REMEDIAL DESIGN/REMEDIAL ACTION (RD/RA) WORK PLAN

HWD SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

Prepared For:
HWD Group

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1.0 INTRODUCTION

This Remedial Design/Remedial Action Work Plan (RD/RA Work Plan) provides for the development and implementation of final plans and specifications for implementing the remedial alternative for the Hazardous Waste Disposal, Inc. (HWD) site (the Site) located at 11A Picone Boulevard in Farmingdale, New York (see Figure 1.1 for the Site location). Past Site activities, including hazardous waste management using 55-gallon drums, one or more tanks, and an unlined sludge pit, allegedly resulted in the release of volatile organic compounds (VOCs), primarily chlorinated VOCs, identified in soil and groundwater at the Site.

This RD/RA Work Plan has been prepared by Conestoga-Rovers & Associates (CRA) in accordance with an Order on Consent (Consent Order) between the New York State Department of Environmental Conservation (NYSDEC) and the HWD Respondents to the Consent Order (the HWD Group), which came effective in July 2007 (Index No. W1-0728-05-07). The Consent Order required the Respondents to prepare a RD/RA Work Plan for the Site consistent with the outline presented in Exhibit K attached to the Consent Order.

This RD/RA Work Plan has been prepared in general accordance with the following guidance, directives, and other publications, were appropriate:

- Exhibit A attached to the Consent Order;
- NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, December 2002;
- Applicable provisions of the New York State Environmental Conservation Law (ECL) and associated regulations, including Title 6 of the New York Code of Rules and Regulations (6 NYCRR) Part 375;
- United States Environmental Protection Agency (USEPA) guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation and Liability Act" (CERCLA), Interim Final (USEPA, 1988); and
- Applicable provisions of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) regulations contained in Title 40 of the Code of Federal Regulations (CFR) Part 300.

Based on the previous investigation activities conducted at the Site, tetrachloroethene (PCE) has been identified in subsurface soil at concentrations exceeding NYSDEC guidance, including the guidance values presented in the NYSDEC Technical and

Administrative Guidance Memorandum (TAGM) #4046 entitled "Determination of Soil Cleanup Objectives and Cleanup Levels", HWR-94-4046, dated January 24, 1994 (NYSDEC, 1994). Five other VOCs, including trichloroethylene (TCE) and benzene, ethylbenzene, toluene, and xylenes (BTEX compounds), were detected in selected subsurface soil samples at concentrations exceeding the TAGM 4046 guidance values, but below the soil action levels presented in NYSDEC TAGM #3028 entitled ""Contained-In Criteria" for Environmental Media" (NYSDEC, 1997), the United States Environmental Protection Agency (USEPA) Region 3 Risk-Based Concentrations (RBCs) for commercial/industrial soil, and the USEPA Region 9 Preliminary Remediation Goals (PRGs) for industrial soil. VOCs have also been detected in groundwater at the Site at concentrations exceeding guidance values presented in the NYSDEC Division of Water, Technical and Operational Guidance Series (TOGS 1.1.1) document entitled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (NYSDEC, 2000).

A Feasibility Study (FS) (September 2003, revised May 2004) was prepared for the Site that identifies and evaluates potential remedial alternatives to address the constituents of interest in soil and groundwater at the Site. Following NYSDEC review and approval of the FS Report, a Proposed Remedial Action Plan (PRAP) was developed that identified the NYSDEC preferred remedial alternative, summarized the alternatives considered, and provided the reasons for proposing the preferred remedy. The PRAP was subjected to a 30-day public comment period, following which NYSDEC issued a Record of Decision (ROD) that identified the Site remedy and included a responsiveness summary to public comments and concerns raised during the public comment period. The selected remedy for the Site included soil treatment, using either in situ chemical oxidation (ISCO) or soil vapor extraction (SVE), and groundwater treatment using either ISCO or air sparging.

This RD/RA Work Plan was prepared to fulfill the HWD Group's requirement for a RD/RA Work Plan under the Consent Order.

The RD/RA Work Plan is organized as follows:

Section 1.0 – Introduction;

Section 2.0 – Background Information;

Section 3.0 – Remedial Action Objectives;

Section 4.0 - Remedial Action Components;

Section 5.0 – Pre-Design Data Collection;

Section 6.0 – Remedial Action Project Plans;

Section 7.0 – Remedial Design Activities;

Section 8.0 – Contingency Plan; and

Section 9.0 – Schedule.

2.0 BACKGROUND INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The Site is located at 11A Picone Boulevard in the Village of Farmingdale, Suffolk County, New York and is identified as part of Tax Lot 31.004 in the Suffolk County, New York tax maps. A Site location map is presented as Figure 1.1. The Site is approximately 0.5 acres in size and includes an approximately 10,000-square-foot area where hazardous waste storage, transfer, and recycling operations were historically conducted. The Site is currently owned by Little Joseph Realty, Inc. Guaranteed Overnight Delivery, Inc., an overnight delivery service, currently leases the property from Little Joseph Realty for use as a truck/tractor-trailer parking lot. The Site is covered by a concrete slab that is approximately 6 to 8 inches thick. Select areas of the slab have been repaired/replaced with bituminous asphalt pavement. The approximate boundaries of the Site are shown on Figure 2.1.

Access to the Site is limited by a chain-link fence to the north, east, and south of the Site, and a concrete wall associated with a storage yard west of the Site. The Site is accessible from Picone Boulevard through a gate along the southern Site boundary, and from a paved driveway that enters the northwestern portion of the Site. The Site is serviced by municipal water and sewer.

Land use in the vicinity of the Site is predominantly commercial/industrial. South of the Site, across Picone Boulevard, is a one-story commercial building occupied by R&D Carpet and Tile (R&D) and Ryder Truck. The R&D side of the building includes a garage area used to store new carpet and various adhesives, coatings/sealers, base fillers, cleaners, paints/stains, etc., and an office area/showroom. Ryder Truck operations make up the west side of the R&D building. The Ryder Truck portion of the building is primarily used as a service garage for medium- and heavy-duty trucks. A one-story building occupied by Ford Brand Service is located west of the Site, immediately west of the storage yard. The Fort Brand Service building is primarily used as a service garage for heavy equipment used in connection with the aviation industry. A furniture warehouse is located west of the Fort Brand Service building. Parking lots for trucking companies/commercial facilities border the Site to the north, east, and southeast.

2.2 SITE HISTORY

HWD operated a hazardous waste storage, transfer, and recycling facility at the Site from approximately 1979 to 1982. Information about the Site history prior to 1979 was unavailable. Hazardous wastes (primarily spent solvents and acidic wastes) were collected from off-Site generators, transported to the Site by HWD, and stored on the Site prior to off-Site transport and disposal. HWD also reportedly utilized the Site to recycle spent solvents for resale. Hazardous wastes stored at the Site were managed in 55-gallon drums, one or more aboveground storage tanks, and a sludge pit.

In November 1982, HWD entered into a Consent Order with NYSDEC that required HWD to cease hazardous waste management operations at the Site. All remaining wastes and waste management tanks were reportedly removed from the Site during 1984. As the result of a 1985 property inspection by NYSDEC, the Site was listed on the New York State Registry of Inactive Hazardous Waste Sites as a Class 2a site, which is a temporary classification assigned by NYSDEC for sites that have inadequate and/or insufficient data for inclusion in any of the other site classifications.

At the time of a Site reconnaissance in May 1990, the Site was being used as a parking lot by J.S. Trucking Company, who was leasing the property from Little Joseph Realty. There were no remaining on-Site structures or evidence of equipment or materials used during the previous business activities of HWD. The Site area where historical activities were conducted was observed to be covered with concrete.

In October 1999, the Potentially Responsible Parties (PRPs) entered into a Consent Order with NYSDEC to conduct a Remedial Investigation (RI) and Feasibility Study (FS). The RI identified elevated concentrations of tetrachloroethene (PCE) and its breakdown products in the soils and groundwater at the Site. Figure 2.2 presents a summary of the soils analytical results, and the groundwater results are presented on Figures 2.3 and 2.4. PCE was also in samples collected from the indoor air of an adjacent building (R&D Carpet and Tile Building) located southwest and downgradient of the Site. The FS evaluated potential remedial alternatives for the Site and recommended an alternative consisting of ISCO for treatment of the soils and groundwater, sub-slab depressurization for the R&D Carpet and Tile Building, and Site controls and monitoring. The active sub-slab depressurization (ASD) system was installed at the R&D Carpet and Tile Building as an Interim Remedial Measure (IRM) in September 2004.

NYSDEC issued a ROD in December 2004. In the ROD, NYSDEC selected a remedy that included soil treatment using either ISCO or soil vapor extraction (SVE) and groundwater treatment using either ISCO or air sparging. The areas identified for remediation are shown on Figure 2.5. The components of the remedy as specified in the ROD are as follows:

- A remedial design program to provide the details necessary to implement the remedial program;
- Treatment of source area soils to SCGs (defined in Section 5.1 of the ROD) to protect groundwater and reduce migration of volatile organic compounds (VOCs) through the soil gas using one of the following methods: in situ chemical oxidation using potassium permanganate, or similar oxidant; or SVE with off-gas treatment to meet applicable discharge requirements;
- Treatment of on-Site and off-Site groundwater to reduce total VOC concentrations to upgradient concentrations by either of the following methods: in situ chemical oxidation; using potassium permanganate, or similar oxidant; or air sparging with off-gas treatment to meet applicable discharge requirements;
- A pre-design investigation to determine the extent of the downgradient groundwater plume and the optimum location for the injection/air sparging wells and performance monitoring wells;
- Verification sampling of treated soil and groundwater to confirm the effectiveness of the remedial actions;
- Continued operation, maintenance, and monitoring of the ASD system IRM to reduce PCE concentrations in indoor air at the former R&D Carpet and Tile Building to ambient background levels;
- Development of a Site management plan to address residual contamination and any use restrictions;
- Imposition of an environmental easement; and
- Annual certification of the institutional and engineering controls.

In July 2007, the HWD Group and NYSDEC entered into a Consent Order to conduct and implement a RD/RA Work Plan. The objective of the RD/RA Work Plan is to provide for the development and implementation of final plans and specifications for implementing the remedial alternative set forth in the NYSDEC ROD, dated December 2004.

3.0 REMEDIAL ACTION OBJECTIVES

As stated in the ROD, the remediation goals for the Site are to eliminate or reduce to the extent practicable:

- Exposures of persons at or around the Site to VOCs in subsurface soils;
- The release of VOCs from soil into groundwater that may create exceedances of groundwater quality standards;
- The release of VOCs from soil into indoor air, through soil vapor;
- The risk of ingestion of groundwater affected by the Site that does not attain drinking water standards; and
- Off-Site migration of groundwater that does not attain groundwater quality standards.

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

- Ambient groundwater quality standards or Site background; and
- SCGs for soils (TAGM 4046 - Determination of Soil Cleanup Objectives and Cleanup Levels and 6 NYCRR Subpart 375-6 - Remedial Program Soil Cleanup Objectives).

4.0 REMEDIAL ACTION COMPONENTS

The primary components of the selected remedial action are as follows:

- Soil treatment;
- Groundwater treatment;
- Pre-design investigation;
- Confirmatory soil and groundwater sampling;
- Site Management Plan;
- Imposition of an environmental easement; and
- Annual certification of the institutional and engineering controls.

A description of each of the remedial action components is presented in the following subsections.

4.1 SOIL TREATMENT

The area requiring soil treatment as presented in the ROD and the FS is approximately 70 feet x 100 feet and extends to the water table at approximately 12 feet below ground surface. Hence, the total volume of soil requiring treatment is estimated to be approximately 84,000 cubic feet.

The ROD specifies that soil treatment shall consist of either SVE or ISCO. Given the Site-specific chemicals of concern (VOCs) and the Site-specific soil conditions, it is proposed that the primary soil treatment technology be SVE. The high permeability, low organic carbon soils present at the Site constitute ideal conditions for successful SVE treatment.

The SVE process involves inducing a negative pressure gradient within the soil through vapor extraction wells. VOCs volatilize as the vacuum propagates through the soil. The vapors are drawn to the extraction wells where they are removed from the subsurface and conveyed via piping to a treatment system. The extracted vapors will be treated by vapor-phase granular activated carbon (GAC) prior to discharge through an exhaust stack.

Within the approximately 84,000 cubic feet soil volume to be treated, the corresponding soil mass is approximately 9.24 million pounds. At an average 30 percent porosity, the total volume of air, or "pore volume" within this soil volume is 25,200 cubic feet. Using an average VOC concentration of 50 parts per million (ppm), the total VOC mass in the treatment zone is estimated to be approximately 462 pounds.

Typical performance expected for SVE treatment of sandy soil lies in the range of 75 to 90 percent VOC mass reduction for every 2,000 soil gas pore volumes extracted. The SVE system will be designed to remove approximately 5,000 pore volumes per year in order to ensure that the achievement of cleanup goals is accomplished as quickly as possible. For this area, a minimum SVE flow rate of 250 cubic feet per minute (cfm) will be required to meet this objective.

Vapor treatment will be performed using vapor phase activated carbon in compliance with NYSDEC Air Guide 1. At a 10 percent VOC loading capacity, less than 5,000 pounds of activated carbon will be necessary over the course of the remedial program.

To complement the high design flow rate, a grid of ten SVE wells will be installed in the soil treatment area. Approximate locations for the SVE wells are shown on Figure 4.1. The closely spaced wells will result in a conservative radius of influence requirement of only 15 feet per well and will also provide flexibility in operation such that multiple subsurface flow patterns can be induced and system optimization can be performed to maximize VOC mass removal rates. Due to the conservative design approach presented above, an SVE pilot test program will not be necessary. CRA's past experience at the Paisley Solvents and Chemicals Superfund Site in Garden City and at a site at 200 Commercial Avenue in Hempstead, New York, indicates that SVE flows in the range of 3 cfm per foot of well screen at less than 10 inches water column are typical for soils in this area. At these rates, a minimum flow of 30 cfm per SVE well will be easy to achieve, with higher flow attainable at increased vacuum. During the installation of the system, CRA's field geologist/engineer will observe the soils to ensure the Site conditions are consistent with these other sites.

The process flow schematic for the SVE system is presented on Figure 4.2. Specific design requirements for the soil treatment system are as follows:

- Delineation of soil treatment area;
- SVE extraction well construction details:
- SVE extraction well layout;
- SVE piping layout;
- SVE system equipment sizing and location;

- Electrical service requirements;
- Vapor treatment system; and
- Operation and monitoring requirements.

The contingency plan for the soil treatment system will include one or more of the following if necessary to eliminate a significant threat to the environment or human health:

- Continued operation of the SVE treatment system for an extended duration;
- Modifications to the SVE system such as installation of additional SVE wells or changes to the SVE blower; and
- Modifications to the operation of the SVE system to focus on areas that require additional treatment.

4.2 GROUNDWATER TREATMENT

The area requiring groundwater treatment is presented in the ROD and includes an area approximately 100 feet x 200 feet. Additional investigation will be conducted in the off-Site area as a pre-design task to further delineate the area requiring remediation.

It is proposed that ISCO be employed as the groundwater treatment technology for the Site. ISCO is a proven treatment technology that involves delivering oxidizing agents to the impacted media. The oxidant will degrade organic constituents in the media to non-toxic byproducts. ISCO involves the construction of an oxidant delivery system followed by oxidant application to treat the VOCs in the groundwater.

Potassium permanganate ($KMnO_4$), Fenton's Reagent, and sodium persulfate are the oxidants most commonly used for treatment of VOCs. Of these oxidants, $KMnO_4$ is the only one that does not require activation with a catalyst. Fenton's Reagent must be catalyzed by iron or low pH, and sodium persulfate must be catalyzed by high pH, hydrogen peroxide, iron, or heat. For both Fenton's Reagent and sodium persulfate, the catalyst must be added separately from the oxidant; therefore, the application must be designed to achieve good contact between the catalyst, the oxidant, and VOC in the subsurface. Depending on Site geology, this contact can be difficult to achieve and often oxidation of VOC may not be optimal. On the other hand, $KMnO_4$ is simple to mix and apply; therefore, it is the preferred oxidant for treatment at this Site. $KMnO_4$ is effective for treatment of VOC, with double bonds such as tetrachloroethene (PCE), trichloroethylene (TCE), and their breakdown products.

A system layout and conceptual process schematic are provided on Figures 4.1 and 4.3, respectively. The following paragraphs provide a description of the conceptual design for the groundwater treatment system. The actual design for the system will be based on the pre-design data and will be presented in the RD.

The ISCO delivery system for the groundwater will consist of a network of vertical injection wells spaced on approximately a 20-foot by 20-foot grid which would result in 40 injection wells. $KMnO_4$ solution will be injected into the wells in order to treat the groundwater. Based upon the groundwater analytical results presented in the RD, groundwater standards for the Site-related VOCs were not exceeded in any of the deep monitoring wells. Therefore, consistent with the ROD, it appears that significant groundwater impacts are limited to the shallow groundwater flow zone. Hence, it is proposed that the ISCO injection wells be installed to a depth of 30 feet below ground surface with 15-foot well screens.

$KMnO_4$ will be mixed with water on Site to obtain a 3 percent $KMnO_4$ solution. The solution will be pumped to each injection point or, for injection points located at a distance or in high traffic areas, transported in a trailer-mounted mixing and injection system, where it will then be injected into the subsurface. It is estimated that the groundwater treatment will involve two injections, total of approximately 125,600 gallons of 3 percent $KMnO_4$ solution (1,570 gallons per well per injection). The two injections will be spaced at least 3 months apart. A treatability study will be performed as a pre-design investigation task to determine the dosage required to achieve the necessary groundwater treatment. The oxidant solution will be injected under pressure to ensure maximum distribution of the solution.

