HAZARDS		
Activity	**Potential Hazards**	**Protective Equipment / Controls**
		specified in Section 8.0 of the HASP. If air monitoring action levels are exceeded, then engineering controls will be implemented. If excursions of the action levels persist, then upgrade to full face respirator with HEPA/organic vapor cartridge as indicated in Section 4.0 of the HASP. Community air monitoring of the area immediately surrounding the work zone will be completed in accordance with the GEI CAMP.
Sediment Sampling	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall/ Drowning	Maintain safe and orderly work areas. Wear approved floatation device. Identify and prepare potential tripping hazards on the boat. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
Survey	Adverse Weather	Monitor weather daily. Discontinue work as necessary based on lightning, limited visibility, impaired mobility, etc.
	Heat/Cold Stress	Acclimatization, work/rest regimes, drinking warm/cold fluids.
	Slip/Trip/Fall	Maintain safe and orderly work areas. Unloading areas should be on even terrain. Identify and repair potential tripping hazards.
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.* General on-site provisions shall 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, sunscreen, hearing protection and washing facilities.		

If site conditions suggest the existence of a situation more hazardous than anticipated, the site personnel shall evacuate the immediate area. The hazard, the level of precautions, and the Personal Protection Equipment (PPE) shall then be reevaluated with the assistance and approval of the GEI Corporate Health and Safety Officer (Steve Hawkins) and Project Manager.

3.2.2 Handling Drums and Containers

Regulations for handling drums and containers are specified by OSHA 29 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 site investigation and remediation activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with all applicable regulations.

3.3 Evaluation of Potential Chemical Hazards

The characteristics of constituents of concern (COC) at the Site are discussed below for information purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below.

3.3.1 Volatile Organic Compounds (VOCs)

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 oil or tar within soils and abandoned pipelines. At high concentrations these compounds generally have a depressant effect on the CNS, may cause chronic liver and kidney damage, and some are suspected human carcinogens. Benzene is a known human carcinogen. Acute exposure to high concentrations 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.

3.3.2 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)fluoranthene, 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, naphthalene, phenanthrene, phenols, pyrene.

Coal tar products and other SVOCs are present at the Site within impacted soil and groundwater and as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former MGP structures, and abandoned pipelines.

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 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.

3.3.3 Heavy Metals

The site soils may contain elevated levels of metals including arsenic, chromium, lead, mercury, and selenium.

Exposure to high concentrations of arsenic can cause dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, and hyperpigmentation of skin. Chronic exposure to arsenic has resulted in lung cancer in humans.

Exposure to high concentrations of 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.

Both 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 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 high concentrations of mercury can cause dizziness, salivation nausea, vomiting, diarrhea, constipation, emotional disturbance, and kidney injury. Chronic exposure to mercury can cause CNS damage.

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.

As with SVOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

3.3.4 Asbestos-Containing Materials

The site soils potentially contain asbestos-containing materials (ACM) in the forms of demolition debris. Chronic exposure to asbestos may cause asbestosis and mesothelioma. The primary route of exposure for asbestos is inhalation during the disturbance and/or removal of asbestos from the pipe insulation and cement pipes.

Asbestos is strictly regulated under OSHA 29 CFR 1910.1001/1926.1101. Employees that may be potentially exposed to ACM must participate in a medical surveillance program, have specific training in the hazards and controls of exposure to asbestos and wear respirators with high efficiency particulate (HEPA) filters. All work must be conducted in demarcated regulated areas to minimize the amount of people within the exposure area. Employers must conduct air sampling and provide signs and labels regarding the presence of asbestos.

3.3.5 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) may be of potential concern based on previous land uses at the site. Exposure to PCBs can occur through unbroken skin without immediate pain or irritation. Acute affects of PCB exposure 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.

3.3.6 Cyanide

Cyanide compounds are common by-products of manufactured gas production. Hydrogen cyanide is toxic because it is a chemical asphyxiant. It replaces the oxygen in the blood and thereby suffocates the cells. Ferrocyanides 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 ferrocyanide molecule, therefore hydrogen cyanide is not a concern at this site.

3.3.7 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 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.

3.3.8 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when personal protective equipment (PPE) must be upgraded or changed. Action levels for volatile organic compounds and associated contingency plans for the work zone are discussed within Section 8.0 of this Health and Safety Plan.

Exposure to organic vapors shall be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photo-ionization detector (PID).
- 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.

3.3.9 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 4.0 will be worn for all activities where contact with potential contaminated media or materials are expected.

Material Safety Data Sheets (MSDS) (as available) and/or Occupational Health Guidelines for decontamination chemicals, laboratory reagents, and calibration gases that may be used on site are included in Appendix B. Specific chemical hazards information from the MSDS and Occupational Health Guidelines are summarized in Table 1.

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Asbestos	1332-21-4	0.1 f/cc	0.1 f/cc over 8 hr period or 1.0f/cc over 30 min.	Inhalation Ingestion Skin Contact	Asbestosis (chronic exposure); mesothelioma, breathing difficulty, interstitial fibrosis' restricted pulmonary function, finger clubbing; irritate eyes, known human carcinogen	Respiratory system, eyes	White, greenish, blue, or gray-green fibrous solids FP: NA LEL: NA UEL NA VP: 0 mm
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3 A.L.005mg/ m^3	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 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, known human carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12^o F 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), leukopenia (reduced blood leucocytes), moncytosis (increased monocytes), Eosinophilia, eye injury, conjunctivitis, skin ulcer, sensitivity dermatitis, potential carcinogen	Blood, respiratory system, liver, kidney, eyes, skin, lung cancer	FP:NA VP: Very Low LEL: NA UEL: NA

Table 1
Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
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, Central Nervous System	FP: 55^{o} F LEL: 0.8% UEL:6.7% VP: 7 mm
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, Central Nervous System	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm
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, Central Nervous System, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA LEL: NA UEL: NA VP: 0 mm
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m^3	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 LEL: NA UEL:NA VP: 0.0012 mm

Table 1
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
PAH's as Coal tar pitch Volatiles (CTPV)	65996-93-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Skin contact Ingestion	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory system, Central Nervous System, liver, kidneys, skin, bladder,	Black or dark brown amorphous residue.
PCBs	11097-69-1	0.5 mg/m^3 (Skin)	0.5 mg/m^3 (Skin)	Inhalation Skin Absorption Ingestion Skin Contact	Irritate eyes; chloracne; liver damage	Skin, eyes, liver, reproductive system	Colorless liquid or solid with a mild, hydro-carbon odor VP = 0.00006 mm
Phenol	108-95-2	10 ppm (skin)	5 ppm (19 mg/m^3) [skin]	Inhalation Skin Absorption Ingestion Skin Contact	Irritates eyes, nose, throat, anorexia, weight loss, weakness, muscle ache, pain, dark urine, cyanosis, liver and kidney damage, skin burns, dermatitis, tremors, convulsions, twitching	Eyes, skin, respiratory system, liver, kidneys	Colorless to light pink crystalline solid with sweet, acrid odor. FP:175 ^{o}F IP:8.5 LEL:1.8% UEL: 8.6% VP: 0.4 mm
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 LEL: NA UEL: NA VP: 0 mm

Table 1
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, Central Nervous System, liver, kidneys	FP: 40° F 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

Abbreviations	
A.L. Action Level	ppm = parts per million
C = ceiling limit, not to be exceeded	STEL = Short-term exposure limit (15 minutes)
FP = Flash point	TWA = Time-weighted average (8 hours)
GI = Gastro-intestinal	UEL = Upper explosive limit
LEL = Lower explosive limit	VP = vapor pressure approximately 68° F in mm Hg (mercury)
mm = millimeter	

3.4 Biological Hazards

The site is located in a commercial area which is surrounded by other commercial properties, residential properties, and some woods and brush-covered areas. Employees working on this project should be aware of the potential biological hazards at this site. Each is discussed in detail below.

3.4.1 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 central nervous system 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.

3.4.2 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.

3.4.3 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 UVA/UVB rays.

3.5 Physical Hazards and Control

3.5.1 Utility Clearance in the Hudson River

New York requires that a utility notification be performed at least two (2) full work days prior to initiation of any subsurface work. GEI will contact Dig Safely New York (1-800-962-7962) to request a mark-out of natural gas, electric, telephone, cable television, water and sewer lines that may be present in the Project Area of the River prior to sampling of sediments. Work will not begin until the required utility clearances have been performed.

Public utility clearance organizations typically do not mark-out underground utility lines that are located on private property. As such, GEI must exercise due diligence and try to identify the location of any private utilities that may be buried within the Project Sub-Areas of the River GEI will fulfill this requirement in several ways, including:

- Obtaining as-built drawings for the areas being investigated from the property owners
- Visually reviewing each proposed sediment sampling location with the property owner or knowledgeable site representative

Due to the limitations associated with utility mark-outs and the fact that work is being conducted in the River, GEI and/or the marine subcontractors' staff may meet with individual utility owners at each Project Sub-Areas to determine if they have any underground lines located in the River. This information will be reviewed by the Project Team. If it is determined that underground utilities are located in the sediment sampling areas, the sampling locations will be changed to reduce the possibility of encountering underground utilities during the proposed investigation.