Specific design requirements for the groundwater treatment system are as follows:

- Delineation of groundwater treatment area;
- Determination of $KMnO_4$ requirements for adequate treatment;
- Design of ISCO injection well construction details;
- Finalize ISCO injection well layout;
- Layout of $KMnO_4$ mixing area and mixing equipment; and
- $KMnO_4$ delivery system.

The contingency plan for the groundwater treatment system will include one or more of the following if necessary to eliminate a significant threat to the environment or human health:

- Additional ISCO injections in areas requiring additional treatment;
- Installation of additional injection wells in areas requiring additional treatment; and
- Modifications to the $KMnO_4$ solution (i.e., higher strength) for additional injections to achieve additional treatment.

4.3 PRE-DESIGN ACTIVITIES

Pre-design activities will be conducted to collect additional data necessary to complete the RD. Pre-design activities include:

- A bench-scale treatability test to estimate the oxidant demand for the Site soil and groundwater;
- Additional groundwater investigation to define the extent of the downgradient dissolved phase VOCs and to determine the optimum location for the oxidant injection points and to determine appropriate locations for the downgradient monitoring wells; and
- Soil sampling to update the baseline soil concentrations prior to treatment.

Details of the pre-design data collection activities are presented in Section 5.0

4.4 SOIL AND GROUNDWATER CONFIRMATORY SAMPLING

4.4.1 SOIL SAMPLING

During and at the conclusion of the soil remediation activities, a soil sampling program will be implemented to determine the effectiveness of the treatment and ultimately verify that the soil treatment criteria have been met. Scheduling of confirmation soil sampling activities will be determined based on the achievement of asymptotic levels of influent VOCs concentrations in the SVE system or after 2 years of SVE operation, whichever comes first.

Confirmatory soil borings will be advanced in the soil treatment area based on a grid approach with one borehole per 20-foot x 20-foot area resulting in approximately 12 boreholes. During confirmatory soil sampling, direct push soil borings will be completed using Geoprobe® drilling techniques. The borings will be advanced to depths of 12 to 16 feet below ground surface based on the water table elevation at the time of the event.

A total of 15 samples will be collected, including one from each boring and three QA/QC samples based on a 20 percent QA/QC sample collection frequency.

Each sample will be selected for laboratory analysis based on field screening using a photoionization detector (PID) with an 11.7 eV lamp. The sample will be chosen based on the observed highest PID reading, or if an elevated reading is not observed, the sample will be collected from the 0 to 2-foot depth interval (typically the shallow soil interval had the highest PCE concentrations during the RI).

Collected soil samples will be submitted to the analytical laboratory under chain-of-custody for analyses of VOCs using EPA Method 8260. All proper sampling and labeling methods will be followed to ensure sample integrity. Analytical results will be evaluated to verify the success of the remedial approach, or to determine the need for additional remedial activities.

Samples will be collected and analyzed in accordance with the QAPP and FSP presented in Appendices B and C, respectively.

4.4.2 GROUNDWATER SAMPLING

Groundwater monitoring will be conducted to assess the overall groundwater quality during the remedial action (see Operation, Maintenance, and Monitoring (OM&M) Plan) and also to specifically evaluate the progress of the treatment system. During the groundwater treatment period, Remedial Monitoring Wells MW-2, MW-2D, MW-7, MW-8, MW-10, and MW-11 will be sampled quarterly and Groundwater Monitoring Wells MW-1, MW-1D, MW-3, MW-3D, MW-4, MW-5, MW-6, MW-9, and MW-12 will be sampled semi-annually. Samples will be submitted for analysis of VOCs using EPA Method 8260.

Prior to implementation of the remedy, a complete round of groundwater samples will be collected from the Remedial Monitoring Wells and the Groundwater Monitoring Wells to establish groundwater conditions before the remediation. The Remedial Monitoring Wells will then be sampled quarterly for four rounds during the first year during the groundwater treatment. Quarterly monitoring will continue at the Remedial

Monitoring Wells for a 1-year period following the remediation to verify that groundwater concentrations remain below the remediation goals. The Groundwater Monitoring Wells will be sampled semi-annually for a 3-year period. A proposed groundwater sampling schedule is presented in Table 4.1.

Samples will be collected and analyzed in accordance with the QAPP and FSP presented in Appendices B and C, respectively.

4.5 SITE MANAGEMENT PLAN

Upon completion of the Site remediation, a Site Management Plan will be prepared to address any residual VOCs remaining at the Site and identify any Site use restrictions. The Site Management Plan will: (a) require soil characterization and, where applicable, disposal/re-use in accordance with NYSDEC regulations; (b) evaluate the potential for vapor intrusion to any buildings developed on the Site, including provision for mitigation of any impacts identified; and (c) identify any Site use restrictions.

4.6 IMPLEMENTION OF ENVIRONMENTAL EASEMENT

Imposition of an institutional control in the form of an environmental easement that will: (a) require compliance with the approved Site Management Plan; (b) limit the use and development of the property to commercial or industrial uses only; (c) restrict use of groundwater as a source of potable or process water, without necessary water quality treatment; and (d) require the property owner to complete and submit an annual certification to the NYSDEC. Where soil, soil gas, and groundwater concentrations reach unrestricted use levels, the appropriate institutional controls could be removed in accordance with applicable regulations.

4.7 ANNUAL CERTIFICATION OF THE INSTITUTIONAL AND ENGINEERING CONTROLS

The property owner will provide an annual certification, prepared and submitted by a professional engineer or environmental professional acceptable to the NYSDEC, which will certify that the institutional controls and engineering controls in place are unchanged from the previous certification and that nothing has occurred that would impair the ability of the controls to protect public health or the environment or constitute a violation or failure to comply with any operation and maintenance or Site management. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible or that the significant threat to the environment or human health that gave rise to the property being placed on the DEC registry of inactive hazardous waste disposal sites has been eliminated.

5.0 PREDESIGN DATA COLLECTION ACTIVITIES

Pre-design activities will be conducted to collect additional data necessary to complete the RD. Pre-design activities include:

- A bench-scale treatability test to estimate the oxidant demand for the Site soil and groundwater;
- Additional groundwater investigation to define the extent of the downgradient dissolved phase VOCs and to determine the optimum location for the oxidant injection points; and
- Soil sampling to update the baseline soil concentrations prior to treatment.

5.1 OXIDANT DEMAND BENCH-SCALE TESTING

A bench-scale treatability study will be performed to evaluate the use of ISCO with potassium permanganate for groundwater treatment at the Site.

ISCO is an effective method for destroying localized high concentrations of a wide range of organic compounds, particularly VOCs. In an oxidation reaction, the oxidizing agent breaks the carbon bonds in the compounds and converts them into non-hazardous or less toxic compounds, primarily carbon dioxide and water. ISCO is site specific, and successful treatment is typically a function of the effectiveness of the delivery system (being able to deliver sufficient amounts of oxidant to the impacted soil and groundwater and making sufficient "contact") and subsequent transport of the oxidant within the soil and groundwater. The treatment performance is dependent to a great extent on the soil chemistry. A critical factor in the evaluation of ISCO treatment is determining the dosages of oxidant that are required to effectively oxidize the hydrocarbon compounds present (referred to as stoichiometric demand) as well as the competing reactions. The competing reactions are typically caused by the presence of natural organic materials such as humates and fulvates, as well as reduced metal species. The consumption of oxidants by these non-target compounds is defined as natural oxidant demand (NOD). In order to determine the optimum dosage, treatability studies are required. Active ISCO requires accurate delineation of the source of hydrocarbons. Large quantities of oxidizing chemicals require regulated handling and pose health and safety concerns.

The primary objective of the bench-scale treatability study is to gather the data necessary to:

- Assess the effectiveness of ISCO for treatment of the VOCs in representative soil and groundwater samples from the Site;
- Assess the variability of NOD at the Site; and
- Determine the effective concentration/dosage of oxidant required to complete treatment as expeditiously as possible.

Task 1: Initial Characterization

One-half gallon of representative soils from the saturated zone and 3 gallons of groundwater from the Site will be shipped on ice overnight to the CRA Treatability Study Laboratory in Niagara Falls, New York. The soil sample will be collected from within the soil treatment area at the borehole locations used to update the baseline soil concentrations (see Section 5.3). The groundwater sample will be collected from well MW-7 that typically has the highest PCE concentrations. The groundwater sample will be placed in glass bottles that are completely filled such that no headspace exists.

The samples will be characterized for key parameters pertinent to chemical oxidation:

- VOCs;
- Metals;
- TOC; and
- pH.

Task 2: Chemical Oxidation Microcosm Tests

In order to evaluate the effectiveness of potassium permanganate for the treatment of VOC at the Site, a series of microcosm tests will be conducted for the Site groundwater. The tests will assess the effectiveness of the chemical oxidants for treatment of VOCs in the groundwater and will determine the optimum concentration range of the solution to be used for the full-scale treatment.

The microcosm tests will consist of placing 115 mL of groundwater in 125 mL serum bottles and mixing with 10 mL of $KMnO_4$ solution at varying concentrations (0.1, 0.5, and 2.0 percent, w/w). Control tests will be prepared similarly but without the use of an oxidizing agent solution. The bottles will be sealed immediately to prevent the loss of VOCs by volatilization and incubated in the dark at lab temperature for 2 weeks.

At the end of the incubation period, the microcosms will be sampled and analyzed for residual VOCs. The samples will be analyzed immediately in CRA's laboratory, therefore, any residual oxidant will not continue to oxidize the VOCs after the microcosm has been sacrificed.

Task 3: Variability of Natural Oxidant Demands

The NOD of the soil sample will be assessed by placing 50 g of soil in an 8 oz jar and adding 100 mL of 1 percent $KMnO_4$. The initial $KMnO_4$ concentration will be recorded by measuring the absorbance at 525 nm and comparing to a standard curve. Each week the jar will be sampled and the $KMnO_4$ concentration recorded.

The natural oxidant demand of the groundwater sample will be assessed by placing 100 mL of groundwater in a 4 oz jar and adding 1 g of solid powdered $KMnO_4$. The initial $KMnO_4$ concentration will be recorded by measuring the absorbance at 525 nm and comparing to a standard curve. Each week the jar will be sampled and the $KMnO_4$ concentration recorded.

Task 4: Reporting

A treatability study report will be prepared describing the testing conducted in the treatability study and including the results obtained. The report will provide a full assessment on the feasibility of chemical oxidation for the remediation of the groundwater at the Site. The treatability study report will be included in the Preliminary Design.

5.2 FOCUSED GROUNDWATER INVESTIGATION AND OXIDANT INJECTION POINT INVESTIGATION

Additional groundwater delineation is proposed downgradient of the Site to define the extent of the groundwater contamination and to determine optimum locations for the oxidant injection points.

A total of ten Geoprobes® will be advanced and two hydropunch groundwater samples will be collected at each location. The proposed Geoprobe® sampling locations are presented on Figure 5.1. The locations were selected to cover the estimated downgradient area requiring treatment, as identified in the FS and the ROD and also to include locations downgradient and on both sides of the estimated treatment area. It should be noted that the ability to access downgradient areas in any direction for sampling is very limited due to the development that has occurred in the area (see Figure 2.1).

At each location, a groundwater sample will be collected near the groundwater table and at a depth of approximately 20 feet below the groundwater table. The samples will be submitted to the laboratory for analyses for VOCs using Method 8260. The hydropunch data also will be used to determine appropriate locations for additional off-Site groundwater monitoring wells, if any. The new wells, if any, will be installed prior to the construction phase and will be used to monitor the effectiveness of the remediation and to monitor the groundwater downgradient of the impacted area. It is currently estimated that three new monitoring wells will be installed in the downgradient area as shown on Figure 5.2. The rationale for the new well locations is presented in Table 5.1. Final locations for the new wells will be presented in the RD following evaluation of the hydropunch pre-design data. It should be noted that some of the proposed new monitoring wells are close to the locations of existing monitoring wells W-1 and W-3. However, on the Site plans these wells are identified as being installed for investigation of other sites. If these existing wells can be used for Site monitoring purposes, some of the proposed new monitoring wells may not need to be installed.

One new monitoring well is proposed at the upgradient Site boundary at the location shown on Figure 5.2. In accordance with the ROD, the groundwater remediation goal is to treat the groundwater to the upgradient concentrations. Since VOC contamination has been identified to be entering the Site from upgradient sources, it is very important to characterize and monitor the upgradient groundwater as this will form the basis for determining when the Site remediation is complete. The new upgradient monitoring well will be installed prior to the construction phase, at the same time as the new downgradient monitoring wells described above.

Samples will be collected and analyzed in accordance with the QAPP and FSP presented in Appendices B and C, respectively.

5.3 SOIL SAMPLING

Soil samples will be collected at six locations shown on Figure 5.3. The data will be used to update the baseline soil concentrations prior to implementing the soil treatment. At each location, a Geoprobe® will be advanced to the groundwater table and one soil sample will be selected from each boring for submittal to the laboratory for VOC chemical analysis. The sample will be selected from the soil interval identified to have the highest potential for VOCs based on PID screening of the soils.

Samples will be collected and analyzed in accordance with the QAPP and FSP presented in Appendices B and C, respectively.

6.0 REMEDIAL ACTION PROJECT PLANS

This section provides an overview of the following Project Plans that are presented as appendices to this RD/RA Work Plan:

- Appendix A - Health and Safety Plan;
- Appendix B - Quality Assurance Project Plan;
- Appendix C - Field Sampling Plan; and
- Appendix D - Operation, Maintenance, and Monitoring Plan.

The aforementioned Project Plans are designed to provide the procedures and protocols that are necessary to support the remedial activities. All work will be conducted in accordance with the Project Plans.

6.1 HEALTH AND SAFETY PLAN

A Site-specific Health and Safety Plan (HASP) is required to ensure that all remedial activities are performed safely and in accordance with applicable regulatory requirements, and that all persons, the general public, and the environment are protected from exposure to Site-related VOCs. The health and safety requirements for the remedial activities were developed in accordance with 29 CFR 1910 and are provided in the HASP presented in Appendix A. The HASP includes:

- General requirements;
- Personnel;
- Levels of protection;
- Safe work practices and safeguards;
- Medical surveillance;
- Personal and environmental air monitoring;
- Personal protective equipment;
- Personal hygiene;
- Decontamination of personnel and equipment;
- Site work zones;
- Contaminant control;
- Contingency and emergency planning;

- Logs, reports, and recordkeeping: and
- Community Air Monitoring Plan.

6.2 QUALITY ASSURANCE PROJECT PLAN

The field and laboratory quality assurance objectives, protocols, and procedures supporting the waste characterization and end-point sampling activities are provided in the Quality Assurance Project Plan (QAPP) presented in Appendix B. The QAPP includes:

- Project description;
- Project organization;
- Project responsibilities;
- Sampling and custody procedures;
- Calibration procedures;
- Quality assurance (QA) objectives;
- Analytical procedures;
- Data analysis and reporting;
- Internal quality control (QC) checks;
- Performance and system audits;
- Preventative maintenance;
- Method-specific procedures for assessing data precision, accuracy, and completeness;
- Laboratory corrective actions; and
- Quality assurance (QA) reports.

6.3 FIELD SAMPLING PLAN

A Site-specific Field Sampling Plan (FSP) is required to ensure that sampling and analyses are performed to established and accepted protocols. All sampling and analyses will be conducted as part of a quality assurance program to ensure that accurate and precise analytical results are obtained. All sampling and analysis activities will be completed in accordance with the FSP presented in Appendix C. The FSP includes:

- Number of samples to be collected;
- Sampling protocols;
- Sample collection locations;
- Special sample collection equipment and techniques (if required); and
- Analytical method to be used.

6.4 OPERATION, MAINTENANCE, AND MONITORING PLAN

Appendix D presents an Operation, Maintenance, and Monitoring (OM&M) Plan for the active sub-slab depressurization (ASD) system at the R&D Carpet and Tile Building. For the RD, a draft OM&M Plan will be prepared for the SVE/ISCO system and the Site groundwater monitoring program as described in Section 7.2.4.

7.0 REMEDIAL DESIGN

7.1 PRELIMINARY DESIGN

At the Preliminary Design stage, all pre-design data collection would be complete and technical requirements of the remediation are addressed and outlined in sufficient detail in order that they may be reviewed to determine if the Final Design will provide an effective remedy for the Site. NYSDEC comments on the Preliminary Design will be addressed as the design proceeds to the Pre-Final Design.

The Preliminary Design will consist of the following components:

- Preliminary Design Report; and
- Preliminary Plans and Specifications.

7.1.1 PRELIMINARY DESIGN REPORT

The Preliminary Design Report will present all of the pre-design data and a detailed description of all preliminary design assumptions and parameters, the basis and rationale for all technical aspects of the design including supporting calculations, and the interaction of the various design components. Calculations will be included for the determination of oxidant demand, the spacing of SVE and/or AS wells, and the sizing of vapor treatment units. The Preliminary Design Report will, at a minimum, address the following:

- Groundwater characterization;
- Hydrogeologic parameters;
- SVE system description;
- In situ chemical oxidation system description;
- Influent and effluent qualities;
- Materials and equipment;
- Performance standards;
- Operations and maintenance requirements; and
- Monitoring requirements.

7.1.2 PRELIMINARY PLANS AND SPECIFICATIONS

The preliminary plans and specifications will include an outline of required drawings, specifications, and performance standards. Drawings will be prepared to present the conceptual aspects of the design. The drawings will be of sufficient detail to provide the reviewer with a clear understanding of the major components of the remediation and the interaction of the key components.

Appropriate project specifications will be selected during the Preliminary Design phase of the work. An outline of the required specifications will be prepared and submitted with the Preliminary Design.

7.2 PRE-FINAL/FINAL DESIGN

The Pre-Final Design will address comments generated from the Preliminary Design review and clearly show any modification of the design as a result of incorporation of the comments. The Pre-Final Design will essentially function as the draft version of the Final Design. All aspects of the design will be 100 percent complete for the Pre-Final Design submittal, subject only to addressing any comments raised by NYSDEC.

Following NYSDEC review and comment on the Pre-Final Design, the Final Design will be prepared along with a memorandum indicating how the Pre-Final Design comments were incorporated into the Final Design. All Final Design documents will be certified by a Professional Engineer registered in the State of New York. The Pre-Final/Final Design will consist of the following components:

- Design Report;
- Plans and Specifications;
- Waste Management Plan;
- Draft Operation, Maintenance, and Monitoring Plan;
- Construction Quality Assurance Project Plan;
- Construction Health and Safety Plan; and
- Construction Schedule.

7.2.1 DESIGN REPORT

The Design Report will present a detailed description of all design assumptions and parameters, the basis and rationale for all technical aspects of the design including supporting calculations, and the interaction of the various design components. The selected design will be presented along with an analysis supporting the design approach. Calculations will include the following:

- Mass balance;
- Chemicals consumption;
- Process pump/blower design;
- Process line design;
- Electrical design; and
- Process equipment design.

7.2.2 PLANS AND TECHNICAL SPECIFICATIONS

A complete set of construction drawings and technical specifications will be submitted, which describe the selected design. This will include detailed design and specifications for all equipment, piping, electrical requirements, and process control.

Design for construction will include a Site plan and equipment arrangements as well as design details for the civil/structural, mechanical, and electrical/instrumentation components complete with appropriate standards and specifications.

It is anticipated that the drawing package will include the following drawings:

Process

- Process Flow Diagram (Mass Balance); and
- P&ID.

Civil/Structural/Architectural

- Overall Site Plan and General Notes;
- Wells, Piping, and Treatment Equipment Enclosure Layout;
- SVE Wells and SVE Piping Trench Details; and

- Fence and Bollard Details.

Mechanical

- Treatment System Piping Plans;
- SVE and ISCO Piping Layout; and
- Piping Sections and Details.

Electrical and Instrumentation

- Electrical Service Plan;
- Electrical Single Line Diagrams;
- Electrical Grounding Plan/Details;
- Electrical Panel Schedules; and
- Miscellaneous Electrical Details.

7.2.3 WASTE MANAGEMENT PLAN

The Waste Management Plan will describe procedures and protocols for the handling of materials generated during the remediation, which includes construction, installation and excavation activities, and long-term operation and maintenance of the system. Potential types of wastes that may be generated include, but may not be limited to the following:

- Aqueous waste;
- Solid waste (e.g., drill cuttings, personal protective equipment);
- Spent carbon from SVE system; and
- VOC-impacted soil.

The overall objectives of the Waste Management Plan are to:

- Minimize the quantity of waste generated and requiring off-Site disposal;
- Prevent commingling of different waste streams;
- Ensure wastes are properly managed on Site to prevent releases to the environment or contamination of otherwise clean areas of the Site; and
- Manage all wastes in accordance with applicable regulations.

The procedures and protocols outlined in the Waste Management Plan will include proper management, characterization testing/sampling, treatment, and transportation and/or disposal of wastes generated during the remediation. These procedures will be performed in conjunction with those presented in the Construction Health and Safety Plan.

The Waste Management Plan may be revised/expanded as appropriate as the remediation work progresses to include information, methodologies, and procedures associated with any changes in work scope and/or Site conditions.

7.2.4 DRAFT OPERATION, MAINTENANCE, AND MONITORING PLAN

The Draft OM&M Plan developed for the RD/RA Work Plan will be updated as necessary and included in the Pre-Final/Final Remedial Design. The OM&M Plan will address the implementation of the remediation and long-term operation, maintenance, and monitoring of the system. The purpose of the OM&M Plan is to provide a summary of the OM&M requirements for the various components of the remedy.

The OM&M Plan will be organized as follows:

- A general introduction and the purpose and organization of the OM&M Plan;
- A description of the organizational structure;
- A description of the system;
- Detailed operational instructions for the system;
- A description of all equipment, including inspection, records retention, and reporting requirements;
- A description of shutdown procedures, potential operating problems, and emergency notifications;
- Inspection and maintenance procedures for the system;
- Recordkeeping requirements for the system; and
- Groundwater Monitoring Program.

The OM&M Plan will be finalized upon completion of the construction to include:

- Equipment manuals and maintenance information;
- Equipment and instrumentation vendor information;

- Set-points;
- Operator logs; and
- Spare parts list.

7.2.5 CONSTRUCTION QUALITY ASSURANCE PLAN

The Construction Quality Assurance Plan (CQAP) will present the quality assurance program to be implemented during the construction phase of the remediation at the Site. The CQAP will be prepared to ensure that the construction elements are constructed to meet or exceed all design criteria, plans, and specifications.

The CQAP will include the following:

- The purpose and organization of the report and background information;
- A description of the project;
- An outline of the project organization and responsibilities;
- The personnel qualification requirements;
- The project meeting requirements;
- The inspection and testing activities required to ensure that construction and materials comply with all design specifications and plans; and
- Documentation requirements of construction quality assurance (CQA) activities.

7.2.6 CONSTRUCTION HEALTH AND SAFETY PLAN

A project-specific HASP will be prepared to describe the health and safety procedures and emergency response guidelines to be implemented during the construction phase of the project. CRA is very cognizant of the importance of health and safety for all aspects of all projects.

During construction activities, personnel will be working with heavy equipment and may come into contact with soils, groundwater, and waste materials, which potentially contain hazardous substances. The HASP will be developed to ensure the following:

- That Site personnel are appropriately trained and aware of potential hazards at the Site;
- That Site personnel are not adversely exposed to the compounds of concern;

- Compliance with applicable governmental and non-governmental (American Conference of Governmental Industrial Hygienists [ACGIH]) regulations and guidelines. In particular, the amended rules of the Occupational Safety and Health Administration (OSHA) for Subpart D of Part 1926 (Title 29 Code of Federal Regulations [CFR] Part 1926.65) will be implemented for Site work where there is a potential to come in contact with hazardous substances; and
- Initiation of proper emergency response procedures to minimize the potential for any adverse impact to Site workers, the general public, or the environment.

All on-Site workers will have completed the 40-hour HAZWOPER training and annual refresher training pursuant to OSHA regulations.

7.2.7 CONSTRUCTION SCHEDULE

The Pre-Final/Final Design will include a final construction schedule.

8.0 CONTINGENCY PLAN

A Contingency Plan will be developed to specify actions to be taken should any element of the RD fail to achieve any of its objectives or otherwise fails to eliminate any significant threat to the environment or human health.

The contingency plan for the soil treatment system will include one or more of the following:

- Continued operation of the SVE treatment system for an extended duration;
- Modifications to the SVE system such as installation of additional SVE wells or changes to the SVE blower; and
- Modifications to the operation of the SVE system to focus on areas that require additional treatment.

The contingency plan for the groundwater treatment system will include one or more of the following:

- Additional ISCO injections in areas requiring additional treatment;
- Installation of additional injection wells in areas requiring additional treatment; and
- Modifications to the $KMnO_4$ solution (i.e., higher strength) to achieve additional treatment.

9.0 SCHEDULE

A schedule for completing the RD and implementing the RA is presented on Figure 9.1. The RD will include an updated schedule for implementing the RA.

TABLE 4.1

GROUNDWATER SAMPLING PLAN
HWD SITE
11 A PICONE BOULEVARD
FARMINGDALE, NEW YORK

	Year 1				*Year 2*				*Year 3*			
	1st Quarter	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*
Remedial Monitoring Wells												
MW-2	√	√	√	√	√	√	√	√	√		√	
MW-2D	√	√	√	√	√	√	√	√	√		√	
MW-7	√	√	√	√	√	√	√	√	√		√	
MW-8	√	√	√	√	√	√	√	√	√		√	
MW-10	√	√	√	√	√	√	√	√	√		√	
MW-11	√	√	√	√	√	√	√	√	√		√	
Groundwater Monitoring Wells												
MW-1	√		√		√		√		√		√	
MW-1D	√		√		√		√		√		√	
MW-3	√		√		√		√		√		√	
MW-3D	√		√		√		√		√		√	
MW-4	√		√		√		√		√		√	
MW-5	√		√		√		√		√		√	
MW-6	√		√		√		√		√		√	
MW-9	√		√		√		√		√		√	
MW-12	√		√		√		√		√		√	

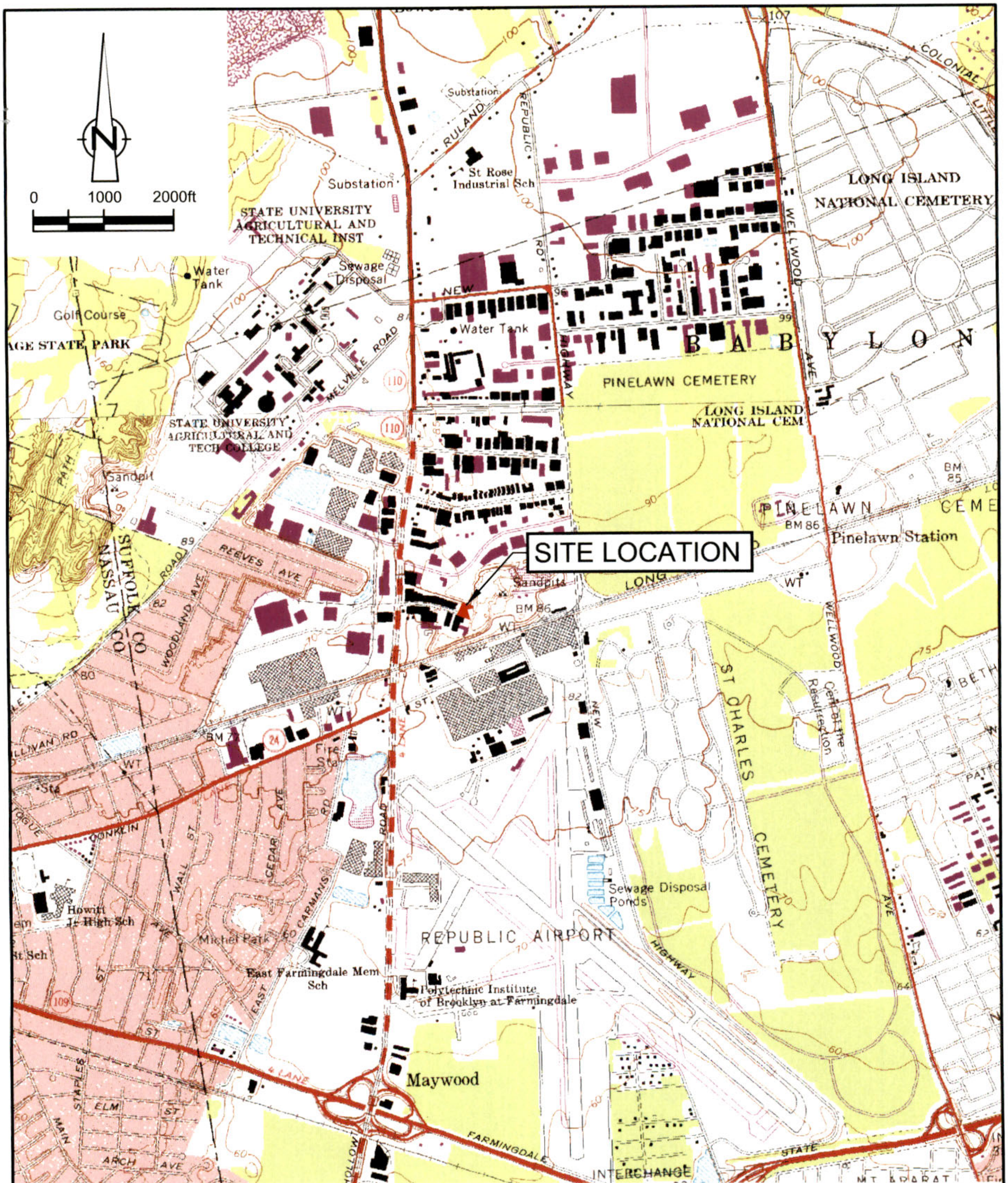
Note:

Schedule based on a 1-year groundwater treatment period and a 2-year soil treatment period.

TABLE 5.1

RATIONALE FOR NEW MONITORING WELL LOCATION
HWD SITE
11 A PICONE BOULEVARD
FARMINGDALE, NEW YORK

Proposed Well	*Rationale*
MW-9	To monitor background groundwater quality northeast of the Site.
MW-10	To monitor groundwater quality within the proposed groundwater treatment area and immediately downgradient of soil treatment areas.
MW-11	To determine groundwater quality downgradient of the souirce area and within the potential groundwater treatment area.
MW012	To monitor groundwater quality directly downgradient of the treatment area.



SOURCE: AMITYVILLE AND HUNTINGTON
U.S.G.S. QUADRANGLE MAPS

figure 1.1

SITE LOCATION
RD/RA WORK PLAN
Farmingdale, New York

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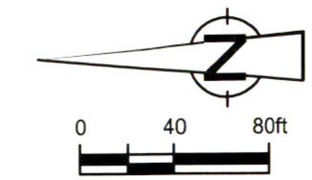

LEGEND:

- SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)
- FENCE LINE
- EXISTING GROUNDWATER MONITORING WELL LOCATION (INSTALLED FOR INVESTIGATION OF THE HWD SITE)
- EXISTING GROUNDWATER MONITORING WELL LOCATION (INSTALLED FOR INVESTIGATION OF OTHER SITES)

NOTES:

1. WELLS MW-1 THROUGH MW-4 INSTALLED BY GIBBS & HILL, INC. IN SEPTEMBER 1990.
2. WELLS MW-5 AND MW-6 WERE INSTALLED IN JUNE 1994 BY FANNING, PHILIPS & MOLNAR.
3. WELLS W-1, W-2 AND W-3 INSTALLED BY TYREE BROTHERS ENVIRONMENTAL SERVICES, INC., SOURCE IS MAP PROVIDED BY GIBBS & HILL, INC. DATED 6/17/94 (NOT TO SCALE).
4. WELLS MW-1D THROUGH MW-3D INSTALLED BY BLASLAND, BOUCK & LEE, INC. (BBL) IN DECEMBER 1999. WELLS MW-7 AND MW-8 INSTALLED BY BBL DURING FEBRUARY 2001 AND APRIL 2003, RESPECTIVELY.
5. THE LOCATION OF THE OLD TANK FIELD IS APPROXIMATE. THE SOURCE IS A MAP PRODUCED BY TYREE BROTHERS ENVIRONMENTAL SERVICES, INC. (NOT TO SCALE, NO DATE PROVIDED).
6. THE LOCATIONS OF THE FORMER GROUNDWATER DRAINPOOL AND MONITORING WELL MW-1A AT 13D PICONE BOULEVARD ARE APPROXIMATE. THE SOURCE IS FIGURE 2 - GROUNDWATER SAMPLING LOCATIONS PREPARED BY FANNING, PHILLIPS & MOLMAR (FPM) DATED 8/23/96.
7. THE LOCATION OF THE ABANDONED GAS STATION (GAS PUMP AND UNDERGROUND TANK) IS APPROXIMATE. THE SOURCE IS A MAP PROVIDED IN THE GIBBS & HILL, INC. DECEMBER 1991 PHASE II INVESTIGATION REPORT (NOT TO SCALE).

SOURCE:

ALL BASE MAP INFORMATION UNLESS OTHERWISE NOTED WAS TAKEN FROM A MAP ENTITLED "MONITORING WELL AND SOIL BORING LOCATION PLAN, HWD SITE-PICONE BOULEVARD, FARMINGDALE NEW YORK, PROJECT No. 604.05 #2". PREPARED BY ALBERT W. TAY. FILE No. 99390-3.DWG. SURVEYED 11/22/99 THROUGH 11/29/99. SURVEY REVISED 2/9/2000 AND 5/13/2003.

figure 2.1

SITE PLAN
RD/RA WORK PLAN
Farmingdale, New York

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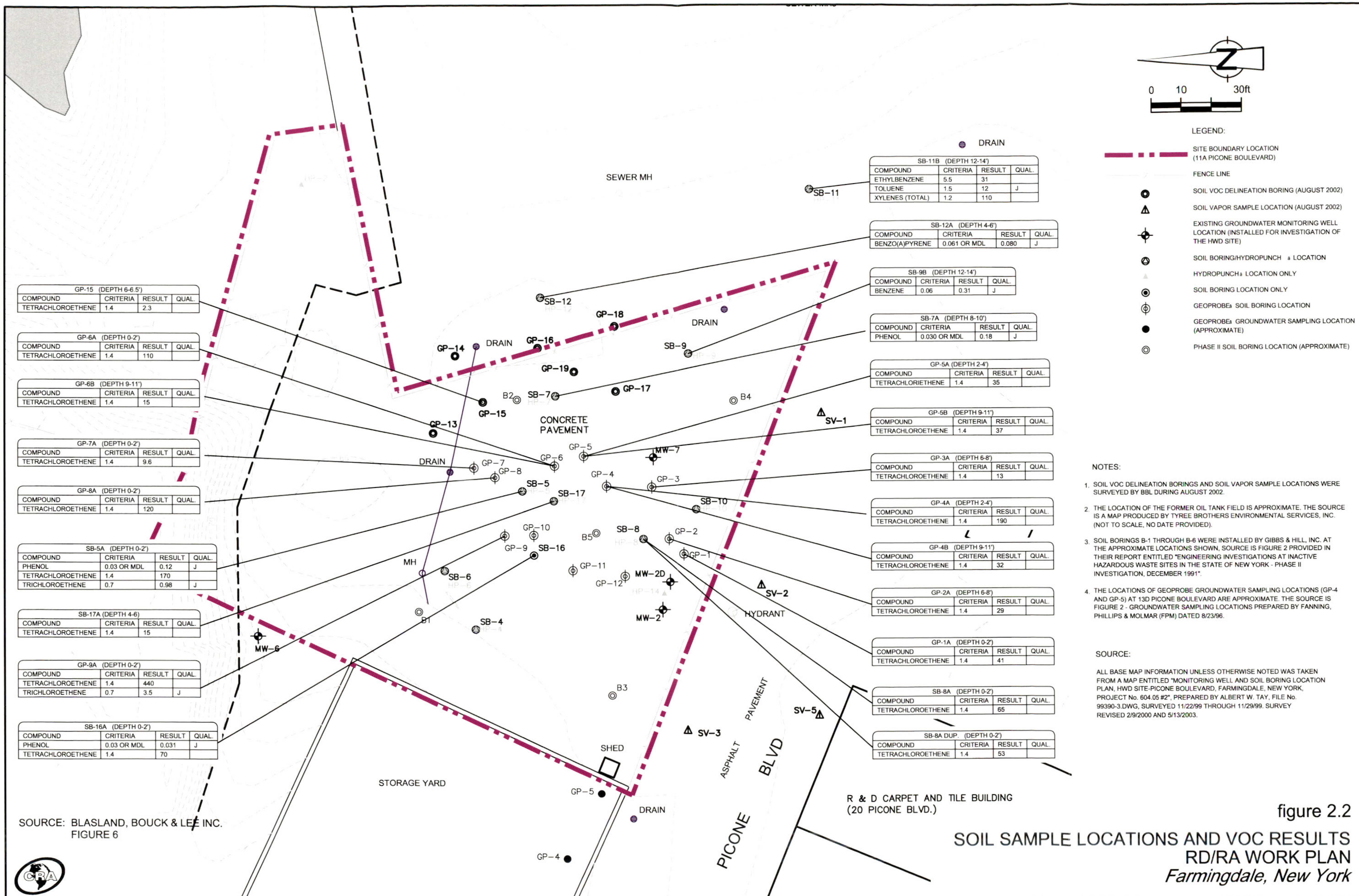