3.6 Slip, Trip, and Fall Hazards

3.6.1 Access to Water

Access to the sediment sampling area will be determined prior to mobilization. When accessing these locations, employees should be aware of the potential for slipping, falling, or tripping and

the presence of various types of debris, including rocks, glass, construction debris, and general refuse. Site workers will walk around, not over or on top of, debris or trash piles. When carrying equipment, identify a path that is clear of any obstructions. It may be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

Boat Deck

The boat or drilling platform itself presents slip, trip, and fall hazards to the field team due to the accumulation of water on the deck. To the extent possible, accumulated water should be removed from the boat or barge deck to avoid this hazard. If possible, anti-slip matting should be placed on the decks as an additional precaution.

Good Housekeeping

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

- Orderly placement of materials, tools, and equipment
- Placing trash receptacles at appropriate locations for the disposal of miscellaneous rubbish
- Prompt removal and secure storage of items that are not needed to perform the immediate task at hand
- Awareness on the part of all employees to walk around, not over or on, equipment that may be stored in the work area

3.7 Working on Water

This project presents unique hazards to the sampling team when compared to land-based investigation programs. Therefore, special attention has been given to the topic of marine safety in this HASP, including the scheduling of a pre-mobilization strategy meeting between GEI and the marine subcontractors to develop the specific safety and emergency communications protocols (based on actual site conditions) to address the hazards of working in the River.

Boat and Inspection

Effort has not been made to incorporate all applicable USCG regulations; however, some selected excerpts from USCG regulations have been included to provide general guidance. The boat captains are ultimately responsible for having knowledge of, and complying with, all USCG and any other applicable marine regulations.

Before being placed in service, boats and barges will be inspected by the boat captains in consultation with the SSO and determined to be in safe operating condition. The boat captains also must verify that all required safety gear is aboard before use. A pre-use inspection of the watercraft also must be performed by the boat captains before each daily use. All safety deficiencies will be corrected prior to permitting the boat or barge to leave the dock and resume normal service.

The boat captains must provide written documentation of the initial boat inspection and the daily inspections to the SSO. These inspections will be documented on standard inspection forms used by the boating contractor.

Watercraft determined to be in unsafe condition shall be taken out of service and its use prohibited until unsafe conditions have been corrected.

Boat Registration

All watercraft must meet USCG or state watercraft registration and numbering requirements. The USCG requires that all motorized watercraft be numbered in the state of principal use. A valid certificate showing the numbers issued to the watercraft is required to be on board the watercraft whenever the watercraft is in use. Watercraft registration numbers are required to be painted or permanently attached to each side of the forward half of the watercraft. Watercraft registration must be updated as the governing laws require.

Boat and Barge Capacity

The survey boat or drilling barge will not be loaded beyond the maximum capacity (number of passengers or the total weight of passengers and gear) as specified on the manufactures capacity plate affixed to the vessel. In addition, consideration will be applied to down rate this capacity (at the discretion of the GEI survey lead) so that there is sufficient room, freeboard, and stability to safely perform the intended task given the prevailing weather and river conditions. All equipment shall be properly loaded and secured to prevent shifting and to limit tripping hazards. All personnel will be evenly distributed on-board and will be instructed to remain seated at all times while the vessel or barge is underway or being moved to the drilling areas.

Personal Flotation Devices

All employees working on the water, near the water's edge, or at any other time where there exists the possibility of falling into the water are required to wear a USCG-approved personal flotation device (PFD). When selecting the appropriate type and style of PFD, the type of activity being conducted and the required mobility of the user must be considered, because some activities may require a PFD which is less restrictive.

GEI employees will be required to wear a USCG-approved Type III PFD or a Type V work vest. Although not as effective as a Type I in turning an unconscious wearer face-up in the water, these vests are generally less bulky and restrictive, and are typically the PFDs of choice in a marine work environment. The use of inflatable PFDs is discouraged due to questionable reliability and maintenance requirements.

Prior to and after each use, each PFD shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

In situations where the water temperature has fallen below 50˚F, a USCG-approved Mustang flotation suit shall be worn in place of the Type III or Type V PFD work vest.

Float Plan

Prior to leaving shore, a plan of the day's activities, including time and place of departure, anticipated return time, and list of employees working on the project, will be filed with the PM. In the event the boat crew does not check in at the designated time stated on the float plan, the PM will be responsible for implementing the emergency procedures outlined in the float plan. A Float Plan Form is presented in this HASP as Appendix E.

Emergency Equipment

All GEI personnel working on boat(s) that are owned/operated by others are to be informed of the locations of all on-board safety equipment including first-aid kit, fire extinguishers, throw-ring, marine radio or other suitable communications equipment as applicable to the specific boat being used. Additionally, all personnel will be instructed as to their individual roles and responsibilities in the event of an on-board emergency (loss of operator, medical emergency, man overboard) prior to the start of any on-water work.

Handling of Fuels

Gasoline must be stored in an approved container or tank. Storage in anything other than an approved container is strictly prohibited. Gasoline is a flammable liquid and should be stored at room temperature, away from potential heat sources such as the sun and away from ignition sources.

Walking in the River

In areas of shallow water, such as along the sides of the River, it may be necessary to walk into the water to perform the probing. If it is necessary to wade into the River, site workers will be required to wear a PFD, hip waders, or knee high boots, depending on the specific conditions at hand. Because of the increased chance of a slip or fall while wading, it is necessary that all site

workers exercise additional care and caution while performing such sampling activities. Site workers are cautioned not to wade into water that are more than knee high in depth, or where the employee cannot visibly see the stream bottom. All water work must be conducted via the buddy system. No site worker will be permitted to work on or near the water alone. An appropriate PFD must be worn at all times when working in or near the water's edge.

4.0 Personal Protective Equipment

The PPE specified in Table 2 represents PPE selection required by 29 CFR 1910.132, and is based on the AHA of Section 3. 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 as follows:

Table 2
PPE Selection

Safety Equipment	Level A	Level B	Level C	Level D
Tyvek™ suit or work overalls				●
Hard hats with splash shields or safety glasses			●	●
Long pants	●	●	●	●
Steel-toe/shank boots				●
Steel-toe/shank boots with overboots			●	●
Chemical-resistant gloves as appropriate for work being performed and materials handled			●	●
Half- or full-face respirators with appropriate cartridges as approved by the CHSO			●	
Tyvek™ splash-resistant suit			●	
Chemical-resistant clothing		●		
Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA	●	●		
Inner and outer chemical-resistant gloves	●	●		
Chemical-resistant safety boots or shoes	●	●		
Two-way radio	●	●		
Hard hat	●	●		
Fully encapsulating chemical-resistant suit	●			
Reflective vest	●	●	●	●

PPE requirements for field activities are as follows.

Activity	Level of Protection	Backup Protection
Mobilization and Demobilization	D	C
Drilling and Sampling	D	C
Excavation and Sampling	D	C
Sediment Sampling	D	C
Survey	D	C
Air Monitoring	D	C

PPE will include hard hats, safety glasses or face shields, long pants, steel toe/steel shank boots, hearing protection, nitrile gloves, and leather or Kevlar gloves. If heavily contaminated soil or groundwater is encountered during intrusive work, Tyvek™ suits and overboots may be utilized. 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 exclusion zone and this HASP will be revised with oversight of the CHSO. GEI personnel will not re-enter the exclusion zone until conditions allow.

OSHA Requirements for Personal Protective Equipment

All PPE used during the course of this field investigation must meet the following OSHA standards:

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 1967
Foot (EH)	ASTM F2413-05	

CFR = Code of Federal Regulations
ANSI = American National Standards Institute
ASTM = American Society For Testing and Materials

5.0 Key Project Personnel/Responsibilities and Lines of Authority

5.1 GEI Personnel

- Tim Olean — GEI Project Manager
- Garrett Schmidt — GEI Site Safety Officer and Field Representative
- Steven Hawkins — GEI Corporate Health and Safety Officer
- Bruce Coulombe — Regional Health and Safety Officer

The implementation of health and safety at this project location will be the shared responsibility of the GEI Project Manager (PM), the GEI Corporate Health and Safety Officer (CHSO), the GEI Project Site Safety Officer (SSO), other GEI personnel implementing the proposed scope of work.

5.1.1 GEI Project Manager

The GEI Project Manager is responsible for ensuring that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Verifying that the GEI staff selected to work on this program are sufficiently trained for the sampling activities
- Assuring that all 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 all 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
- Coordinating the activities of all GEI subcontractors and ensuring that they are aware of the pertinent health and safety requirements for this project

5.1.2 GEI Corporate Health and Safety Officer

The GEI CHSO, Steve Hawkins, 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:

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

5.1.3 GEI Site Safety Officer

All 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, the Field Team Leader 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 all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO's specific responsibilities include:

- Assuring that all personnel to whom this HASP applies, including subcontractors, have submitted a completed copy of the HASP receipt and acceptance form
- Conducting the pre-entry briefing prior to beginning work, and subsequent safety meetings as necessary
- Conduct daily Safety Tailboard meeting in accordance with O&R (can be combined with “pre-entry”) briefing for river related work
- Assuring that all personnel to whom this HASP applies have attended and actively participated in a pre-entry briefing and any subsequent safety meetings that are conducted during the implementation of the program
- Maintaining a high level of health and safety consciousness among employees implementing the proposed 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 all 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 all noncompliance situations and stopping work in the event that an immediate danger situation is perceived
- Monitoring and controlling the safety performance of all personnel within the established restricted areas to ensure that required safety and health procedures are being followed
- Stopping work in the event that an immediate danger situation is perceived
- Conducting accident/incident investigations and preparing accident/incident investigation reports

5.1.4 GEI Field Personnel

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

Lines of Authority will be as follows:

On site – GEI will have responsibility for safety of its employees during the work performed at the Nyack MGP site in, Nyack, New York. 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 Project Manager and with the O&R representative.