GP-15 (DEPTH 6-6.5')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	2.3	

GP-6A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	110	

GP-6B (DEPTH 9-11')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	15	

GP-7A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	9.6	

GP-8A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	120	

SB-5A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
PHENOL	0.03 OR MDL	0.12	J
TETRACHLOROETHENE	1.4	170	
TRICHLOROETHENE	0.7	0.98	J

SB-17A (DEPTH 4-6)			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	15	

GP-9A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	440	
TRICHLOROETHENE	0.7	3.5	J

SB-16A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
PHENOL	0.03 OR MDL	0.031	J
TETRACHLOROETHENE	1.4	70	

SB-11B (DEPTH 12-14')			
COMPOUND	CRITERIA	RESULT	QUAL.
ETHYLBENZENE	5.5	31	
TOLUENE	1.5	12	J
XYLENES (TOTAL)	1.2	110	

SB-12A (DEPTH 4-6')			
COMPOUND	CRITERIA	RESULT	QUAL.
BENZO(A)PYRENE	0.061 OR MDL	0.080	J

SB-9B (DEPTH 12-14')			
COMPOUND	CRITERIA	RESULT	QUAL.
BENZENE	0.06	0.31	J

SB-7A (DEPTH 8-10')			
COMPOUND	CRITERIA	RESULT	QUAL.
PHENOL	0.030 OR MDL	0.18	J

GP-5A (DEPTH 2-4')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLORIETHENE	1.4	35	

GP-5B (DEPTH 9-11')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	37	

GP-3A (DEPTH 6-8')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	13	

GP-4A (DEPTH 2-4')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	190	

GP-4B (DEPTH 9-11')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	32	

GP-2A (DEPTH 6-8')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	29	

GP-1A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	41	

SB-8A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	65	

SB-8A DUP. (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	53	

NOTES:

1. SOIL VOC DELINEATION BORINGS AND SOIL VAPOR SAMPLE LOCATIONS WERE SURVEYED BY BBL DURING AUGUST 2002.
2. THE LOCATION OF THE FORMER OIL TANK FIELD IS APPROXIMATE. THE SOURCE IS A MAP PRODUCED BY TYREE BROTHERS ENVIRONMENTAL SERVICES, INC. (NOT TO SCALE, NO DATE PROVIDED).
3. SOIL BORINGS B-1 THROUGH B-6 WERE INSTALLED BY GIBBS & HILL, INC. AT THE APPROXIMATE LOCATIONS SHOWN, SOURCE IS FIGURE 2 PROVIDED IN THEIR REPORT ENTITLED "ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES IN THE STATE OF NEW YORK - PHASE II INVESTIGATION, DECEMBER 1991".
4. THE LOCATIONS OF GEOPROBE GROUNDWATER SAMPLING LOCATIONS (GP-4 AND GP-5) AT 13D PICONE BOULEVARD ARE APPROXIMATE. THE SOURCE IS FIGURE 2 - GROUNDWATER SAMPLING LOCATIONS PREPARED BY FANNING, PHILLIPS & MOLMAR (FPM) DATED 8/23/96.

SOURCE:

ALL BASE MAP INFORMATION UNLESS OTHERWISE NOTED WAS TAKEN FROM A MAP ENTITLED "MONITORING WELL AND SOIL BORING LOCATION PLAN, HWD SITE-PICONE BOULEVARD, FARMINGDALE, NEW YORK, PROJECT No. 604.05 #2", PREPARED BY ALBERT W. TAY, FILE No. 99390-3.DWG, SURVEYED 11/22/99 THROUGH 11/29/99. SURVEY REVISED 2/9/2000 AND 5/13/2003.

SOURCE: BLASLAND, BOUCK & LEE INC. FIGURE 6

figure 2.2

SOIL SAMPLE LOCATIONS AND VOC RESULTS
RD/RA WORK PLAN
Farmingdale, New York

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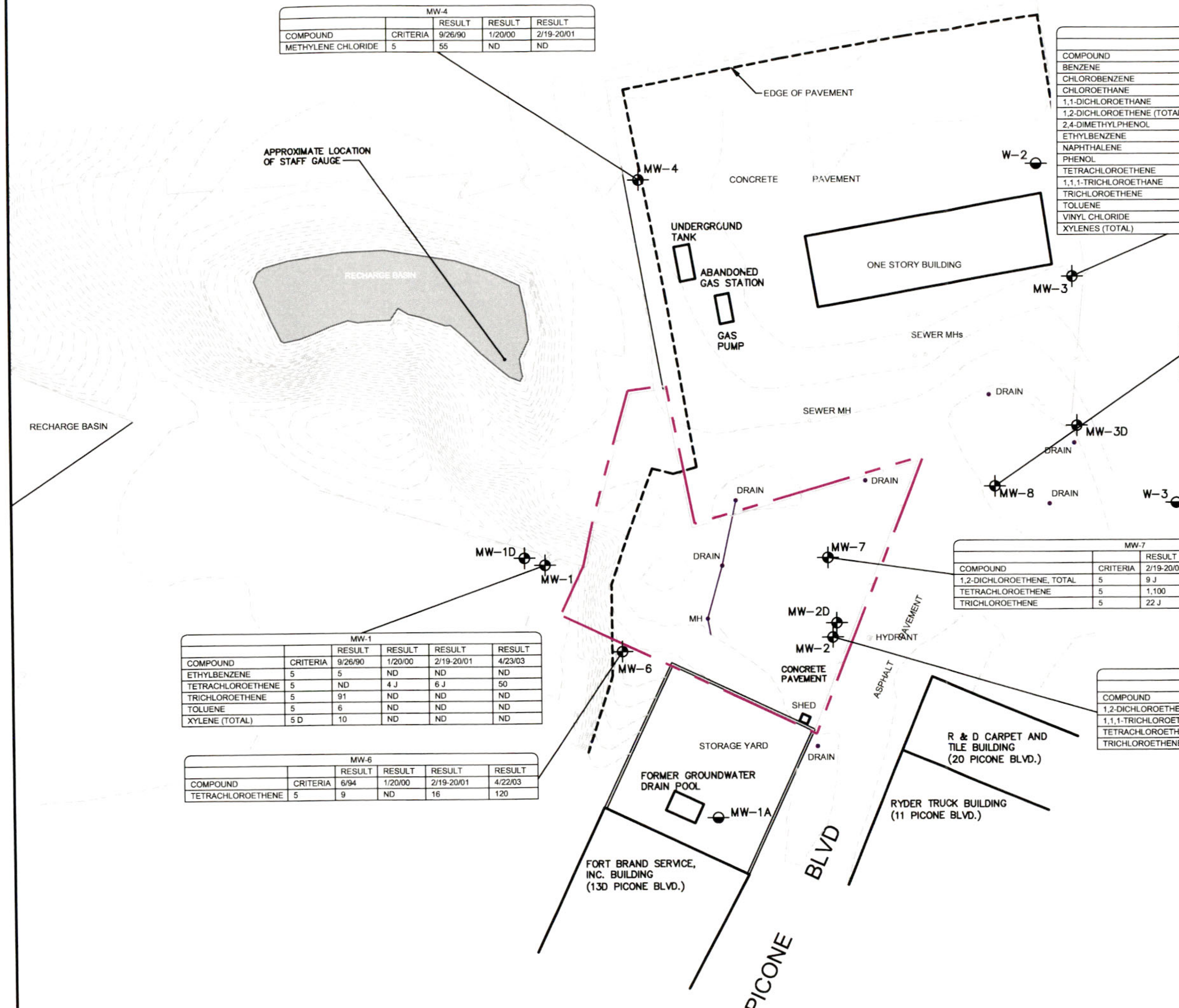


MW-4

		RESULT	RESULT	RESULT
COMPOUND	CRITERIA	9/26/90	1/20/00	2/19-20/01
METHYLENE CHLORIDE	5	55	ND	ND

MW-3

		RESULT	RESULT	RESULT	RESULT	DUP
COMPOUND	CRITERIA	9/26/90	1/20/00	2/19-20/01	4/22/03	4/22/03
BENZENE	1	ND	ND	ND	2.0	1.8
CHLOROBENZENE	5	30	69 J	31 J	19	17
CHLOROETHANE	5	48	ND	ND	ND	ND
1,1-DICHLOROETHANE	5	32	ND	ND	ND	ND
1,2-DICHLOROETHENE (TOTAL)	5*	200	14 J	10 J	2.3	1.9
2,4-DIMETHYLPHENOL	1 A	ND	13 J	NA	NA	NA
ETHYLBENZENE	5	440	1,200	650	310	270
NAPHTHALENE	10 G	65	220	NA	NA	NA
PHENOL	1 A	32	ND	NA	NA	NA
TETRACHLOROETHENE	5	29	ND	ND	1.4	1.2
1,1,1-TRICHLOROETHANE	5	150	ND	ND	ND	ND
TRICHLOROETHENE	5	18	ND	ND	ND	ND
TOLUENE	5	2,300	200 J	120	9.6	8.2
VINYL CHLORIDE	2	11	ND	ND	ND	ND
XYLENES (TOTAL)	5 D	2,000	4,400	1,400	40	35

MW-8

		RESULT
COMPOUND	CRITERIA	4/22/03
TETRACHLOROETHENE	5	970
1,2-DICHLOROETHENE, TOTAL	5	27
TRICHLOROETHENE	5	25

MW-7

		RESULT	DUP	RESULT
COMPOUND	CRITERIA	2/19-20/01	2/19-20/01	4/23/03
1,2-DICHLOROETHENE, TOTAL	5	9 J	8J	38
TETRACHLOROETHENE	5	1,100	1,000	2,600
TRICHLOROETHENE	5	22 J	19 J	48

MW-1

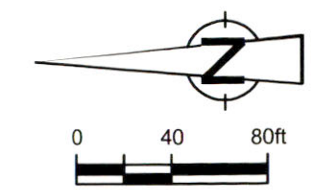
		RESULT	RESULT	RESULT	RESULT
COMPOUND	CRITERIA	9/26/90	1/20/00	2/19-20/01	4/23/03
ETHYLBENZENE	5	5	ND	ND	ND
TETRACHLOROETHENE	5	ND	4 J	6 J	50
TRICHLOROETHENE	5	91	ND	ND	ND
TOLUENE	5	6	ND	ND	ND
XYLENE (TOTAL)	5 D	10	ND	ND	ND

MW-2

		RESULT	RESULT	RESULT	RESULT
COMPOUND	CRITERIA	9/26/90	1/20/00	2/19-20/01	4/23/03
1,2-DICHLOROETHENE (TOTAL)	5*	59	ND	8 J	21
1,1,1-TRICHLOROETHANE	5	6	ND	ND	ND
TETRACHLOROETHENE	5	790 BD	68	360	1,200
TRICHLOROETHENE	5	130	ND	14 J	34

MW-6

		RESULT	RESULT	RESULT	RESULT
COMPOUND	CRITERIA	6/94	1/20/00	2/19-20/01	4/22/03
TETRACHLOROETHENE	5	9	ND	16	120



LEGEND:

SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)

FENCE LINE

EXISTING GROUNDWATER MONITORING WELL LOCATION (INSTALLED FOR INVESTIGATION OF THE HWD SITE)

EXISTING GROUNDWATER MONITORING WELL LOCATION (INSTALLED FOR INVESTIGATION OF OTHER SITES)

NOTES:

1. ALL CONCENTRATIONS ARE REPORTED IN MICROGRAMS PER LITER (ug/L) EQUIVALENT TO PARTS PER BILLION (ppb).
2. G = GUIDANCE VALUE
3. * = CRITERIA VALUE LISTED FOR 1,2-DICHLOROETHENE (Total) APPLIES TO THE Cis AND Trans- ISOMERS INDIVIDUALLY.
4. D = VALUE LISTED APPLIES TO EACH ISOMER INDIVIDUALLY.
5. A = VALUE LISTED APPLIES TO THE SUM OF THESE SUBSTANCES.
6. J = THE RESULT IS LESS THAN THE QUANTITATION LIMIT BUT GREATER THAN ZERO. CONCENTRATION GIVEN IS AN APPROXIMATE VALUE.
7. BD = CONTAMINANT ALSO DETECTED IN METHOD BLANK. DILUTED SAMPLE ANALYSIS.
8. ND = NOT DETECTED.
9. NA = NOT ANALYZED.
10. CRITERIA REFERENCE: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) DIVISION OF WATER TECHNICAL AND OPERATIONAL GUIDANCE SERIES (1.1.1), DOCUMENT TITLED AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES AND GROUNDWATER EFFLUENT LIMITATIONS, DATED JUNE 1998, UPDATED APRIL 2000.

SOURCE:

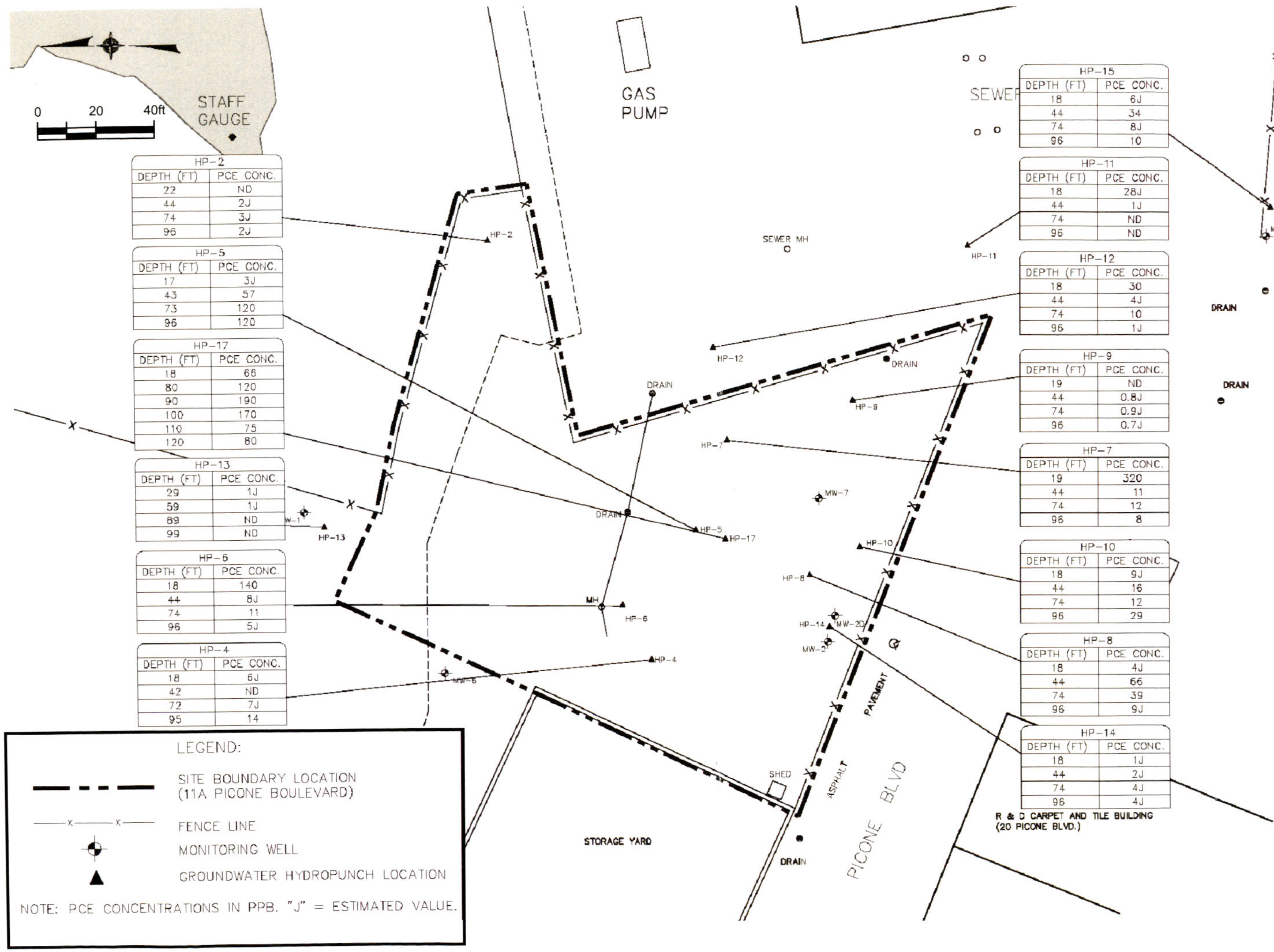
ALL BASE MAP INFORMATION UNLESS OTHERWISE NOTED WAS TAKEN FROM A MAP ENTITLED "MONITORING WELL AND SOIL BORING LOCATION PLAN, HWD SITE-PICONE BOULEVARD, FARMINGDALE NEW YORK, PROJECT No. 604.05 #2". PREPARED BY ALBERT W. TAY. FILE No. 99390-3.DWG. SURVEYED 11/22/99 THROUGH 11/29/99. SURVEY REVISED 2/9/2000 AND 5/13/2003.