Boat Captain

GEI will hire marine subcontractors to provide boats, drilling platforms or barges, drilling and coring equipment, survey equipment, boat captains and crews for the sediment sampling task. All boat captains assigned to the project will be responsible for managing all on-water operations conducted in support of these proposed efforts. These responsibilities include:

- Complying with all applicable USCG regulations and requirements
- Serving as primary point of contact for coordinating marine operations with GEI's SSO
- Verifying that the vessels are properly licensed/registered and that the vessels are properly sized and equipped for existing conditions
- Conducting a mandatory all-hands marine safety briefing prior to the start of on-water activities, which will include a review of procedures for abandoning ship and man overboard emergencies
- Support GEI SSO with daily safety tailboard meetings
- Performing a thorough daily inspection of the boats and support equipment prior to departure and submitting inspection documentation to the SSO
- Postponing or suspending marine operations due to weather and water conditions
- Coordinating all on-water emergency response efforts, if necessary

5.2 Subcontractors

GEI may subcontract the following firms or additional firms that will be identified prior to the start of the project to assist in performing work on this project:

Analytical Services	Dr. Steven Hawthorne University of North Dakota Energy & Environmental Research Center (EERC) 15 North 23rd Street - Stop 9018 Grand Forks, ND 58202-9018 TestAmerica Laboratories 30 Community Drive, Suite 11 South Burlington, VT 05403
Sediment Quality Triad Interpretation	Nick Azzolina David V. Nakles, Ph.D., P.E., D.E.E. 4952 Oakhurst Ave. Gibsonia, PA 15044

Geotechnical and ISS Treatability Testing	GeoTesting Express 1145 Massachusetts Avenue Boxborough, MA 01719 KEMRON Environmental Services 1359-A Ellsworth Industrial Blvd. Atlanta, GA 30318
Toxicity Testing	AquaTox Research 1201 East Fayette Street Syracuse, NY 13210
Benthic Community Analysis	Aquatec Biological Services 273 Commerce Street Williston, VT 05495
Survey and Vibracore Services	Thew Associates 6431 US Highway 11 Canton, NY 13617

The list of GEI subcontractors will be finalized with an amendment to this HASP prior to site mobilization. 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.

5.3 Emergency Contact List

<table>
<tr><th colspan="3">EMERGENCY INFORMATION</th></tr>
<tr><th colspan="2">Important Phone Numbers</th><th>Directions to Hospital</th></tr>
<tr><td>Local Police</td><td>911</td><td rowspan="10">Nyack Hospital
160 North Midland Ave.
Nyack, New York 10960

Start out going south on Gedney St toward 4th Ave. Take the 1st right onto 4th Ave. Take the 1st right onto N Broadway. Take the 1st left onto 5th Ave. Turn left onto N Midland Ave. 160 N MIDLAND AVE is on the right.

Total Travel Estimate: 2 mins / 0.66 miles

See Map in Appendix A

<u>Nearest Occupational Health Clinic</u>

Westchester Medical Center
100 Woods Rd.
Valhalla, New York 10595

(914) 493-7000

Total Travel Estimate: 20 mins / 12.54 miles</td></tr>
<tr><td>Fire Department</td><td>911</td></tr>
<tr><td>Ambulance</td><td>911</td></tr>
<tr><td>State Police or
County Sheriff</td><td>911</td></tr>
<tr><td>Local Hospital:
Nyack Hospital
160 N. Midland Ave.
Nyack, NY 10960</td><td>(845) 348-2000</td></tr>
<tr><td>Project Manager
Tim Olean</td><td>(607) 216-8958</td></tr>
<tr><td>Corporate Health and
Safety Officer
Steve Hawkins</td><td>(860) 368-5348 office
(860) 916-4167 cell</td></tr>
<tr><td>Regional Health and
Safety Officer
Bruce Coulombe</td><td>(607) 216-8959 office
(607) 793-3424 cell</td></tr>
<tr><td>Maribeth McCormick
O&R Client Contact</td><td>(845) 783-5534
914.5557.1361</td></tr>
<tr><td>Utility Clearance
Permit #</td><td>Not Applicable</td></tr>
<tr><td colspan="3">Nearest Telephone Location: On-site cellular</td></tr>
</table>

6.0 Training Program

6.1 HAZWOPER Training

In accordance with 29 CFR 1910.120, hazardous waste site workers shall, 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 shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical). Proof of training shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all 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 shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

6.3 Site-Specific Training

Prior to commencement of field activities, the GEI CHSO or her representative will ensure all 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 all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Personnel that have not received site-specific training will not be allowed on site.

6.4 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by GEI's field representative to assist GEI personnel in safely conducting work activities. The briefings will 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 or on the GEI Daily Safety Briefing form. The meetings will also be an opportunity to periodically update the workers on monitoring results. In addition, all GEI personnel shall sign the HASP to

document that they understand the hazards and control measures presented and agree to comply with the procedures established in the plan.

6.5 First Aid and CPR

The PM will identify individuals certified in first aid and CPR, or identify individuals for such training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association.

7.0 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. Steven Hawkins is GEI's CHSO and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at all branch office locations. Comprehensive examinations are given to all GEI field personnel participating in hazardous waste operations on an annual or biennial basis (as determined to be appropriate by the CHSO). The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Steve Hawkins telephone number is:
(860) 368-5348 office
(860) 916-4167 cell

Under the CHSO's supervision, all 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 all levels of respiratory protection, in particular.

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.

All 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 shall be submitted to the GEI CHSO or her representative prior to the start of field activities.

8.0 Monitoring

Monitoring shall 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.

GEI will conduct perimeter air monitoring, and work zone monitoring for on-site workers. GEI will monitor and document daily site conditions and operations and inform field representative of results. If action levels are exceeded GEI's field representative will immediately implement dust suppression activities and notify GEI's Project Manager.

GEI will provide the following equipment for health and safety monitoring of on-site personnel:

- Particulate Meter (PM-10 capable)
- Four-gas meter (O_2, H_2S, CGI, CO)
- Photo-ionization Detector (PID)
- Sound Level Meter if deemed necessary by the CHSO or PM (type to be appropriate to the activities performed)

The perimeter and work zone air monitoring will be conducted during drilling and excavation activities. Table 3 provides a summary of real time air monitoring action levels and contingency plans for work zone activities.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
PID	Breathing Zone	1 ppm	Use Dräger Chip Measurement System (CMS) tube for benzene or Z-nose® to verify if concentration is benzene.
PID	Breathing Zone	0 - 500 ppm	No respiratory protection is required.
		500 - 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 & CHSO.
Oxygen meter (O_2)	Breathing Zone	< 20.7%	Stop work; withdraw from work area; ventilate area, notify PM & CHSO.
		> 21.1%	Stop work; withdraw from work area; notify PM & CHSO.
Hydrogen Sulfide (H_2S) meter	Breathing Zone	<5 ppm	No respiratory protection is required.
		>5 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, and notify PM & CHSO.
Combustible Gas Indicator (CGI)	Excavation/ Work Zone	< 10 % Lower Explosive Limit (LEL)	Investigate possible causes, allow excavation to ventilate; use caution during procedures.

Table 3
Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action
		> 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 & CHSO.
Particulate Meter	Excavation/ Work Zone	150 $\mu g/m^3$	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

9.0 Site Control Measures

9.1 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 shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall 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 shall 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 Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone. 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 shall 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.

9.2 Buddy System

GEI personnel should be in line-of-site or communication contact with another on-site person. The other on-site personnel should be aware of their role as a "buddy" and be able to provide

assistance in the event of an emergency. A copy of this plan shall be given to any person acting as a GEI "buddy" for informational purposes.

9.3 Sanitation for Temporary Work Sites

Temporary sanitary facilities including toilets will be available on site.

9.4 Illumination

Illumination requirements identified by OSHA are directed to work efforts inside buildings and/or during non-daylight hours. All 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 29 CFR 1926.56, Illumination.

9.5 Utilities

The location of any utility that could pose a risk to workers must be communicated to all workers during site safety indoctrination. Utilities should be marked or access otherwise restricted to avoid change 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. All utilities shall be considered “live” or active until reliable sources demonstrate otherwise.

9.5.1 Overhead Utilities

Overhead transmission and distribution lines are present at the site. 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 shall 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 and a competent electrician has certified that arcing cannot occur between the work location or superstructure.

10.0 Accident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, such as: lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage. The report shall be made to the GEI Project Manager verbally within 2 hours of the incident. The Project Manager will immediately inform the CHSO, the Director of Human Resources, and the O&R representative of the incident. An Accident Report Form will be completed and submitted to the CHSO and the Director of Human Resources within 24 hours of the incident.

11.0 Decontamination Procedures

A decontamination pad has been established for personnel decontamination and equipment decontamination.

11.1 Personnel Decontamination Station

A personnel decontamination station where workers 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 container) and disposed of in an approved facility. Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with all applicable state and federal regulations.

11.2 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 handle soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Methanol
- Liquid detergent and paper towels
- Plastic trash bags

The Contractor performing decontamination procedures is responsible for ensuring that the above materials, as required for their operation, are in sufficient supply.