figure 2.3

MONITORING WELLS & VOC RESULTS
RD/RA WORK PLAN
Farmingdale, New York

CRA

50138-00(002)GN-WA004 OCT 31/2007



HP-2

DEPTH (FT)	PCE CONC.
22	ND
44	2J
74	3J
96	2J

HP-5

DEPTH (FT)	PCE CONC.
17	3J
43	57
73	120
96	120

HP-17

DEPTH (FT)	PCE CONC.
18	66
80	120
90	190
100	170
110	75
120	80

HP-13

DEPTH (FT)	PCE CONC.
29	1J
59	1J
89	ND
99	ND

HP-6

DEPTH (FT)	PCE CONC.
18	140
44	8J
74	11
96	5J

HP-4

DEPTH (FT)	PCE CONC.
18	6J
42	ND
72	7J
95	14

HP-15

DEPTH (FT)	PCE CONC.
18	6J
44	34
74	8J
96	10

HP-11

DEPTH (FT)	PCE CONC.
18	28J
44	1J
74	ND
96	ND

HP-12

DEPTH (FT)	PCE CONC.
18	30
44	4J
74	10
96	1J

HP-9

DEPTH (FT)	PCE CONC.
19	ND
44	0.8J
74	0.9J
96	0.7J

HP-7

DEPTH (FT)	PCE CONC.
19	320
44	11
74	12
96	8

HP-10

DEPTH (FT)	PCE CONC.
18	9J
44	16
74	12
96	29

HP-8

DEPTH (FT)	PCE CONC.
18	4J
44	66
74	39
96	9J

HP-14

DEPTH (FT)	PCE CONC.
18	1J
44	2J
74	4J
96	4J

figure 2.4

GROUNDWATER HYDROPUNCH RESULTS
RD/RA WORK PLAN
Farmingdale, New York

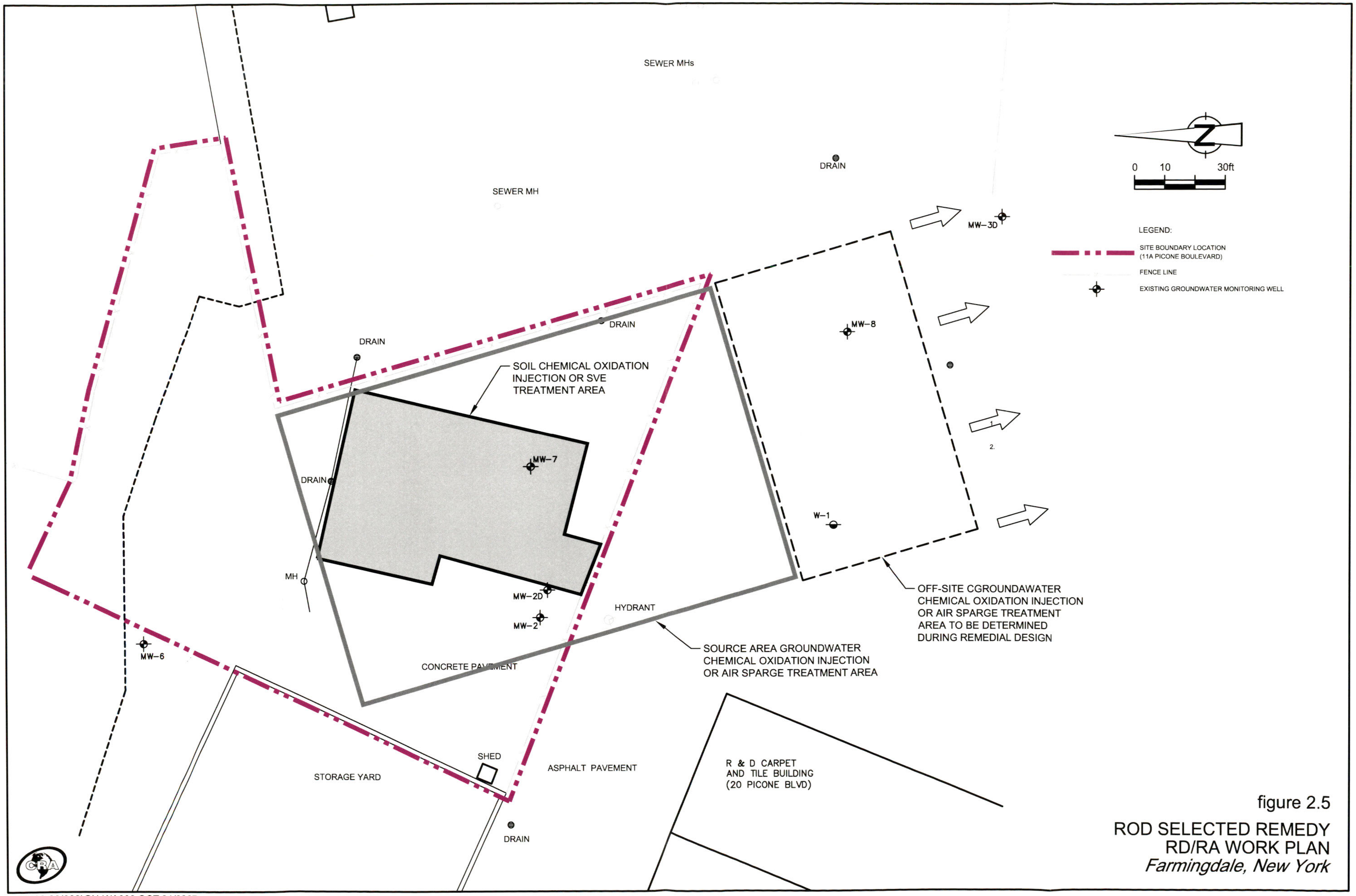
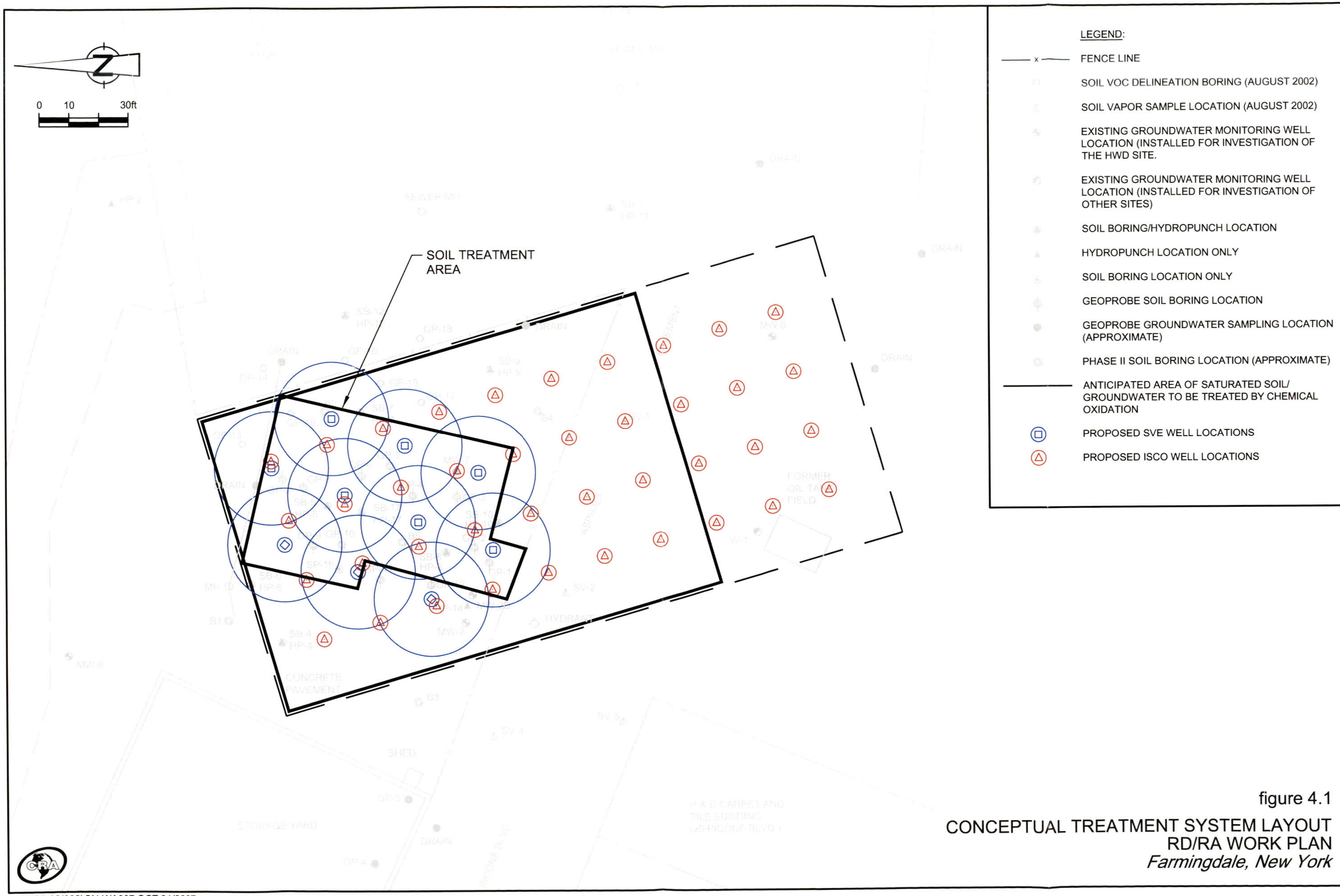


figure 2.5

ROD SELECTED REMEDY
RD/RA WORK PLAN
Farmingdale, New York

50138-00(002)GN-WA006 OCT 31/2007



50138-00(002)GN-WA007 OCT 31/2007

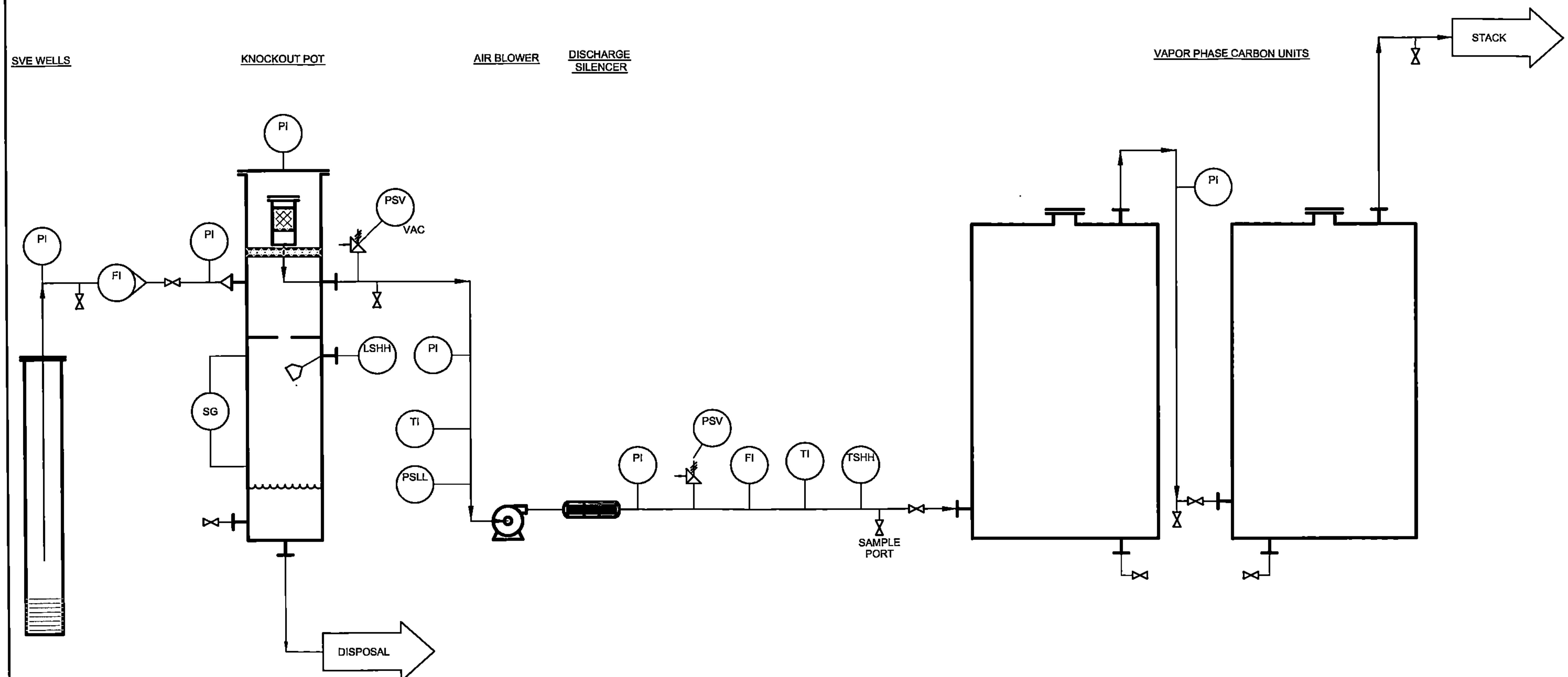


figure 4.2

CONCEPTUAL PROCESS SCHEMATIC - SOIL VAPOR EXTRACTION
RD/RA WORK PLAN
Farmingdale, New York