12.0 Supplemental Contingency Plan Procedures

12.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their 40-hour HAZWOPER training. All hazardous materials used on the site will be properly labeled, stored, and handled. Material Safety Data sheets (MSDS) will be available to all potentially exposed employees.

12.2 Fire

In the event of a fire, all 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 GEI Project Manager and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager.

12.3 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.

Section 5 of this HASP contains detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. GEI field personnel will carry a cellular telephone.

12.4 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 mph, heavy rains or snow squalls, thunderstorms, hurricanes, 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 GEI Project Manager, the CHSO, and the O&R representative. The field representative will account for GEI personnel and subcontractor personnel and report their status to the GEI Project Manager.

12.5 Spills or Material Release

If a hazardous waste spill or material release, the SSO or his representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following.

- MSDS, if available, 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
- 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 ensure implementation of the necessary remedial action. If the release is beyond the capabilities of the site personnel, all 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 O&R representative.

12.6 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.

Health and Safety Plan Sign-Off

All GEI personnel conducting site activities must read the Health and Safety Plan, be familiar with its requirements, and agree to its implementation.

Once the Health and Safety Plan has been read, complete this sign-off sheet, and return it to the Project Manager.

Site Name:
Nyack Former MGP Site
Village of Nyack, Rockland County, New York
NYSDEC Site #3-44-046

Investigation:
O&R Property
Adjacent Properties

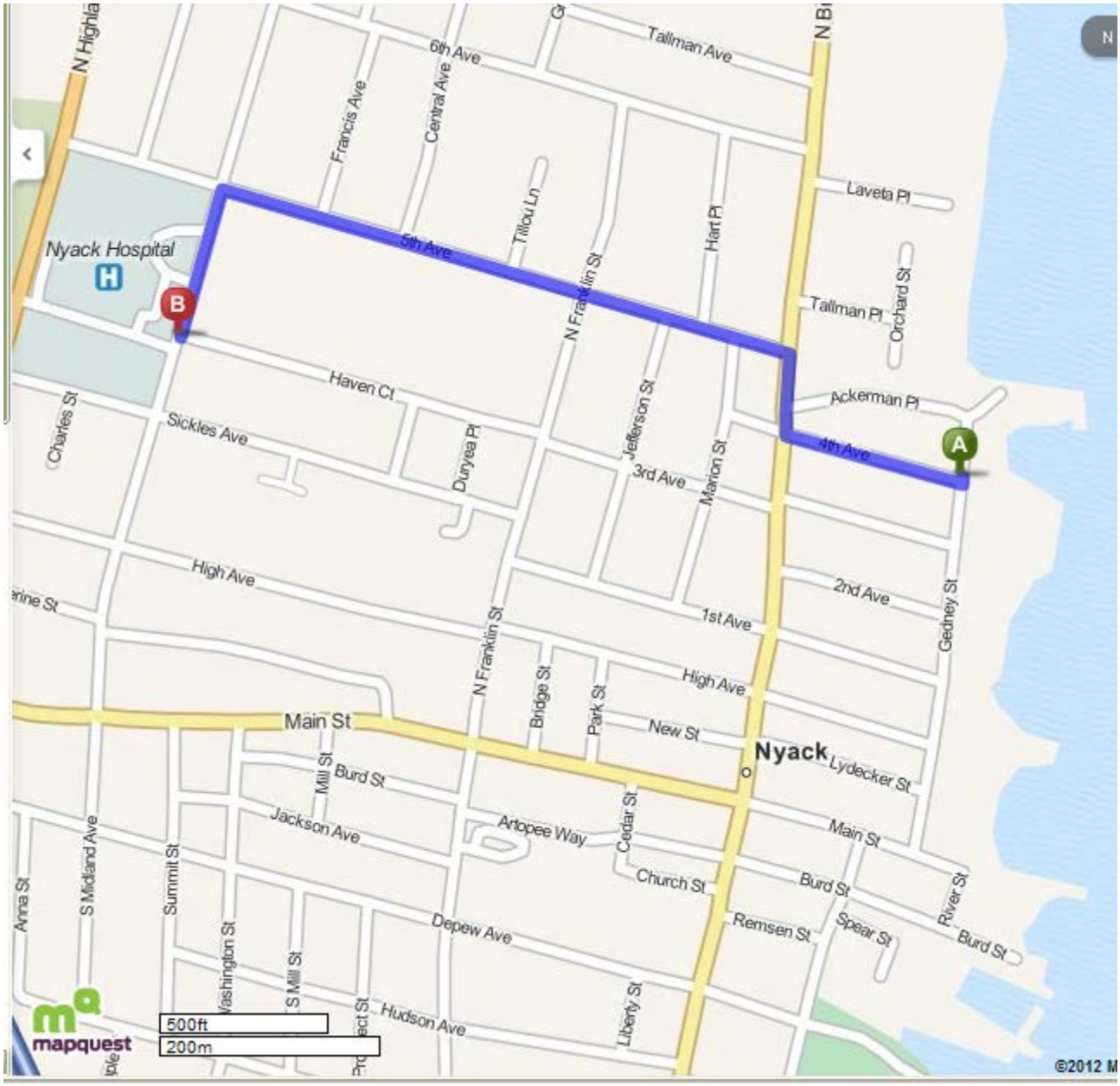
GEI Project No: 121640-*-1001

I have received and read the Health and Safety Plan, been briefed on it, and agree to its implementation.

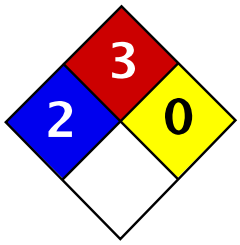
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:
Name:	Signature:	Date:

APPENDIX A – HOSPITAL MAP

Gedney Street, Nyack, NY to Nyack Hospital, 160 North Midland Ave Nyack, New York



APPENDIX B – MATERIAL SAFETY DATA SHEETS



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
The substance is toxic to blood, bone marrow, central nervous system (CNS).
The substance may be toxic to liver, Urinary System.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Slightly flammable to flammable in presence of oxidizing materials.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire.
Reacts on contact with iodine heptafluoride gas.

Dioxygenyl tetrafluoroborate is as very powferful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition.
Contact with sodium peroxide with benzene causes ignition.
Benzene ignites in contact with powdered chromic anhydride.
Virgorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States]
TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States]
TWA: 0.1 STEL: 1 from NIOSH
TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States]
TWA: 10 (ppm) from OSHA (PEL) [United States]
TWA: 3 (ppm) [United Kingdom (UK)]
TWA: 1.6 (mg/m3) [United Kingdom (UK)]
TWA: 1 (ppm) [Canada]
TWA: 3.2 (mg/m3) [Canada]
TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Aromatic. Gasoline-like, rather pleasant.
(Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

pH (1% soln/water): Not available.

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone.
Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Benzene vapors + chlorine and light causes explosion.
Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate.
Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion.
Interaction of nitryl perchlorate with benzene gave a slight explosion and flash.
The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene.
Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion.
Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 930 mg/kg [Rat].
Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC.
MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE].
Causes damage to the following organs: blood, bone marrow, central nervous system (CNS).
May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:
Very hazardous in case of inhalation.
Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects.
May affect genetic material (mutagenic).
May cause cancer (tumorigenic, leukemia))
Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism,and urinary system.
Eyes: Causes eye irritation.
Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and

other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system.
Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene
California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene
Connecticut carcinogen reporting list.: Benzene
Connecticut hazardous material survey.: Benzene
Illinois toxic substances disclosure to employee act: Benzene
Illinois chemical safety act: Benzene
New York release reporting list: Benzene
Rhode Island RTK hazardous substances: Benzene
Pennsylvania RTK: Benzene
Minnesota: Benzene
Michigan critical material: Benzene
Massachusetts RTK: Benzene
Massachusetts spill list: Benzene
New Jersey: Benzene
New Jersey spill list: Benzene
Louisiana spill reporting: Benzene
California Director's list of Hazardous Substances: Benzene

TSCA 8(b) inventory: Benzene
SARA 313 toxic chemical notification and release reporting: Benzene
CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R22- Harmful if swallowed.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R45- May cause cancer.
R62- Possible risk of impaired fertility.
S2- Keep out of the reach of children.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S39- Wear eye/face protection.
S46- If swallowed, seek medical advice immediately and show this container or label.
S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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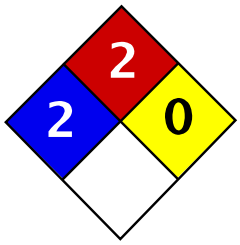

Health	2
Fire	2
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Naphthalene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Naphthalene

Catalog Codes: SLN1789, SLN2401

CAS#: 91-20-3

RTECS: QJ0525000

TSCA: TSCA 8(b) inventory: Naphthalene

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: C10H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Naphthalene	91-20-3	100

Toxicological Data on Ingredients: Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit]. VAPOR (LC50): Acute: 170 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 567°C (1052.6°F)

Flash Points: CLOSED CUP: 88°C (190.4°F). OPEN CUP: 79°C (174.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 5.9%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Flammable solid.
Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Israel: TWA: 10 (ppm)
TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1995]
TWA: 52 STEL: 79 (mg/m3) from ACGIH [1995]
Australia: STEL: 15 (ppm)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 128.19 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: 218°C (424.4°F)

Melting Point: 80.2°C (176.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.162 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 4.4 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.038 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:
Partially dispersed in hot water, methanol, n-octanol.
Very slightly dispersed in cold water.
See solubility in methanol, n-octanol.

Solubility:
Partially soluble in methanol, n-octanol.
Very slightly soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Highly reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: May attack some forms of rubber and plastic

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 490 mg/kg [Rat].
Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 170 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.

DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of ingestion.
Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 305.2 ppm 96 hour(s) [Trout].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Naphthalene, refined : UN1334 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Rhode Island RTK hazardous substances: Naphthalene
Pennsylvania RTK: Naphthalene
Florida: Naphthalene
Minnesota: Naphthalene
Massachusetts RTK: Naphthalene
TSCA 8(b) inventory: Naphthalene
TSCA 8(a) PAIR: Naphthalene
TSCA 8(d) H and S data reporting: Naphthalene: 06/01/87
SARA 313 toxic chemical notification and release reporting: Naphthalene: 1%
CERCLA: Hazardous substances.: Naphthalene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-4: Flammable solid.
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36- Irritating to eyes.
R40- Possible risks of irreversible effects.
R48/22- Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R48/23- Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R63- Possible risk of harm to the unborn child.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 2

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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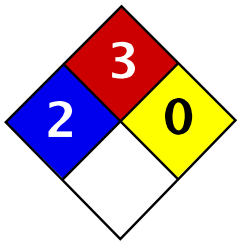

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide;

concentrated nitric acid, sulfuric acid + nitric acid; N_2O_4; $AgClO_4$; BrF_3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States]
TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN
TWA: 100 STEL: 150 from NIOSH [United States]
TWA: 375 STEL: 560 (mg/m^3) from NIOSH [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone.
Practically insoluble in cold water.
Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide.
Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride.
Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C.
Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 636 mg/kg [Rat].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin.
Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days.
Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite.
Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation.
Chronic Potential Health Effects:
Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis.
Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may

arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene
California prop. 65 (no significant risk level): Toluene: 7 mg/day (value)
California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene
Connecticut hazardous material survey.: Toluene
Illinois toxic substances disclosure to employee act: Toluene
Illinois chemical safety act: Toluene
New York release reporting list: Toluene
Rhode Island RTK hazardous substances: Toluene
Pennsylvania RTK: Toluene
Florida: Toluene
Minnesota: Toluene
Michigan critical material: Toluene
Massachusetts RTK: Toluene
Massachusetts spill list: Toluene
New Jersey: Toluene
New Jersey spill list: Toluene
Louisiana spill reporting: Toluene
California Director's List of Hazardous Substances.: Toluene
TSCA 8(b) inventory: Toluene
TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92
SARA 313 toxic chemical notification and release reporting: Toluene
CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S25- Avoid contact with eyes.
S29- Do not empty into drains.
S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Occupational Health Guideline for Coal Tar Pitch Volatiles

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

Anthracene

- Formula: $C_{14}H_{10}$
- Synonyms: None
- Appearance and odor: Pale green solid with a faint aromatic odor.

Phenanthrene

Formula: $C_{14}H_{10}$
Synonyms: None
Appearance and odor: Colorless solid with a faint aromatic odor.

Pyrene

- Formula: $C_{16}H_{10}$
- Synonyms: None
- Appearance: Bright yellow solid

Carbazole

- Formula: $C_{12}H_9N$
- Synonyms: None
- Appearance and odor: Colorless solid with a faint aromatic odor.

Benzo(a)pyrene

- Formula: $C_{20}H_{12}$
- Synonyms: BaP, 3,4-benzopyrene
- Appearance and odor: Colorless solid with a faint aromatic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for coal tar pitch volatiles is 0.2 milligram of coal tar pitch volatiles per cubic meter of air (mg/m^3) averaged over an eight-hour work shift. NIOSH has recommended that the permissible exposure limit for coal tar products be reduced to 0.1 mg/m^3 (cyclohexane-extractable fraction) averaged over a work shift of up to 10 hours per day, 40 hours per week, and that coal tar products be regulated as occupational carcinogens. The NIOSH Criteria Document for Coal Tar Products and NIOSH Criteria Document for Coke Oven Emissions should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Coal tar pitch volatiles can affect the body if they are inhaled or if they come in contact with the eyes or skin.

- **Effects of overexposure**

Repeated exposure to coal tar pitch volatiles has been associated with an increased risk of developing bronchitis and cancer of the lungs, skin, bladder, and kidneys. Pregnant women may be especially susceptible to exposure effects associated with coal tar pitch volatiles. Repeated exposure to these materials may also cause sunlight to have a more severe effect on a person's skin. In addition, this type of exposure may cause an allergic skin rash.

- **Reporting signs and symptoms**

A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to coal tar pitch volatiles.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to coal tar pitch volatiles at potentially hazardous levels:

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the oral cavity, respiratory tract, bladder, and kidneys should be stressed. The skin should be examined for evidence of chronic disorders, for premalignant and malignant lesions, and evidence of hyperpigmentation or photosensitivity.

—Urinalysis: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. A urinalysis should be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment, as well as a test for red blood cells.

—Urinary cytology: Coal tar pitch volatiles are associated with an excess of kidney and bladder cancer. Employees having 5 or more years of exposure or who are 45 years of age or older should have a urinary cytology examination.

—Sputum cytology: Coal tar pitch volatiles are associated with an excess of lung cancer. Employees having 10 or more years of exposure or who are 45 years of age or older should have a sputum cytology examination.

—14" x 17" chest roentgenogram: Coal tar pitch volatiles are associated with an excess of lung cancer. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Coal tar pitch volatiles are reported to cause an excess of bronchitis. Periodic surveillance is indicated.

—A complete blood count: Due to the possibility of benzene exposure associated with coal tar pitch volatiles, a complete blood count is considered necessary to search for leukemia and aplastic anemia.

—Skin disease: Coal tar pitch volatiles are defatting agents and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of these agents.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis, and semi-annually for employees 45 years of age or older or with 10 or more years' exposure to coal tar pitch volatiles.

• **Summary of toxicology**

Coal tar pitch volatiles (CTPV) are products of the destructive distillation of bituminous coal and contain polynuclear aromatic hydrocarbons (PNA's). These hydrocarbons sublime readily, thereby increasing the amounts of carcinogenic compounds in working areas. Epidemiologic evidence suggests that workers intimately exposed to the products of combustion or distillation of bituminous coal are at increased risk of cancer at many sites. These include cancer of the respiratory tract, kidney, bladder, and skin. In a study of coke oven workers, the level of exposure to CTPV and the length of time exposed were related to the development of cancer. Coke oven workers with the highest risk of cancer were those employed exclusively at topside jobs for 5 or more years, for whom the increased risk of dying from lung cancer was 10-fold; all coke oven workers had a 7-½-fold increase in risk of dying from kidney cancer. Although the causative agent or agents of the cancer in coke oven workers is unidentified, it is suspected that several PNA's in the CTPV generated during the coking process are involved. Certain industrial populations exposed to coal tar products have a demonstrated risk of skin cancer. Substances containing PNA's which may produce skin cancer also produce contact dermatitis; examples are coal tar, pitch, and cutting oils. Although allergic dermatitis is readily induced by PNA's in guinea pigs, it is only rarely reported in humans from occupational contact with PNA's; these have resulted largely from the therapeutic use of coal tar preparations. Components of pitch and coal tar produce cutaneous photosensitization; skin eruptions are usually limited to areas exposed to the sun or ultraviolet light. Most of the phototoxic agents will induce hypermelanosis of the skin; if chronic photodermatitis is severe and prolonged, leukoderma may occur. Some oils containing PNA's have been associated with changes of follicular and sebaceous glands which commonly take the form of acne. There is evidence that exposures to emissions at coke ovens and gas retorts may be associated with an increased occurrence of chronic bronchitis. Coal tar pitch volatiles may be associated with benzene, an agent suspected of causing leukemia and known to cause aplastic anemia.

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data—Anthracene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.24
4. Vapor density (air = 1 at boiling point of anthracene): 6.15
5. Melting point: 217 C (423 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Phenanthrene**

1. Molecular weight: 178.2
2. Boiling point (760 mm Hg): 340 C (644 F)
3. Specific gravity (water = 1): 1.18
4. Vapor density (air = 1 at boiling point of phenanthrene): 6.15
5. Melting point: 100.5 C (213 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Pyrene**

1. Molecular weight: 202.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)

3. Specific gravity (water = 1): 1.28
4. Vapor density (air = 1 at boiling point of pyrene): 6.9
5. Melting point: 150.4 C (303 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Carbazole**

1. Molecular weight: 167.2
2. Boiling point (760 mm Hg): 355 C (671 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of carbazole): 5.8
5. Melting point: 246 C (475 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Physical data—Benzo(a)pyrene**

1. Molecular weight: 252.3
2. Boiling point (760 mm Hg): Greater than 360 C (greater than 680 F)
3. Specific gravity (water = 1): Greater than 1
4. Vapor density (air = 1 at boiling point of benzo(a)pyrene): 8.7
5. Melting point: 179 C (354 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
8. Evaporation rate (butyl acetate = 1): Not applicable

• **Reactivity**

1. Conditions contributing to instability: None hazardous
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: None
4. Special precautions: None

• **Flammability**

1. Flash point: Anthracene: 121 C (250 F) (closed cup); Others: Data not available
2. Autoignition temperature: Anthracene: 540 C (1004 F); Others: Data not available
3. Flammable limits in air, % by volume: Anthracene: Lower: 0.6; Others: Data not available
4. Extinguishant: Foam, dry chemical, and carbon dioxide

• **Warning properties**

Grant states that "coal tar and its various crude fractions appear principally to cause reddening and squamous eczema of the lid margins, with only small erosions of the corneal epithelium and superficial changes in the stroma, which disappear in a month following exposure. Chronic exposure of workmen to tar fumes and dust has been reported to cause conjunctivitis and discoloration of the cornea in the palpebral fissure, either near the limbus or, in extreme cases, across the whole cornea. Occasionally, epithelioma of the lid margin has been attributed to contact with coal tar."