50138-00(002)GN-WA008 OCT 31/2007

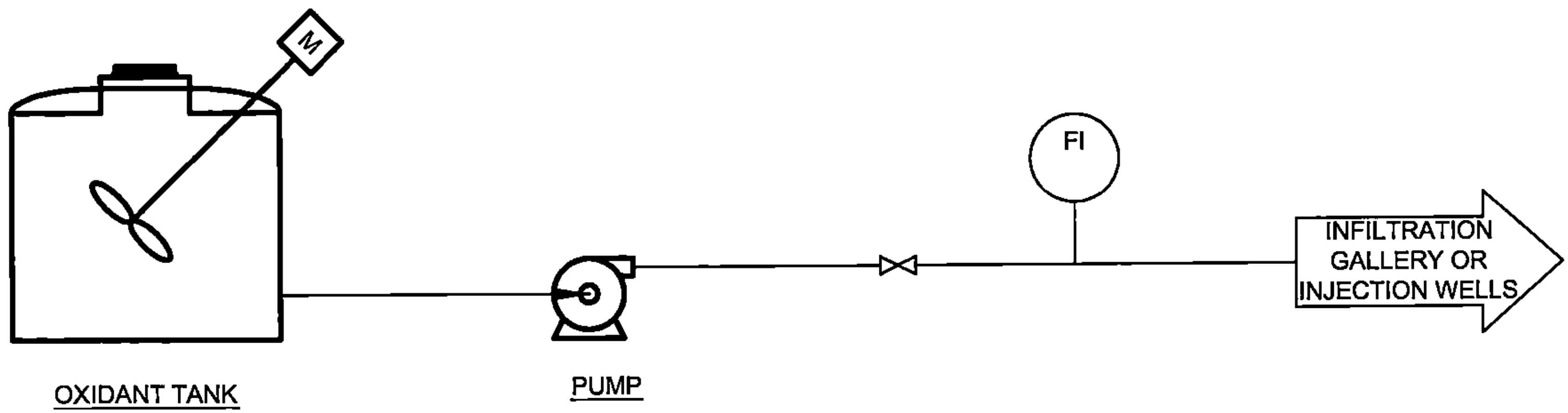


figure 4.3

CONCEPTUAL PROCESS SCHEMATIC - IN-SITU CHEMICAL OXIDATION
RD/RA WORK PLAN
Farmingdale, New York

50138-00(002)GN-WA008 OCT 19/2007

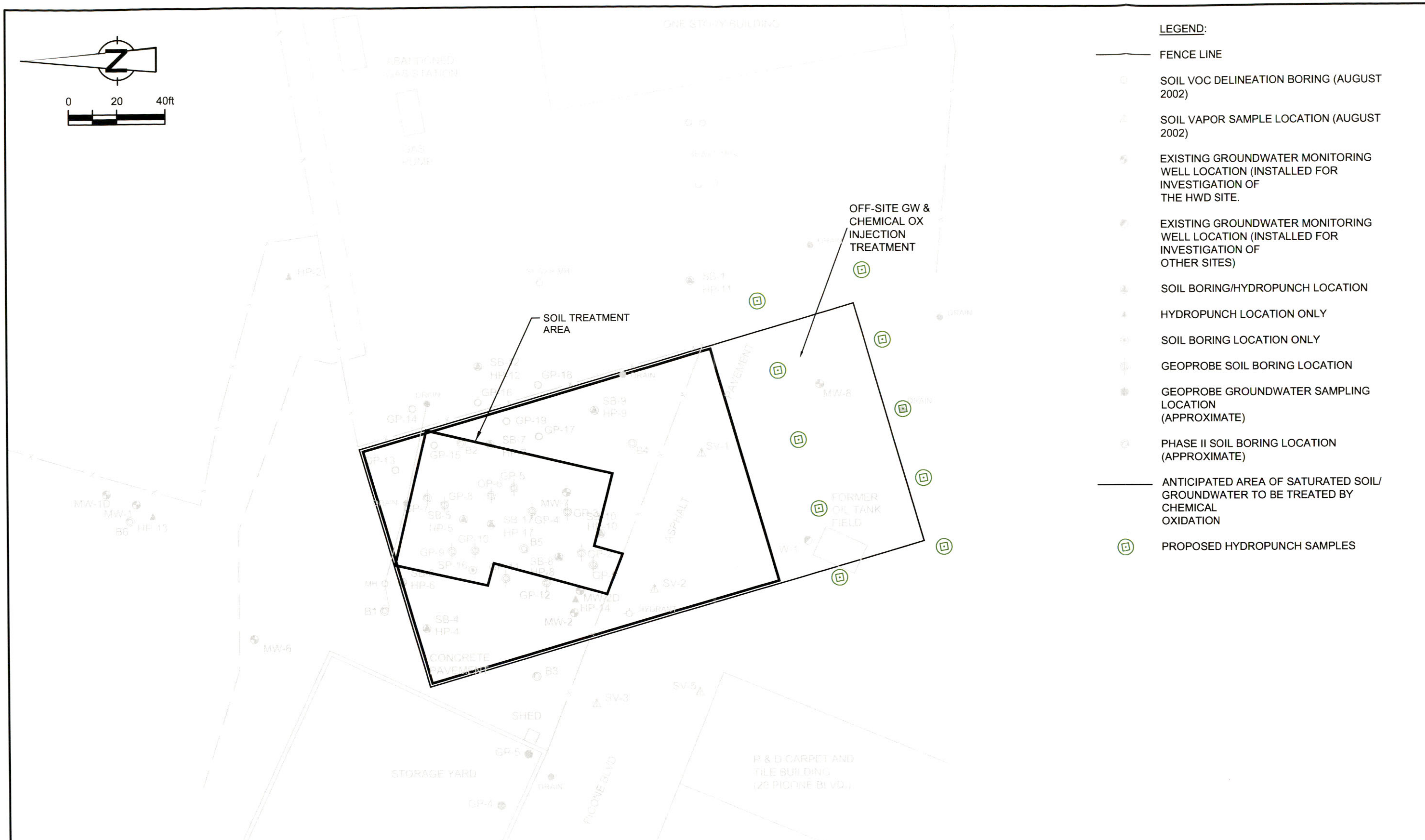


figure 5.1

PREDESIGN HYDROPUNCH GROUNDWATER SAMPLING LOCATIONS
RD/RA WORK PLAN
Farmingdale, New York

50138-00(002)GN-WA009 OCT 31/2007

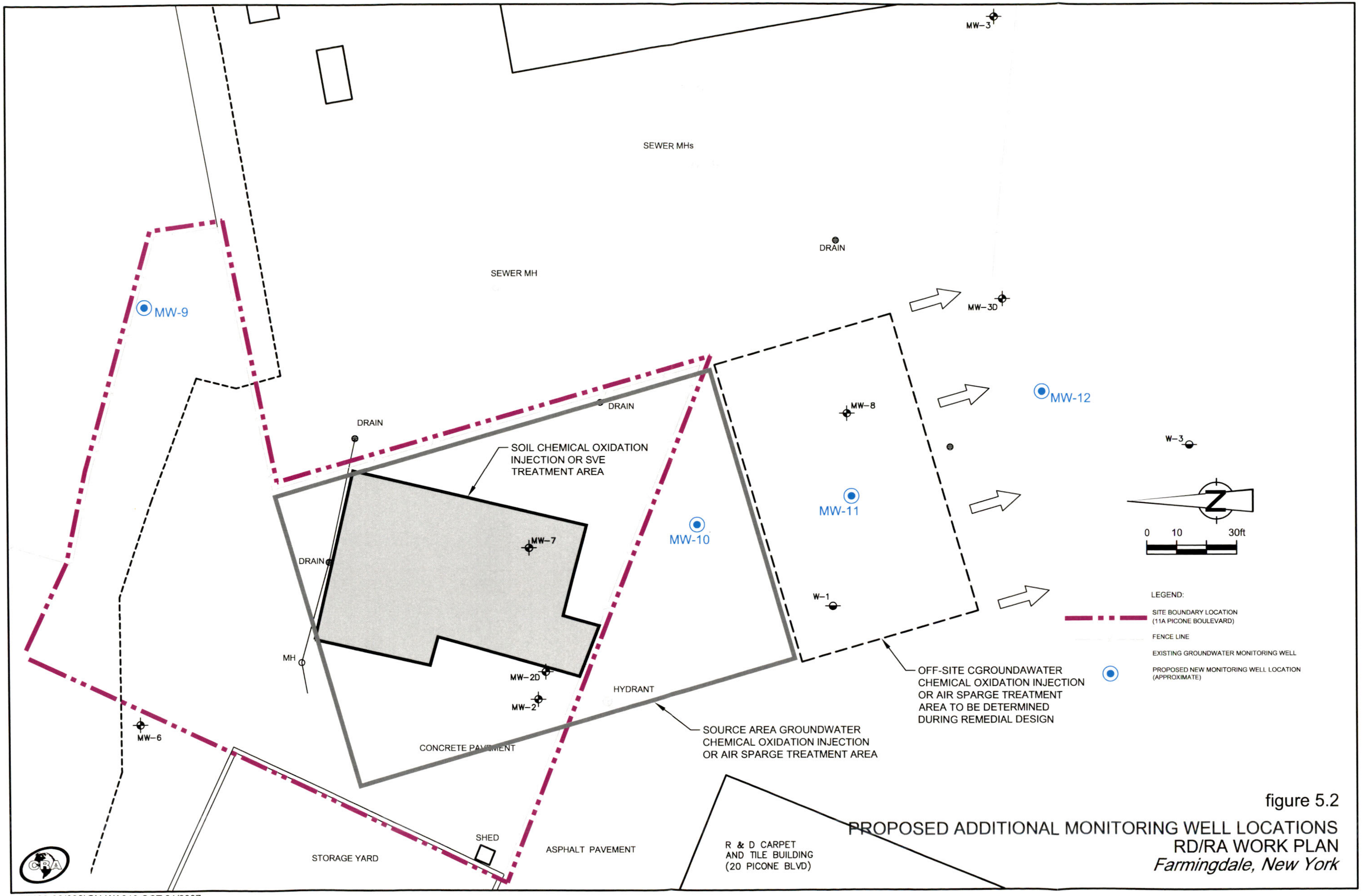
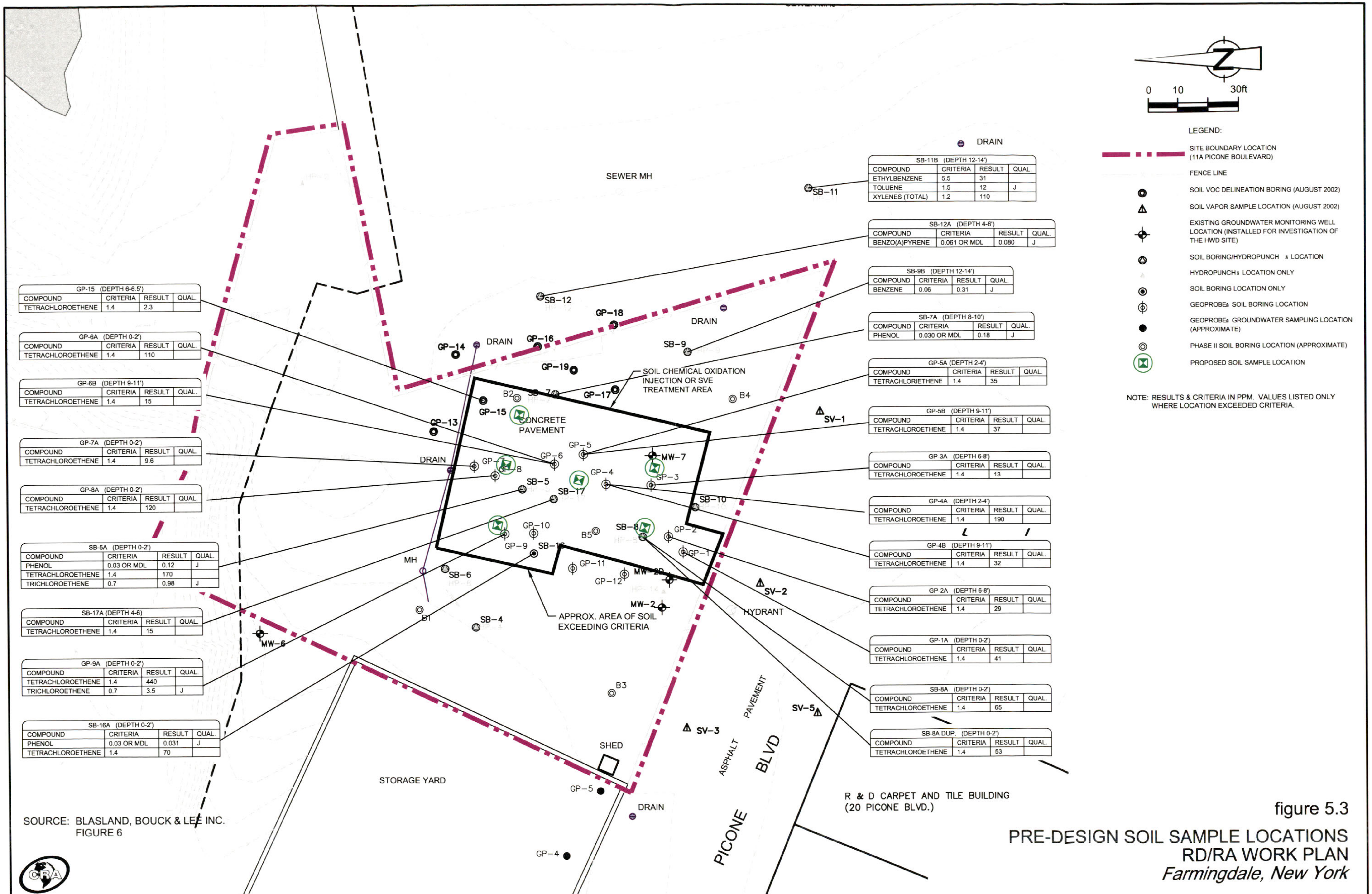


figure 5.2

PROPOSED ADDITIONAL MONITORING WELL LOCATIONS
RD/RA WORK PLAN
Farmingdale, New York

50138-00(002)GN-WA010 OCT 31/2007



GP-15 (DEPTH 6-6.5')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	2.3	

GP-6A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	110	

GP-6B (DEPTH 9-11')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	15	

GP-7A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	9.6	

GP-8A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	120	

SB-5A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
PHENOL	0.03 OR MDL	0.12	J
TETRACHLOROETHENE	1.4	170	
TRICHLOROETHENE	0.7	0.98	J

SB-17A (DEPTH 4-6)			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	15	

GP-9A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	440	
TRICHLOROETHENE	0.7	3.5	J

SB-16A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
PHENOL	0.03 OR MDL	0.031	J
TETRACHLOROETHENE	1.4	70	

SB-11B (DEPTH 12-14')			
COMPOUND	CRITERIA	RESULT	QUAL.
ETHYLBENZENE	5.5	31	
TOLUENE	1.5	12	J
XYLENES (TOTAL)	1.2	110	

SB-12A (DEPTH 4-6')			
COMPOUND	CRITERIA	RESULT	QUAL.
BENZO(A)PYRENE	0.061 OR MDL	0.080	J

SB-9B (DEPTH 12-14')			
COMPOUND	CRITERIA	RESULT	QUAL.
BENZENE	0.06	0.31	J

SB-7A (DEPTH 8-10')			
COMPOUND	CRITERIA	RESULT	QUAL.
PHENOL	0.030 OR MDL	0.18	J

GP-5A (DEPTH 2-4')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLORIETHENE	1.4	35	

GP-5B (DEPTH 9-11')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	37	

GP-3A (DEPTH 6-8')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	13	

GP-4A (DEPTH 2-4')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	190	

GP-4B (DEPTH 9-11')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	32	

GP-2A (DEPTH 6-8')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	29	

GP-1A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	41	

SB-8A (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	65	

SB-8A DUP. (DEPTH 0-2')			
COMPOUND	CRITERIA	RESULT	QUAL.
TETRACHLOROETHENE	1.4	53	

figure 5.3

PRE-DESIGN SOIL SAMPLE LOCATIONS
RD/RA WORK PLAN
Farmingdale, New York

50138-00(002)GN-WA011 NOV 07/2007

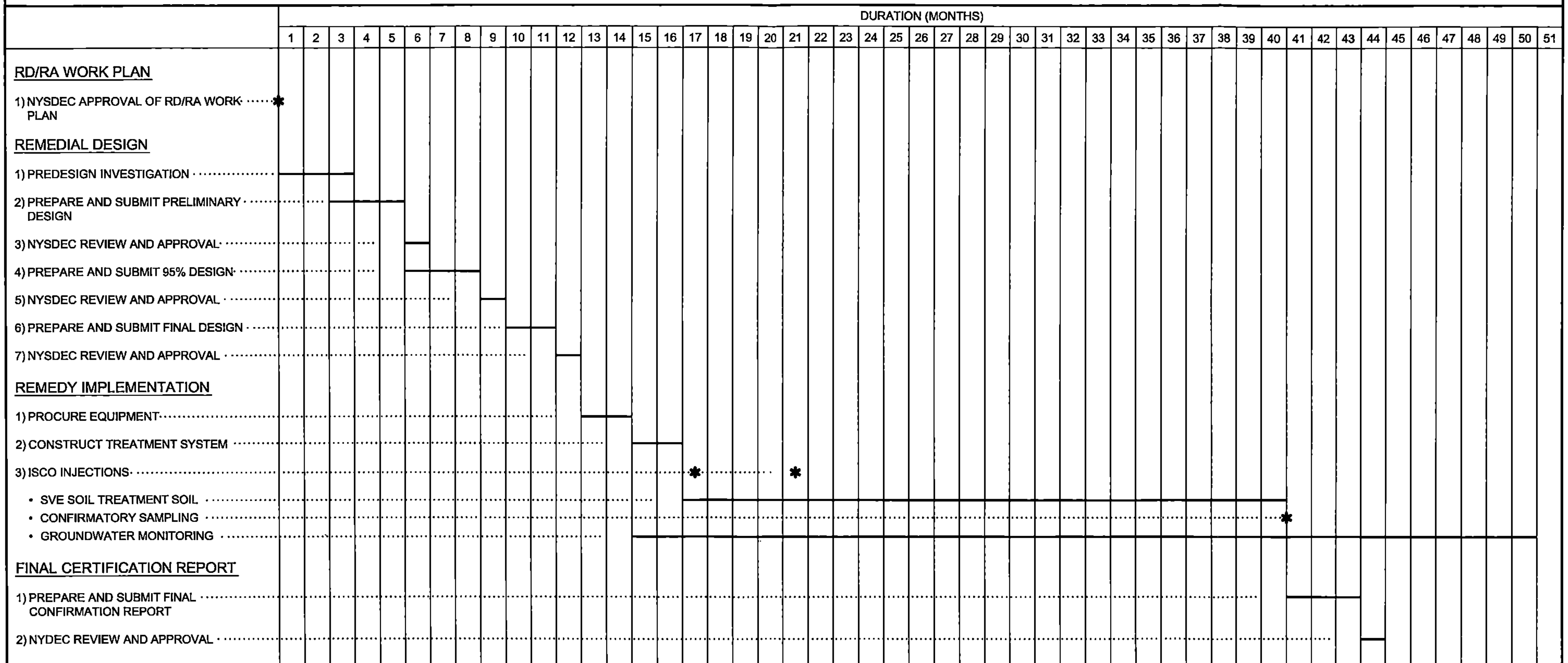


figure 9.1

PROJECT SCHEDULE
RD/RA WORK PLAN
Farmingdale, New york

50138-00(002)GN-WA014 OCT 30/2007

APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

FOR REMEDIAL DESIGN/REMEDIAL ACTION ACTIVITIES
HWD SITE
FARMINGDALE, NEW YORK

Prepared For:
HWD Group

NOVEMBER 2007
REF. NO. 050138 (2)
This report is printed on recycled paper.

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1.0 INTRODUCTION

This HASP has been prepared to support the Remedial Design/Remedial Action (RD/RA) project activities associated with the ROD Remedy Implementation at the HWD Site (Site) located in Farmingdale, New York. The Site is located at 11A Picone Boulevard as shown on Figure 1.1 in the RD/RA Work Plan (Work Plan). Figure 2.1 in the RD/RA Work Plan presents the layout of the Site. The Health and Safety Plan (HASP) presented herein describes the health and safety procedures and emergency response guidelines to be implemented during the project activities.

Conestoga-Rovers & Associates (CRA) believes that safety is paramount in all project activities and will take every precaution necessary to protect project personnel. CRA also believes that safety is a shared responsibility and that project personnel also have ownership in making sure that they avoid being injured or involved in an accident. Safety Awareness is key in helping to prevent accidents and injuries in the workplace.

1.1 PURPOSE

The purpose of this HASP is to provide specific guidelines and establish procedures for the protection of project personnel performing activities as described in Section 2.0 Project Operations. The information in this HASP has been developed in accordance with applicable standards and is, to the extent possible, based on information available to date. This HASP is intended to be a living document in that it must continually evolve as conditions at the Site change and/or additional or new knowledge is learned. Continual updating of the HASP will help to promote a safe working environment.

A vital element of the CRA's Health and Safety Program is the implementation of a Project-specific HASP for this project. This HASP requires the following measures to be implemented:

i) the communication of the contents of this HASP to all project personnel;

ii) the elimination of unsafe conditions. Efforts must be initiated to identify conditions that can contribute to an accident and to remove exposure to these conditions;

iii) the reduction of unsafe acts. Project personnel shall make a conscious effort to work safely. A high degree of safety awareness must be maintained so that safety factors involved in a task become an integral part of the task; and

iv) ensure that frequent inspections are made. Regular safety inspections of the work areas, materials, and equipment by qualified persons ensures early detection of unsafe conditions. Safety and health deficiencies shall be corrected as soon as possible, or project activities shall be suspended.