MONITORING AND MEASUREMENT PROCEDURES

• **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Method**

Coal tar products may be sampled by collection on a glass fiber filter with subsequent ultrasonic extraction and weighing. An analytical method for coal tar pitch volatiles is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 1, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00267-3).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent skin contact with condensed coal tar pitch volatiles, where skin contact may occur.

• If employees' clothing may have become contaminated with coal tar pitch volatiles, employees should change into uncontaminated clothing before leaving the work premises.

• Clothing contaminated with coal tar pitch volatiles

should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of coal tar pitch volatiles from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the coal tar pitch volatiles, the person performing the operation should be informed of coal tar pitch volatiles's hazardous properties.

- Employees should be provided with and required to use splash-proof safety goggles where condensed coal tar pitch volatiles may contact the eyes.

SANITATION

- Workers subject to skin contact with coal tar pitch volatiles should wash with soap or mild detergent and water any areas of the body which may have contacted coal tar pitch volatiles at the end of each work day.
- Employees who handle coal tar pitch volatiles should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- Areas in which exposure to coal tar pitch volatiles may occur should be identified by signs or other appropriate means, and access to these areas should be limited to authorized persons.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to coal tar pitch volatiles may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from extraction and packaging from coal tar fraction of coking	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as a binding agent in manufacture of coal briquettes used for fuel; use as a dielectric in the manufacture of battery electrodes, electric-arc furnace electrodes, and electrodes for alumina reduction	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture of roofing felts and papers and roofing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use for protective coatings for pipes for underground conduits and drainage; use as a coating on concrete as waterproofing and corrosion-resistant material; use in road paving and sealing	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in manufacture and repair of refractory brick; use in production of foundry cores; use in manufacture of carbon ceramic items	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

- **Eye Exposure**

If condensed coal tar pitch volatiles get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with these chemicals.

- **Skin Exposure**

If condensed coal tar pitch volatiles get on the skin, wash the contaminated skin using soap or mild detergent and water. Be sure to wash the hands before eating or smoking and to wash thoroughly at the close of work.

- **Breathing**

If a person breathes in large amounts of coal tar pitch volatiles, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of releases until cleanup has been completed.
- If coal tar pitch volatiles are released in hazardous concentrations, the following steps should be taken:

1. Ventilate area of spill.

2. Collect released material in the most convenient and safe manner for reclamation or for disposal in sealed containers in a secured sanitary landfill.

• Waste disposal method:

Coal tar pitch volatiles may be disposed of in sealed containers in a secured sanitary landfill.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "Coal Tar Pitch Volatiles," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

• Bingham, E.: "Environmental Carcinogens," *Archives of Environmental Health*, 19:779-85, DES 1969.

• Bingham, E.: "Thresholds in Cancer Inductions," *Archives of Environmental Health*, 22:692-95, June 1971.

• "Coke Oven Emissions," *Federal Register*, 40:32268-32282, July 31, 1975.

• Committee on Biologic Effects of Atmospheric Pollutants, Division of Medical Sciences, National Research Council: *Particulate Polycyclic Organic Matter*, National Academy of Sciences, Washington, D.C., 1972.

• Fannick, N., et al.: "Exposure to Coal Tar Pitch Volatiles at Coke Ovens," *American Industrial Hygiene Association Journal*, 33:461-468, 1972.

• Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.

• Hittle, D. C., and Stukel, J. J.: "Particle Size Distribution and Chemical Composition of Coal-Tar Fumes," *American Industrial Hygiene Association Journal*, 37:199-204, 1976.

• *Hygienic Information Guide No. 89 – Coal Tar Pitch Volatiles*, Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of Occupational Health, 1972.

• International Labour Office: *Encyclopedia of Occupational Health and Safety*, McGraw-Hill, New York, 1971.

• Lloyd, J. W.: "Long-Term Mortality Study of Steelworkers. V. Respiratory Cancer in Coke Plant Workers," *Journal of Occupational Medicine*, 13:53-68, 1971.

• Mazumdar, S., et al.: "An Epidemiological Study of Exposure to Coal Tar Pitch Volatiles among Coke Oven Workers," *Journal of the Air Pollution Control Association*, 25:382-389, 1975.

• National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare: *Criteria for a Recommended Standard . . . . Occupational Exposure to Coal Tar Products*, HEW Publication No. (NIOSH) 78-107, U.S. Government Printing Office, Washington, D.C., 1977.

• National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare: *Criteria for a Recommended Standard . . . . Occupational Exposure to Coke Oven Emissions*, HEW Publication No. HSM 73-11016, GPO No. 017-033-00015, U.S. Government Printing Office, Washington, D.C., 1973.

• Redmond, C. K., et al.: "Long-Term Mortality Study of Steelworkers. VI. Mortality from Malignant Neoplasms Among Coke Oven Workers," *Journal of Occupational Medicine*, 14:621-629, 1972.

• Scala, R. A.: "Toxicology of PPOM," *Journal of Occupational Medicine*, 17:784-788, 1975.

• Tye, R., and Stemmer, K. L.: "Experimental Carcinogenesis of the Lung. II. Influence of Phenols in the Production of Carcinoma," *Journal of the National Cancer Institute*, 39:175-179, 1967.

RESPIRATORY PROTECTION FOR COAL TAR PITCH VOLATILES

Condition	Minimum Respiratory Protection* Required Above 0.2 mg/m³
Particulate and Vapor Concentration	
2 mg/m³ or less	A chemical cartridge respirator with an organic vapor cartridge(s) and with a fume or high-efficiency filter. Any supplied-air respirator. Any self-contained breathing apparatus.
10 mg/m³ or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and with a fume or high-efficiency filter. A gas mask with a chin-style or a front- or back-mounted organic vapor canister and with a full facepiece and a fume or high-efficiency filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
200 mg/m³ or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode. A powered air-purifying respirator with an organic vapor cartridge and a high-efficiency particulate filter.
400 mg/m³ or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 400 mg/m³ or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors and particulates, including pesticide respirators which meet the requirements of this class. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: ISOBUTYLENE

1. Chemical Product and Company Identification

BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 20101

PRODUCT NAME: ISOBUTYLENE
CHEMICAL NAME: Isobutylene
COMMON NAMES/SYNONYMS: 2-Methylpropene, Isobutene
TDG (Canada) CLASSIFICATION: 2.1
WHMIS CLASSIFICATION: A, B1, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/7/96

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Isobutylene FORMULA: C4H8 CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	Simple Asphyxiant	Simple Asphyxiant	LC_{50} 620 mg/m^3/3H (rat)

[1] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[2] As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW

This product does not contain oxygen and may cause asphyxia if released in a confined area. Simple hydrocarbons can cause irritation and central nervous system depression at high concentrations. flammable.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	No

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
No	Yes	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects		
None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
Irritation may occur.

SKIN EFFECTS:
None anticipated as product is a gas at room temperature.

INGESTION EFFECTS:
Ingestion is unlikely.

INHALATION EFFECTS:
Product is relatively nontoxic. Simple hydrocarbons can irritate the eyes, mucous membranes and respiratory system at high concentrations.

Inhalation of high concentrations may cause dizziness, disorientation, incoordination, narcosis, nausea or narcotic effects.

This product may displace oxygen if released in a confined space. Maintain oxygen levels above 19.5% at sea level to prevent asphyxiation.

Effects of oxygen deficiency resulting from simple asphyxiants may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

NFPA HAZARD CODES		HMIS HAZARD CODES		RATINGS SYSTEM
Health:	1	Health:	1	0 = No Hazard
Flammability:	4	Flammability:	4	1 = Slight Hazard
Reactivity:	0	Reactivity:	0	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

4. First Aid Measures

EYES:
Never introduce oil or ointment into the eyes without medical advice! If pain is present, refer the victim to an ophthalmologist for further treatment and follow up.

SKIN:

Remove contaminated clothing and wash affected area with soap and water. If irritation persists, seek medical attention.

INGESTION:
Not normally required. Seek immediate medical attention.

INHALATION:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given assisted (artificial) respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: Flammable liquid and vapor		
Flash point: -105 °F (-76 °C)	Method: Closed Cup	Autoignition Temperature: 869 °F (465 °C)
LEL(%): 1.8	UEL(%): 9.6	
Hazardous combustion products: Carbon monoxide, Carbon dioxide		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:
Isobutylene is heavier than air and may travel a considerable distance to an ignition source. Isobutylene is a flammable gas! Keep away from open flame and other sources of ignition. Do not allow smoking in storage areas or when handling.

EXTINGUISHING MEDIA:
Water, carbon dioxide, dry chemical.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop the flow of gas with a remote valve. Use water spray to cool fire exposed containers. If fire is extinguished and flow of gas is continued, increase ventilation to prevent a build up of a flammable/ explosive atmosphere. Extinguish sources of ignition.

Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. Direct 500 GPM water stream onto containers above the liquid level with remote monitors. Limit the number of personnel in proximity to the fire. Evacuate surrounding areas to at least 3000 feet in all directions.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. Increase ventilation to prevent build up of a flammable/explosive atmosphere. Extinguish all sources of ignition! If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location

7. Handling and Storage

Earth bond and ground all lines and equipment associated with the product system. Electrical equipment should be non-sparking and explosion proof.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (<250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time.

Post "No Smoking" signs in storage or use areas.

For additional recommendations consult Compressed Gas Association Pamphlet P-1.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Isobuylene FORMULA: C4H8 CAS: 115-11-7 RTECS #: UD0890000	99.0 to 99.8	Simple Asphyxiant	Simple Asphyxiant	LC_{50} 620 mg/m^3/3H (rat)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

ENGINEERING CONTROLS:
Use local exhaust to prevent accumulation. Use general ventilation to prevent build up of flammable concentrations. May use hood with forced ventilation when handling small quantities. If product is handled routinely where the potential for leaks exists, all electrical equipment must be rated for use in potentially flammable atmospheres. Consult the National Electrical Code for details.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Protective gloves made of plastic or rubber.

RESPIRATORY PROTECTION:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes, safety shower, eyewash.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure at 70°F	: 39	psia
Vapor density at STP (Air = 1)	: 1.98	
Evaporation point	: Not Available	
Boiling point	: 19.5	°F
	: -6.9	°C
Freezing point	: -220.6	°F
	: -140.3	°C
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Insoluble	
Odor threshold	: Not Available	
Odor and appearance	: A colorless gas with an unpleasant odor similar to that of burning coal.	

10. Stability and Reactivity

STABILITY:
Stable

CONDITIONS TO AVOID (STABILITY):
None

INCOMPATIBLE MATERIALS:
Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon monoxide

11. Toxicological Information

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

No chronic effects data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Isobutylene	Isobutylene
HAZARD CLASS:	2.1	2.1
IDENTIFICATION NUMBER:	UN 1055	UN 1055
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Isoutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

Material Safety Data Sheet: **Simple Green® All-Purpose Cleaner**
Simple Green® Scrubbing Pad
Version No. 1300509A Date of Issue: January 2009 *ANSI-Z400.1-2003 Format*

Section 1: PRODUCT & COMPANY IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Simple Green® Scrubbing Pad
Additional Name: Simple Green® Concentrated Cleaner/Degreaser/Deodorizer

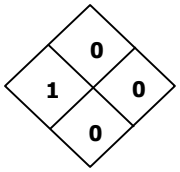
Manufacturer's Product Code Numbers: **Please refer to page 4*

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 ● 562-795-6000 Fax: 562-592-3830
Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Use of Product: An all purpose cleaner and degreaser used diluted in water for direct, spray and dip tank procedures. Scrubbing pad is used with water for manual scrubbing applications. Both are for cleaning water-safe surfaces.

Section 2: HAZARDS IDENTIFICATION

Emergency Overview: CAUTION. Mild eye irritant.
Simple Green@ is a dark green liquid with a sassafras odor. Scrubbing Pad is a green fibrous rectangle.



HMIS Rating:
Health = 1 = slight
Fire = 0
Reactivity, and Special = 0 = minimal

Eye Contact: Mild Eye Irritant.

Skin Contact: No adverse effects expected under typical use conditions. Prolonged exposure may cause dryness. Under this condition, use of gloves or skin moisturizer after washing may be indicated.

Ingestion: May cause stomach or intestinal upset if swallowed (due to detersive properties.)

Inhalation: No adverse effects expected under typical use conditions. Adequate ventilation should be present when using Simple Green® over a prolonged period of time. Open windows or ventilate via fan or other air-moving equipment if necessary.

Carcinogens: No ingredients are listed by OSHA, IARC, or NTP as known or suspected carcinogens.

Medical Conditions: No medical conditions are known to be aggravated by exposure to Simple Green®. Dermal-sensitive users may experience mild but reversible reactions.

UN Number: Not Required **Dangerous Goods Class:** Non-hazardous

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

The only ingredient of Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<4%) (Butyl Cellosolve; CAS No. 111-76-2) [*1% for Scrubbing Pad*]: the ACGIH TLV-TWA is 20 ppm (97 mg/m^3). Based upon chemical analysis, Simple Green® contains no known EPA priority pollutants, heavy metals or chemicals listed under RCRA, CERCLA, or CWA. Analysis by TCLP (Toxicity Characteristic Leaching Procedure) according to RCRA revealed no toxic organic or inorganic constituents.

All components of Simple Green® are listed on the TSCA Chemical Substance Inventory.
This product does not contain any ingredients covered by the provisions of 29 CFR 1910.1200.

Section 4: FIRST AID MEASURES

Eye Contact: Reddening may develop. Immediately rinse the eye with large quantities of cool water; continue 10-15 minutes or until the material has been removed; be sure to remove contact lenses, if present, and to lift upper and lower lids during rinsing. Get medical attention if irritation persists.

Skin Contact: Minimal effects, if any; rinse skin with water, rinse shoes and launder clothing before reuse. Reversible reddening may occur in some dermal-sensitive users; thoroughly rinse area and get medical attention if reaction persists.

Swallowing; Essentially non-toxic. Give several glasses of water to dilute; do not induce vomiting. If stomach upset occurs, consult physician.

Inhalation: Non-toxic. Exposure to concentrate may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.

Section 5: FIRE FIGHTING MEASURES

Simple Green® is stable, not flammable, and will not burn. No special procedures required.

Flash Point/Auto-Ignition: Not flammable. Extinguishing Media: Not flammable/non-explosive.
Flammability Limits: Not flammable. Special Fire Fighting Procedures: None required.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid contact with eyes. Do not rub eyes with hands during cleanup. No special precautions for dermal contact are needed. Wash hands thoroughly after cleaning up spill or leak.

Method for cleaning up: Recover usable material by convenient method, residual may be removed by wipe or wet mop. If necessary, unrecoverable material may be washed to drain with large quantities of water.

Section 7: HANDLING AND STORAGE

No Special precautions are required. **This product is non-hazardous for storage and transport according to the U.S. Department of Transportation Regulations.** Simple Green® requires no special labeling or placarding to meet U.S. Department of Transportation requirements.

UN Number: Not Required **Dangerous Goods Class:** Non-hazardous

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits: The Simple Green® formulation presents no health hazards to the user when used according to label directions for its intended purposes. Mild skin and eye irritation is possible (please see Eye contact and Skin contact in section IV.) No special precautionary measures required under normal use conditions.

Ventilation: No special ventilation, precautions or respiratory protection is required during normal use. Large-scale use indoors should provide an increased rate of air exchange.

Human Health Effects or Risks From Exposure: Adverse effects on human health are not expected from Simple Green®, based on 20 years of use of Simple Green® without reported adverse health incidence in diverse population groups, including extensive use by inmates of U.S. Federal prisons in cleaning operations.

Eye protection: Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate. Eye protection not generally required. Wash hands after using wipes.

Skin protection: Simple Green® is not likely to irritate the skin in the majority of users. Repeated daily application to the skin without rinsing, or continuous contact on the skin may lead to temporary, but reversible, irritation. Rinse completely from skin after contact.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION – continued –

General hygiene conditions: There are no known hazards associated with this material when used as recommended. The following general hygiene considerations are recognized as common good industrial hygiene practices:

- Avoid breathing vapor or mist.
- Avoid contact with eyes.
- Wash thoroughly after handling and before eating, drinking, or smoking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Cleaner is a dark green liquid, pad is a fibrous green matrix; both exhibit a sassafras odor.			
Specific Gravity:	1.010 ± 0.010	**Vapor Pressure:**	18 mm Hg @ 20°C; 23.5 mmHg @ 26°C
Evaporation:	>1 (butyl acetate = 1)	**Vapor Density:**	1.3 (air = 1)
Water Solubility:	100%	**Density:**	8.5 lbs/gallon
Boiling Point:	100.6°C (212°F)	**pH:**	9.5 ± 0.3
Ash Content:	At 600°F: 1.86% by weight	**Nutrient Content:** Phosphorus: 0.3% by formula Nitrogen <1.0% by weight (fusion and qualitative test for ammonia) Sulfur: 0.6% by weight (barium chloride precipitation method)	
Freezing Point: Approx -9 °C (16 °F) *If product freezes, it will reconstitute without loss of efficacy when brought back to room temperature and agitated.*			
VOC Composite Partial Pressure: 0.006 mmHg @ 20°C			
Volatile Organic Compounds (VOCs): CARB Method 310 3.8% SCAQMD Method 313 2.8%	Cleaner meets CARB & BAAQMD regulations. Cleaner must be diluted 1:1 with water to Meet SCAQMD Rule 1171 & Rule 1122 VOC requirements for solvent cleaning operations. [*Scrubber VOCs = 3.3% prior to dilution w/water*]		

Section 10: STABILITY AND REACTIVITY

Stability: Stable
Materials to Avoid: None known
Hazardous Decomposition Products: None expected

Section 11: TOXICOLOGICAL INFORMATION

Toxicology information is based on chemical profile of ingredients and extrapolation of data from similar formulas.

Acute Toxicity: Oral LD_{50} (rat) >5 g/kg body weight*
Dermal LD_{50} (rabbit) >2 g/kg body weight

**Calculation from OECD series on testing and assessment number 33, Chapter 3.2*

Eye Irritation: Moderate/Mild reversible eye irritation may occur based on relevant laboratory studies. This potential is reduced by immediate rinsing of eyes in case of eye contact.