The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the removal of project personnel from that area and reevaluation of the hazard and the levels of protection.

1.2 PERSONNEL REQUIREMENTS

All project personnel conducting activities at the Site for which a reasonable potential exposure exists must be in compliance with all applicable Occupational Safety and Health Administration (OSHA) regulations, to include but not limited to 29 CFR 1910, 29 CFR 1926 and CRA polices and procedures. Project personnel must also be familiar with the procedures and requirements of this HASP. In the event of conflicting safety procedures/requirements, personnel must implement those safety practices, which afford the highest level of safety and protection.

1.3 PROJECT MANAGEMENT AND SAFETY ORGANIZATION

Project Manager CRA - (Jamie Puskas)

The Project Manager will provide support to the project with respect to all operations on this project and shall be responsible for the overall implementation of the HASP, and for ensuring that all health and safety responsibilities are carried out in conjunction with this project. This shall include, but is not limited to, review and approval of the HASP and consultation with the Site owner regarding appropriate changes to the HASP.

Site Supervisor (SS)/Site Safety Officer (SSO) - (To Be Determined)

The SS/SSO is the person who, under the supervision of the Project Manager, shall be responsible for the communication of the Site requirements to project personnel and any subcontractors. The SS/SSO is responsible for carrying out the health and safety responsibilities by making sure that:

i) all necessary cleanup and maintenance of safety equipment is conducted by project personnel;

ii) emergency services are contacted, if necessary;

iii) forms attached to the HASP are completed, filed, and submitted correctly; and

iv) a pre-entry briefing is conducted which will serve to familiarize Site personnel with the procedures, requirements, and provisions of this HASP.

The SS/SSO also has the responsibility of enforcing safe work practices for project personnel. The SS/SSO also will oversee the safety of any visitor(s) who enter the Site. The SS/SSO maintains communication with the owner of the Site as appropriate.

Other specific duties of the SS/SSO include:

i) orders the immediate shutdown of project activities in the case of a medical emergency, unsafe condition, or unsafe practice;

ii) designates work areas and define minimum PPE requirements;

iii) provides the safety equipment, PPE, and other items necessary for project personnel;

iv) enforces the use of required safety equipment, PPE, and other items necessary for project personnel or community safety;

v) conducts Site inspections as a part of quality assurance for safety and health;

vi) reports safety and health concerns to upper management as necessary;

vii) conducts the personnel safety indoctrination session which includes a discussion on the potential hazards, personal hygiene principles, safety equipment usage, the project-specific Hazard Communication Program and emergency procedures; and

viii) ensures that all project personnel have obtained the required medical examination prior to arrival at the Site, have met the OSHA training requirements and have been fit-tested for the respiratory equipment that they may potentially use.

Emergency Coordinator (EC)

The SS/SSO and/or his designee will act as the EC. The EC shall be able to implement the emergency procedures and is responsible for the following in the event of an emergency (See Section 10.0 – Emergency Response for additional details and information):

i) the EC, or his/her designee, shall immediately respond to all imminent or actual emergency situations. The EC shall notify all project personnel and emergency response agencies, identify the problem, assess the health and/or environmental hazards, and take all reasonable measures to stabilize the situation;

ii) the EC shall take all reasonable measures necessary to ensure that fire, explosion, emission or discharge does not occur, reoccur, or spread. These measures may include stopping operations, collecting and containing released materials, and/or removing or isolating containers; and

iii) the EC shall also be responsible for follow-up activities after an incident such as cleanup of the affected area, maintenance and decontamination of the emergency equipment, and submission of any reports.

Project Personnel Safety Responsibility

CRA project personnel are responsible for their own safety as well as the safety of those around them. Project personnel shall use any equipment provided in a safe and responsible manner, as directed by their supervisor. Project personnel shall follow the policies set forth in the HASP.

Project personnel are directed to take the following actions when appropriate:

i) suspend any operations which may cause an imminent health hazard to employees, subcontractors, or others;

ii) correct project hazards when possible to do so, without endangering life or health;

iii) report safety and health concerns to the Project Manager; and

iv) implement the "Buddy System" whenever possible. The "Buddy System" implies that there will be at least two individuals working at the Site whenever work is taking place in an Exclusion Zone as defined in Section 5.1.

Subcontractors

Subcontractors to CRA will also be responsible for adhering to their own HASP as written for this project. Subcontractors will be required to attend an initial briefing on the requirements of their own and this HASP, overall project safety procedures and attend subsequent safety meetings.

Authorized Visitors

Authorized visitors shall be provided with all known information with respect to Site activities and hazards as applicable to the purpose of their visit.

2.0 SITE BACKGROUND

2.1 SITE CHARACTERIZATION AND POTENTIALLY HAZARDOUS COMPOUNDS

Section 2.0 of the Work Plan presents a detailed description of the Site and provides background information on the Site including a characterization of the Site.

Previous investigations at the Site detected the presence of chemical constituents, primarily volatile organic compounds (VOCs). Table A.2.1 presents the maximum detected concentration of chemical compounds of concern in Site soils and groundwater. The exposure routes and regulatory time weighted averages (TWA) exposure levels for the compounds of concern (COC) are listed in Table A.2.2. These levels are set to protect the health of project personnel.

2.2 SCOPE OF WORK

The HASP covers the specific Site activities to be conducted by CRA and/or subcontractor(s) at the project Site including:

i) mobilization and demobilization of labor, equipment, materials, and supplies to and from the Site;

ii) Geoprobe™ and/or drilling activities;

iii) soil sampling activities;

iv) groundwater sampling activities;

v) inspection activities for the building slab depressurization system;

vi) potential construction and operation and maintenance activities for a soil vapor extraction (SVE) and/or air-sparging system;

vii) potential in situ oxidation activities (e.g., injection of potassium permanganate); and

viii) decontamination activities.

During these activities personnel may come in contact with impacted groundwater and/or soil. If Site operations are altered or if additional tasks are assigned, this HASP will be revised to address the change in activities.

3.0 TRAINING AND MEDICAL SURVEILLANCE REQUIREMENTS

All personnel conducting work at this Site with a reasonable potential for exposure to Site chemicals will have completed the appropriate health and safety training as applicable to their job tasks/duties. The required training is referenced throughout the HASP and identified within the activity hazard analysis forms presented in Attachment A-1.

At a minimum, these personnel will have completed 40 hours of OSHA training and be current with their 8-hour refreshers in accordance with 29 CFR 1926.65(e).

3.1 SITE-SPECIFIC TRAINING

An initial Site-specific training session or briefing will be conducted by the SS/SSO prior to commencement of work activities. During this initial training session, project personnel will be instructed on the following topics:

i) personnel responsibilities;

ii) Site-specific Hazard Communication Program, which includes review of Material Safety Data Sheets (MSDSs) for chemicals associated with project activities;

iii) content and implementation of the HASP;

iv) Site hazards and control measurers;

v) Site-specific hazardous procedures;

vi) training requirements;

vii) personnel protective equipment requirements;

viii) emergency information, including local emergency response team phone numbers, route to nearest hospital, accident reporting procedures, and emergency response procedures;

ix) instruction for required inspections and the completion of forms; and

x) location of safety equipment (e.g., portable eyewash, first aid kit, fire extinguishers, etc.)

At the conclusion of this training/briefing, CRA project personnel and subcontractor personnel will be required to sign an acknowledgement form located in Attachment A-2 identifying that they attended the briefing and will follow all of the Site safety procedures.

Supplemental daily safety meetings will be conducted by the SS/SSO to discuss potential health and safety hazards associated with the work to be completed on each day, new tasks that will be initiated, and necessary precautions to be taken. These meetings will be documented on the Safety Meeting Form located in Attachment A-2.

4.0 MEDICAL SURVEILLANCE

In accordance with the requirements detailed in 29 CFR 1926.65, and 29 CFR 1910.134, all Site personnel who will come in contact with materials with potentially elevated chemical presence will have received, within 1 year prior to starting field activities, medical surveillance by a licensed physician or physician's group.

Medical records for all project personnel will be maintained by their respective employers. The medical records will detail the tests that were taken and will include a copy of the consulting physician's statement regarding the tests and the employee's suitability for work. The medical records will be available to the employee or his/her designated representative upon written request, as outlined in 29 CFR 1910.1020.

Each employer will provide certifications to the SS/SSO that its personnel involved in Site activities will have all necessary medical examinations and will have obtained medical certification prior to commencing work, which requires respiratory protection or potential exposure to hazardous materials. Personnel not obtaining medical certification will not perform work within the Contaminant Reduction Zone (CRZ) as defined in Section 5.2 and Exclusion Zone (EZ).

Interim medical surveillance will be completed in accordance with 29 CFR 1926.62 or if an individual exhibits poor health or high stress responses due to any Site activity or when accidental exposure to elevated concentrations of chemicals occur.

5.0 SITE CONTROL

5.1 EXCLUSION ZONE (EZ)

The EZ consists of the specific work area of suspected chemical impact. All project personnel entering the EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. The location of each EZ will be identified by cones, caution tape, or other appropriate means.

5.2 CONTAMINATION REDUCTION ZONE (CRZ)

The CRZ or transition area will be established to perform decontamination of project personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated at this location as a temporary wash pad will be constructed in this area. The initial decontamination of all personnel will be performed on Site adjacent to the EZ in a temporary CRZ. Personal protective outer garments and respiratory protection will be removed in the temporary CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the support zone (SZ).

5.3 SUPPORT ZONE (SZ)

The SZ is a clean area outside of the CRZ located to prevent personnel exposure to hazardous substances. Eating and drinking will be permitted in the support area only after proper decontamination of personnel has occurred. Smoking will not be permitted on Site. The SZ also provides an area for the storage of equipment and supplies.

6.0 HAZARD EVALUATION

This section identifies and evaluates the potential chemical, physical, and biological hazards, which may be encountered during the completion of this project. Activity Hazard Analysis Forms have been developed to address the hazards associated with the Site operations and are provided in Attachment A-1.

6.1 CHEMICAL EXPOSURE

Preventing exposure to chemicals is a primary concern. Chemical substances can enter the unprotected body by inhalation, skin absorption, ingestion, or through a puncture wound (injection). A chemical can cause damage at the point of contact or can act systematically, causing an adverse effect in a part of the body distant from the point of initial contact. The chemicals of concern at the Site are identified in Table A.2.1.

Chemical exposures are generally divided into two categories: acute and chronic. Symptoms resulting from acute exposures usually occur during or shortly after exposure to a sufficiently high concentration of a chemical. The concentration required to produce such effects varies widely from chemical to chemical. The term "chronic exposure" generally refers to exposures to "low" concentrations of a chemical over a long period of time. The "low" concentrations required to produce symptoms of chronic exposure depend upon the chemical, the duration of each exposure, and the number of exposures. For a given chemical, the symptoms of an acute exposure may be completely different from those resulting from chronic exposure.

For either chronic or acute exposure, the effect may be temporary and reversible, or may be permanent (disability or death). Some chemicals may cause obvious symptoms such as burning, coughing, nausea, tearing eyes, or rashes. Other chemicals may cause health damage without any such warning signs (this is a particular concern for chronic exposures to low concentrations). Health effects may not become evident for several years or decades after exposure. In addition, some chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Thus, a worker's senses or feelings cannot be relied upon in all cases to warn of potential toxic exposure.

The effects of exposure not only depend on the chemical, its concentration, route of entry, and duration of exposure, but may also be influenced by personal factors such as the individual's smoking habits, alcohol consumption, medication use, nutrition, age, and sex.

A potential exposure route of concern at the Site is inhalation. The lungs are vulnerable to chemical agents. Even substances that do not directly affect the lungs may pass through lung tissue into the bloodstream, where they are transported to other vulnerable areas of the body. Some chemicals present in the atmosphere may not be detected by human senses (i.e., they may be colorless, odorless, and their toxic effects may not produce any immediate symptoms). Respiratory protection is therefore important if there is a possibility that the work Site atmosphere may contain such hazardous substances. Chemicals can also enter the respiratory tract through punctured eardrums. Where this is a hazard, individuals with punctured eardrums should be medically evaluated specifically to determine if such a condition would place them at an unacceptable risk and preclude their working at the task in question.

Direct contact of the skin and eyes by hazardous substances is another potential route of exposure. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. Abrasions, cuts, heat, and moisture enhance skin absorption. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.

Although ingestion should be the least significant route of exposure at the Site, it is important to be aware of how this type of exposure can occur. Deliberate ingestion of chemicals is unlikely; however, personal habits such as chewing gum or tobacco, drinking, eating, smoking cigarettes, and applying cosmetics at the Site may provide a route of entry for chemicals.

The last potential route of chemical exposure is injection, whereby chemicals are introduced into the body through puncture wounds (i.e., by stepping or tripping and falling onto contaminated sharp objects). Wearing safety shoes, avoiding physical hazards, and taking common sense precautions are important protective measures against injection.

6.1.1 CHEMICAL HAZARD CONTROLS

CRA and subcontractor personnel will control the exposure or contact with the on-Site chemicals by:

i) administrative and engineering controls, and where feasible, remote work methods, and personal hygiene procedures;

ii) adhering to established air monitoring action levels;

iii) skin contact with chemicals will be controlled by use of the PPE and good housekeeping procedures. The proper PPE (i.e., Tyvek® suit and gloves) as described in Section 7.0 shall be worn for all activities where contact with potentially harmful media or materials is anticipated;

iv) using respiratory protection as appropriate, in areas known to have concentrations above the specified action level for each chemical; and

v) although ingestion should be the least significant route of exposure at the Site, it is important to be aware of how this type of exposure can occur. Deliberate ingestion of chemicals is unlikely; however, personal habits such as chewing gum or tobacco, drinking, eating, smoking cigarettes, and applying cosmetics at the Site may provide a route of entry for chemicals.

6.1.2 HAZARD COMMUNICATION

Personnel required to handle or use hazardous materials as part of their job duties will be trained and educated in accordance with the Hazard Communication standard. The training shall include instruction on the safe usage, and handling procedures of hazardous materials, how to read and access MSDSs, and the proper labeling requirements.

The MSDSs for chemicals in use at the Site will be available to project personnel and will be maintained on Site by the SS/SSO.

6.2 PHYSICAL HAZARDS

Physical hazards that may be present during project activities include noise, slip/trip/hit/fall injuries, heat stress/cold stress, use of material handling devices and heavy lifting, hazardous energy, fall hazards, working around heavy and drilling equipment, compressed gas cylinders, overhead and underground utilities and potential adverse weather conditions. Personnel will also be working around operating equipment. In addition, personnel must be aware that the protective equipment worn can limit dexterity and visibility increasing the difficulty of performing some tasks.

6.2.1 HEAVY EQUIPMENT AND DRILLING SAFETY

Heavy Equipment

The following practices shall be adhered to by project personnel operating and working in the vicinity of heavy equipment (such as backhoes) and drilling equipment:

- Heavy equipment is to be inspected when equipment is initially mobilized/ delivered to the Site and after it has been repaired and returned to service to ensure that it meets all manufacturer and OSHA specifications (e.g., fire extinguishers, backup alarms, etc.).
- Heavy equipment is to be inspected on a daily basis. Documentation of this daily pre-operational inspection is to be filed in the project files.
- Heavy equipment is only to be operated by authorized, competent operators.
- Seat belts are to be provided on heavy equipment that is not designed for stand-up operation.
- Equipment/vehicles whose payload is loaded by a crane, excavator, loader, etc. will have a cab shield and/or canopy to protect the operator.
- Project personnel will not be raised/lowered in buckets.
- Project personnel will not ride on fender steps or any place outside the cab.
- Before leaving the equipment controls, ensure that the equipment is in its safe resting position. For a backhoe, apply the parking brake, put the front loader bucket down on the ground level, and ensure that the rear excavator bucket is locked in the travel position. Bulldozers and scraper blades, loader buckets, dump bodies, and similar equipment will be fully lowered or blocked when not in use.
- Before raising any booms, buckets, etc., check for overhead obstructions.
- Project personnel involved in the operation shall not wear any loose-fitting clothing, which has the potential to be caught in moving machinery.
- Project personnel shall wear high visibility safety vests, steel-toed shoes, safety glasses, hearing protection, and hard hats during heavy equipment operations.
- When moving heavy equipment or when working in tight quarters, a spotter should be used.

Drilling Equipment

The following practices shall be adhered to by drilling personnel:

- Equipment should be inspected daily by the operator to ensure that there are no operational problems.
- Before leaving the controls, shift the transmission controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.
- Before raising the mast, check for overhead obstructions.
- Before the mast of a drill rig is raised, the drill rig must first be leveled and stabilized with leveling jacks and/or cribbing. Re-level the drill rig if it settles after initial setup. Lower the mast only when the leveling jacks are down, and do not raise the leveling jack pads until the mast is lowered completely.
- Project personnel involved in the operation shall not wear any loose-fitting clothing, which has the potential to be caught in moving machinery.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Project personnel shall wear steel-toed shoes, safety glasses, hearing protection, and hard hats during drilling operations.
- The area shall be roped off, marked, or posted to keep the area clear of pedestrian traffic or spectators.
- Project personnel should be instructed in the location and use of the emergency kill switch on the drill rig.

6.2.2 MATERIAL HANDLING

Material handling operations to be conducted at the Site include manual lifting of materials to and from trucks and storage areas.

General Storage Practices

The storage of materials and supplies must not create a hazard. General storage area practices include:

i) bags, containers, bundles, etc. stored in tiers will be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse;

ii) all stacked materials, cargo, etc. will be examined for sharp edges, protrusions, signs of damage, or other factors likely to cause injury to persons handling these objects. Defects should be corrected as they are detected;

iii) storage areas will not accumulate materials that constitute hazards from tripping, fire, explosion, or pest harborage;

iv) storage areas will have provisions to minimize manual lifting and carrying. Aisles and passageways will provide for the movement of mechanical lifting and conveyance devices;

v) stored materials will not block or obstruct access to emergency exits, fire extinguishers, alarm boxes, first aid equipment, lights, electrical control panels, or other control boxes;

vi) "NO SMOKING" signs will be conspicuously posted, as needed, in areas where combustible or flammable materials are stored and handled; and

vii) cylindrical materials such as pipes and poles will be stored in racks, or stacked on the ground and blocked.