Dermal Irritation: Mild, reversible skin irritation may occur based on relevant laboratory studies. A 6-hour exposure to human skin under a patch did not produce irritation

Repeat Exposure Via Skin Contact: Based on relevant laboratory studies, no toxic effects are expected to be associated with daily skin exposures (with up to 2 g/kg/day tested for 13 weeks on rabbits). Skin irritation may, however, occur with repeated or prolonged exposures.

Reproductive Effects Assessment: Based on relevant laboratory studies (CD-1 mouse 18-week fertility assessment continuous breeding), no adverse effects on reproduction, fertility, or health of offspring are expected.

Section 12: ECOLOGICAL INFORMATION

Hazard to wild animals & aquatic organisms: Low, based on toxicological profile.

Biodegradability: Readily biodegradable based on biodegradation profile,
PRO/FT CBT-AC 014-7 "Ready Biodegradability: Closed Bottle Test" OECD, and OECD 302B laboratory tests

Environmental Toxicity Information: It is important not to allow the runoff from cleaning into closed systems such as decorative ponds. Always protect closed systems with tarps or dikes if necessary.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of in accordance with all applicable local, state and federal laws. Dispose of used or unused product, and empty containers in accordance with the local, State, Provincial, and Federal regulations for your location. Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

This product is non-hazardous for transport according to the U.S. Department of Transportation Services
UN Number: Not required Dangerous Goods Class: Non-hazardous

Section 15: REGULATORY INFORMATION

*Reportable components:

All components are listed on:	EINECS and TSCA Inventory
No components listed under:	Clean Air Act Section 112
SARA:	This material contains 2-Butoxyethanol, < 4%, (CAS# 111-76-2) which is subject to the reporting requirements of Section 313 of SARA Title III and 49 CFR Part 373.

RCRA Status:	Not a hazardous waste.	CERCLA Status:	No components listed
TSCA TRI Reporting:	Not required / Not listed	CA PROP. 65 Status:	No components listed

Section 16: OTHER INFORMATION

Questions about the information found on this MSDS should be directed to:
SUNSHINE MAKERS, INC. – TECHNICAL DEPARTMENT
15922 Pacific Coast Hwy. Huntington Harbour, CA 92649

Phone: 800/228-0709 [8am-5pm Pacific time, Mon-Fri] *Fax:* 562/592-3830 *Email:* infoweb@simplegreen.com

CAGE CODE 1Z575
GSA/FSS - CONTRACT NO. GS-07F-0065J
National Stock Numbers & Industrial Part Numbers:

	Part Number	NSN	Size
Simple Green	13012	7930-01-342-5315	24 oz spray (12/case)
	13005	7930-01-306-8369	1 Gallon (6/case)
	13006	7930-01-342-5316	5 Gallon
	13016	7930-01-342-5317	15 Gallon
	13008	7930-01-342-4145	55 Gallon
Scrubbing Pad	Part Number	NSN	Size
	10224	7930-01-346-9148	Each (24/case)

Retail Numbers:

Part Number	Size
13002	16 oz Trigger (12/case)
13005	1 Gallon (6/case)
13013	24 oz Trigger (12/case)
13014	67 oz / 2 L (6/case)
13033	32 oz Trigger (12/case)

** part number is for both industrial and retail*

****International Part Numbers May Differ.**

DISCLAIMER: The information provided with this MSDS is furnished in good faith and without warranty of any kind. Personnel handling this material must make independent determinations of the suitability and completeness of information from all sources to assure proper use and disposal of this material and the safety and health of employees and customers. Sunshine Makers, Inc. assumes no additional liability or responsibility resulting from the use of, or reliance on this information.

APPENDIX C – HEAT STRESS/COLD STRESS GUIDELINES

Cold Stress Guidelines

	Symptoms	What to do
Mild Hypothermia	• Body Temp 98-90°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 of blankets • Cover the head • Drink warm (not hot) sugary drink
Moderate Hypothermia	• Body temp 90-86°F • Shivering stops • Unable to walk or stand • Confused 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 86-78°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 sugary drink

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, 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, severe headache, collapse, delirium, 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 five days.

APPENDIX D – GEI UTILITY CLEARANCE AND GEI ACCIDENT REPORTING FORM

ACCIDENT REPORT FORM

Report No. _____

Site: _____ Project No. _____

Location: _____

Date of Report: _____ Preparer's Name: _____

Name and Address of Injured: _____

Date of Birth _____ Date of Hire: _____ Title/Classification: _____

Division/Department _____ Date of Accident _____ Time: _____

Accident Category: ___ Motor Vehicle ___ Property Damage ___ Fire

___ Chemical Exposure ___ Near Miss ___ Other

Severity of Injury or Illness: ____ Non-disabling ___ Disabling

____ Medical Treatment ___ Fatality

Amount of Damage: $_____ Property Damaged: _____

Estimated Number of Days Away from Job: _____

Nature of Injury or Illness: _____

CLASSIFICATION OF INJURY:

____ Fractures	____ Heat Burns	____ Cold Exposure
____ Dislocations	____ Chemical Burns	____ Frostbite
____ Sprains	____ Radiation Burns	____ Heat Stroke
____ Abrasions	____ Bruises	____ Heat Exhaustion
____ Lacerations	____ Blisters	____ Concussion
____ Punctures	____ Toxic Respiratory Exposure	____ Faint/Dizziness
____ Bites	____ Toxic Ingestions	____ Toxic Respiratory
____ Toxic Ingestions	____ Dermal Allergy	

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care Was Received: _____

Where Medical Care Was Received: _____

Address (if off site): _____

ACCIDENT LOCATION:

Causative agent most directly related to accident (object substance, material, machinery, equipment conditions):

_____

_____

Was weather a factor? _____

Unsafe mechanical/physical/environmental condition at time of accident (be specific):

_____

_____

Unsafe act by injured and/or others contributing to the accident (be specific, must be answered):

_____

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue):

_____

_____

Level of personal protection equipment required in Site Safety Plan: _____

_____

Modifications: _____

Was injured using required equipment? _____

If not, how did actual equipment use differ from plan? _____

_____

What can be done to prevent a recurrence of this type of accident (modification of machine; mechanical guards; correct environment training):

_____

_____

Detailed narrative description (how did accident occur, why; objects, equipment, tools used, circumstance assigned duties) (be specific):

_____

_____

(Use separate sheet as required)

Witnesses to accident _____

Signature of Preparer _____

Signature of Site Leader _

Utility Clearance Documentation

Client: _____

Project: _____

Site: _____

Drilling Location ID: _____

Driller: _____

GEI PM: _____

GEI Field Team Leader: _____

Utility Drawings Reviewed: _____

Provided By: _____

Reviewed By: _____

One Call Utility Clearance Call Date: _____

Utility Clearance Received back from (list utilities): _____

Completed By (Company): _____ Date: _____

GEI Staff Responsible for Oversight: _____

Metal Detector Survey (yes/no): _____

Drilling Location Cleared by: _____

Contractor: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Physical Test Pit Clearance Required (yes/no): _____

Contractor: _____ Date: _____

GEI Staff Responsible for Oversight: _____

Hand clearing Performed: _____ Date: _____

Contractor: _____

GEI Staff Responsible for Oversight: _____

Notes: _____

_____

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 exist, they are approved by the client signature below.

Client Signature (Optional): _____ Date: _____

GEI, Inc. Representative: _____ Date: _____

APPENDIX E – FLOAT PLAN

GEI Consultants

Daily Float Plan

Name of vessel's operator:	
Telephone Number:	
Name of Vessel:	
Registration No.:	
Description of Vessel: Type: Make: Color of Hull/Trim Most distinguishing identifiable feature:	

Rafts/Dinghies: Number:_____ Size:_____ Color:_____

Radio: Type: _____ Frequencies Monitored: _____

Number of persons onboard:

Name:	Age:	Address & Telephone:

Engine Type:_____ H.P.:_____ Normal Fuel Supply (days):_____

Survival equipment on board: (check as appropriate)

- ☐ Life Jackets
- ☐ Flares
- ☐ Smoke Signals
- ☐ Medical Kit
- ☐ EPIRB
- ☐ Paddles
- ☐ Anchor
- ☐ Loran/Gps
- ☐ _____

Trip:

Date & Time of Departure:	
Departure From:	
Departure To:	

Expected to arrive by:_____ In no case later than:_____

GEI Consultants

GEI Consultants

Daily Float Plan

Name of vessel's operator:	
Telephone Number:	
Name of Vessel:	
Registration No.:	
Description of Vessel: Type: Make: Color of Hull/Trim Most distinguishing identifiable feature:	

Rafts/Dinghies: Number:_____ Size:_____ Color:_____

Radio: Type: _____ Frequencies Monitored: _____

Number of persons onboard:

Name:	Age:	Address & Telephone:

Engine Type:_____ H.P.:_____ Normal Fuel Supply (days):_____

Survival equipment on board: (check as appropriate)

- ☐ Life Jackets
- ☐ Flares
- ☐ Smoke Signals
- ☐ Medical Kit
- ☐ EPIRB
- ☐ Paddles
- ☐ Anchor
- ☐ Loran/Gps
- ☐ _____

Trip:

Date & Time of Departure:	
Departure From:	
Departure To:	

Expected to arrive by:_____ In no case later than:_____

GEI Consultants