Special Precautions for Hazardous or Incompatible Materials Storage

Generally, materials are considered hazardous if they are ignitable, corrosive, reactive, or toxic. Manufacturers and suppliers of these materials must provide the recipient with MSDSs, which describe their hazardous characteristics, and give instructions for their safe handling and storage.

Many hazardous materials are incompatible, which means they form mixtures that may have hazardous characteristics not described on the individual MSDSs. The following special precautions shall be followed regarding the storage of hazardous materials:

i) based on the information available on the MSDSs, incompatible materials shall be kept in separate storage areas; and

ii) warning signs shall be conspicuously posted, as needed, in areas where hazardous materials are stored.

Hoisting and Rigging

Wire ropes, chains, ropes, and other rigging equipment will be inspected prior to each use and as necessary during use to assure their safety. Defective rigging equipment will be immediately removed from service.

Rigging will not be used unless the weight of the load falls within the rigging's safe work operating range. This must be verified by the authorized rigger prior to any "pick" or lifting operation.

Only personnel trained in safe rigging procedures will be authorized to engage in rigging procedures. Additionally, the rigger must understand and use recognized crane signals.

Job or shop hooks and links and other makeshift fasteners **will not** be used. When U-bolts are used for eye splices, the U-bolt will be applied so the "U" section is in contact with the dead end of the rope.

Wire ropes, chains, ropes, and other rigging equipment will be stored where they will remain clean, dry, and protected from the weather and corrosive fumes.

The proper length of rope or chain slings will be used to avoid wide-angle lifts and dangerous slack. Knotted ropes or lengths of ropes reduced by bolts, knots, or other keepers will not be used.

Cranes and Hoists

It should be pointed out that the use of cranes may take place during project activities. There are many hazards associated with using cranes. Potential contact with overhead electrical lines and potential crushing of workers who may wander into the swing path radius of the crane are just two. When cranes are brought on site for use, CRA will ensure that the following safety practices are enforced:

- Crane operators will provide a copy of the crane's annual inspection report to the SHO/SS prior to initiating operations.
- Operators of cranes and hoists will make visual and operational inspections of the equipment prior to use. Any discrepancies that would jeopardize the safe operation of the equipment will be corrected prior to use. These inspections are to be documented via a daily inspection checklist or equivalent.

- The posted capacity of the crane will be adhered to and overloading of the equipment will not be allowed.
- The accessible swing radius of the crane will be demarcated and/or barricaded to prevent employees from entering the area.
- The crane's load and boom will be kept a minimum of 10 feet away from utility lines and 20 feet from power lines. **Any deviation must be approved by the PM in conjunction with the RSHM.**
- Competent person will investigate the soil for stability and determine the necessary amount of "cribbing" to be placed under the outrigger pads or if crane mats are necessary.
- No personnel will be permitted work under a suspended load.
- The operator will only recognize signs and signals from one designated signal person. This signal person will serve as the crane operator's eyes in areas that the crane operator cannot see. This person will be familiar with crane signals, operation of the crane, and safe methods of securing and handling a load.

Heavy Lifting Method

When lifting objects, CRA project personnel will use the following lifting techniques:

i) feet must be parted, with one foot alongside the object being lifted and one foot behind. When the feet are comfortably spread a more stable lift can occur and the rear foot is in a better position for the upward thrust of the lift;

ii) use the squat position and keep the back straight - but remember that straight does not mean vertical. A straight back keeps the spine, back muscles, and organs of the body in correct alignment. It minimizes the compression of the guts that can cause a hernia;

iii) grip is one of the most important elements of correct lifting. The fingers and the hand are extended around the object you are going to lift - using the full palm. Fingers have very little power - use the strength of your entire hand; and

iv) the load must be drawn close, and the arms and elbows must be tucked into the side of the body. Holding the arms away from the body increases the strain on the arms and elbows. Keeping the arms tucked in helps keep the body weight centered.

The body must be positioned so that the weight of the body is centered over the feet. This provides a more powerful line of thrust and also ensures better balance. Start the lift with a thrust of the rear foot. Do not twist.

6.2.3 NOISE EXPOSURE

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on Site.

Project activities that exceed the decibel range (85 dBA or above) will require the use of hearing protection. Such is the case when working around heavy equipment, drill rigs and power tools, which can generate excessive noise levels. Hearing protection (ear plugs/muffs) will be available to project personnel and visitors that would require entry into these areas.

Control: All project personnel must wear hearing protection with a Noise Reduction Rating (NRR) of at least 20 when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All project personnel who are exposed to noise must receive baseline and annual audiograms as well as causes and prevention of hearing loss training

Equipment that does not generate excessive noise levels will be selected for this project whenever possible. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

6.2.4 SLIP/TRIP/HIT/FALL

Slip/trip/hit/fall injuries are the most frequent of all injuries to workers. CRA project personnel will minimize the risk by utilizing the following:

i) spot check the work area to identify hazards;
ii) establish and utilize a pathway which is most free of slip and trip hazards;
iii) beware of trip hazards and uneven surfaces or terrain;
iv) carry only loads which you can see over;
v) keep work areas clean and free of clutter, especially in walkways; and
vi) communicate hazards to project personnel.

6.2.5 UNDERGROUND UTILITIES

Close attention needs to be paid with locating underground utilities and avoiding any penetration of them during construction activities. CRA's Utility Clearance Procedure will be used to identify and locate all underground obstructions. After all utilities have been located, they will be documented on CRA's Utility Clearance Form. Responsible parties will be asked to sign off on this form.

6.2.6 CLEARANCES FOR ENERGIZED OVERHEAD ELECTRICAL LINES

Any vehicle or mechanical equipment capable of having parts of its structure near energized overhead lines shall be operated so that a clearance of 20 feet is maintained. The OSHA Standard requires 10 feet; however, 20 feet is being set to provide a margin for error. If the voltage is higher than 50 kV, the clearance (10 feet) shall be increased 4 inches for every 10 kV over 50 kV.

6.2.7 HOT WORK

Project activities may involve brazing, cutting, and welding on selected equipment. Because of the serious potential for fire and explosion, safe work practices and procedures must be employed. The primary objective is that hot work be done only in a safe designated area. Prior to any hot work being performed, CRA will use a Hot Work Permit, which is found in the company's Safety and Health Policy Manual. Project personnel shall also comply with all hot work procedures that are presented in the Safety and Health Policy Manual.

6.2.8 EXCAVATIONS

All CRA excavation and trenching operations, for which project personnel will enter, will be observed by a designated competent person. The competent person shall be responsible for evaluating and inspecting excavation and trenching operations to prevent possible cave-in and entrapment, and to avoid other hazards presented by excavation activities.

Project personnel in an excavation shall be protected from cave-ins by one of three systems:

- Sloping and benching systems.
- Shoring.
- Shielding systems.

All excavation and trenching operations shall be conducted in accordance to and in compliance with OSHA's Standards for the Construction Industry; specifically, outlined in CRA's SOP for excavation and trenching activities. At a minimum, the following safety guidelines shall be adhered to while conducting excavation and trenching activities:

- Excavation and trenching operations require pre-planning to determine whether sloping or shoring systems are required, and to develop appropriate designs for such systems. Also, the estimated location of all underground installations must be determined before digging/drilling begins. Necessary clearances must be observed.
- If there are any nearby buildings, walls, sidewalks, trees, or roads that may be threatened or undermined by the excavation, where the stability of any of these items may be endangered by the excavation, they must be removed or supported by adequate shoring, bracing, or underpinning.
- Excavations may <u>not</u> go below the base of footings, foundations, or retaining walls unless they are adequately supported or a person who is registered as a Professional Engineer (PE) has determined that they will not be affected by the soil removal. Civil engineers or those with licenses in a related discipline and experience should be consulted in the design and use of slopping and shoring systems. PE qualifications must be documented in writing.

Access and Egress

Project personnel access and egress from trench and/or excavations are as follows:

- A stairway, ladder, ramp, or other means of egress must be provided in trenches greater than 4 feet deep and for every 25 feet of lateral travel.
- All ladders shall extend 3 feet above the top of the excavation.
- Structural ramps used for access or egress of equipment will be designed by a competent person, qualified in structural design or by a licensed professional engineer.

Atmosphere Monitoring and Testing

There are three parameters by which air quality is measured: 1) oxygen concentration, 2) flammability, and 3) the presence of hazardous substances.

Project personnel should not be exposed to atmospheres containing less than 19.5 percent oxygen, or having a lower flammable limit greater than 10 percent. They should also not be exposed to hazardous levels of atmospheric chemicals.

Whenever potentially hazardous atmospheres are suspected in excavations and trenches, the atmosphere shall be tested by a competent person. Detector tubes, gas monitors, and explosion meters are examples of monitoring equipment that may be used for this purpose.

In the event that an unusual odor or liquid is suspected in excavations and trenches, the competent person shall stop work on the site and arrange for air quality assessment and mitigation, if necessary.

Atmospheric testing and monitoring shall be performed in excavations in or adjacent to landfill areas, in areas where hazardous materials are/were stored, or in areas where the presence of hazardous materials is suspected.

Daily Inspections

The competent person shall perform daily inspections of excavations, the adjacent areas, and all protective systems for situations that could potentially result in slope failure.

Additionally, the competent person shall be aware of the potential for confined space situations and other hazardous work conditions.

The competent person shall inspect, evaluate, and complete the excavation checklist at the following intervals:

- Prior to the start of work, after each extended halt in work, and as needed throughout the shift as new sections of an excavation or trench are opened.
- After every rainstorm and other natural or man-made event that may increase the load on the walls of the excavation, or otherwise affect their stability.

The inspections shall be documented using the CRA Excavation Inspection Checklist, which is found in CRA's Safety and Health Policy Manual.

The competent person shall stop the work and instruct all project personnel to leave the excavation or trench when any potential hazards are detected. The competent person has the ***authority*** to immediately suspend work if any unsafe condition is detected.

6.2.9 ELECTRICAL HAZARDS

Project personnel shall not be permitted to work on any part of an electrical power circuit unless the person is protected against electric shock by de-energizing the circuit and grounding it, or ensure that it has been locked and tagged out. All electrical circuits shall be grounded according to the National Electric Code (NEC) and their codes. Ground fault circuit interrupters (GFCIs) shall be used whenever possible. All project personnel who are exposed to electrical shock hazards will receive in CRA's electrical safety procedures which are found in CRA's Safety and Health Policy Manual.

6.2.10 CONTROL OF HAZARDOUS ENERGY

OSHA's "Control of Hazardous Energy Sources" standard, 29 CFR 1910.147, covers the servicing and maintenance of machines and equipment in which the unexpected energization or startup of the machines or equipment could cause injury to project personnel.

The standard also establishes minimum performance requirements to control hazardous energy and requires that employers develop and implement an energy control program. The elements of an energy control program are as follows:

i) lockout/tagout;
ii) personnel protection;
iii) energy control procedure;
iv) protective materials and hardware;
v) periodic inspections;
vi) training and communication;
vii) energy isolation; and
viii) project personnel notification.

Project personnel who are required to conduct operation and maintenance activities that will require the isolation of an energy hazard through the use of a Lockout/Tagout device shall follow CRA's employer-specific program that is found in the Safety and Health Policy Manual. Written energy control procedures will be developed for any equipment that is installed at the Site.

Training

Project personnel authorized to attach and remove lockout/tagout devices shall be provided with initial training regarding the safe application, usage, and removal of such devices. Each authorized person will receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the associated energy, and the methods necessary for energy isolation and control.

All authorized persons will be provided with refresher training annually, or at more frequent intervals whenever the following conditions apply:

i) there is a job assignment change;
ii) there is a change in machinery or equipment, or a process change that presents new hazards;
iii) there is a change in the energy control procedures;
iv) the supervisor has reason to believe that there are deficiencies in the person's understanding of the following:
   - the hazards associated with the energy that controls the machinery or equipment in the employee's work area; and
   - application and removal procedures for lockout/tagout devices.

6.2.11 HAND AND POWER TOOLS

The following guidelines shall be implemented when working with hand and power tools:

Hand Tools

i) hand tools must meet the manufacturer's safety standards;
ii) hand tools must not be altered in any way;
iii) at a minimum, eye protection must be used when working with hand tools;
iv) wrenches (including adjustable, pipe, end, and socket wrenches) must not be used when jaws are sprung to the point that slippage occurs;

v) impact tools (such as drift pins, wedges, and chisels) must be kept free of mushroom heads; and

vi) wooden handles must be free of splinters or cracks and secured tightly to the tool.

Power Tools

i) all power tools must be inspected regularly and used in accordance with the manufacturer's instructions and the tool's capabilities;

ii) electric tools must not be used in areas subject to fire or explosion hazards, unless they are approved for that purpose;

iii) portable electric tools must be connected to a GFCI when working in wet areas;

iv) proper eye protection must be used when working with power tools;

v) personnel must be trained in the proper use of each specific tool; and

vi) any defective power tools must be immediately tagged and removed from service.

6.2.12 COMPRESSED GAS CYLINDERS

Compressed gases present several hazards. The cylinder must be properly labeled, identifying the hazardous properties of the gas, such as toxicity, flammability, or if it is an oxidizer, and the manufacturer must supply a MSDS. In addition to the gas hazards, compressed gas cylinders pose other hazards simply because they contain gas under pressure.

Regardless of the properties of the gas, any gas under pressure can explode if the cylinder is improperly stored or handled. Improperly releasing the gas from a compressed gas cylinder is extremely dangerous. A sudden release of the gas can cause a cylinder to become a missile-like projectile, destroying everything in its path. Cylinders have been known to penetrate concrete-block walls. To prevent such a dangerous situation, there are several general procedures to follow for the safe storage and handling of a compressed gas cylinder:

i) store cylinders in an area specifically designated for that purpose. This area must protect the cylinders from being struck by another object. The area must be well-ventilated and away from sources of heat. It must be at least 20 feet away from highly combustible materials. Oxidizers must be stored at least 20 feet away from flammable gases;

ii) cylinders must not be dropped or allowed to fall. Chain and rack them in an upright position during use and storage. When transporting cylinders, they must be secured from falling;

iii) when moving a cylinder, even for a short distance, all the valves must be closed, the regulator removed, and the valve cap installed. Never use the valve cap to lift a cylinder. If you are using a crane or some other lifting device to move a cylinder, use a cradle or boat designed for that purpose. Never use a sling or a magnet to move a cylinder;

iv) never permit cylinders to contact live electrical equipment or grounding cables;

v) cylinders must be protected from the sun's direct rays, especially in high-temperature climates. Cylinders must also be protected from ice and snow accumulation; and

vi) before the gas is used, install the proper pressure-reducing regulator on the valve. After installation, verify the regulator is working, that all gauges are operating correctly, and that all connections are tight to ensure that there are no leaks. When you are ready to use the gas, open the valve with your hands. Never use a wrench or other tool. If you cannot open it with your hands, do not use it.

6.2.13 FALL HAZARDS

Project personnel who will use ladders and/or aerial lifts or have the potential hazard of working on elevated surfaces of 6 feet or greater during project activities shall follow CRA's SOP for Fall Protection. The Fall Protection SOP includes procedures for working from aerial lifts, ladders, and scaffolds. Specific guidelines for portable ladders are outlined below.

Emergency Rescue Plan when workers are wearing personal fall arrest equipment

When personal fall arrest systems are used, emergency rescue will be pre-planned and written to assure that employees can be promptly rescued or can rescue themselves should a fall occur. The availability of rescue personnel, ladders, or other rescue equipment will be evaluated and used in the development of the Emergency Rescue Plan, which is as follows:

(To be developed by project personnel prior to initiation of project activities that require the use of personal fall arrest equipment).

6.2.14 PORTABLE LADDERS

Climbing ladders will be done with the free use of both hands and feet, to allow three points of control at all times. The body will be facing the ladder and centered between the ladder's side rails when climbing.

Materials or tools will **not** be carried in the hands while ascending or descending ladders. The use of portable ladders will be limited to tasks requiring access to an elevated task that is performed infrequently, or when the pre-job safety analysis indicates that redesigning the job or providing work platforms is not feasible. Strict adherence to section on Portable Ladders in the Fall Protection SOP is required whenever using ladders.

In addition, the following safety precautions are required:

All peripheral equipment must be carried in a backpack or other method as to allow the use of both hands while climbing the ladder.

Portable ladders will **not** be loaded beyond the maximum intended load for which they were built or beyond their manufacturer's rate load capacity.

Portable ladder use will be in accordance with the rules below:

i) ladders will be maintained free of oil, grease, and other slipping hazards;

ii) ladders will be maintained in good usable condition;

iii) ladders will be inspected before climbing or after the ladder is involved in a tip over. Defects should be marked, and the ladder taken out of service until repairs can be made;

iv) the ladder base will be placed with a secure footing to prevent slipping, or it will be lashed, or held in position;

v) use the 4-to-1 ratio; that is, place the ladder so its feet are 1 foot away from what it leans against for every 4 feet in height to the point where the ladder rests. Example: If the top of a 16-foot ladder leans against a wall, its feet should be placed 4 feet from the wall. The "fireman's method" is a convenient way of checking the angle of the ladder. Place your toes against the base of the ladder, fully extend both arms toward the side rail and parallel to the ground. When standing erect you should be able to hold the ladder's side rails;

vi) do not use a ladder in a horizontal position as a runway or a scaffold;

vii) do not place a ladder in front of a door that opens toward it unless the door is locked, blocked, or guarded by someone;

viii) place a portable ladder so that both side rails have a secure footing. Provide solid footing on soft ground to prevent the ladder from sinking;

ix) place the ladder's feet on a substantial and level base, not on a movable object;

x) on uneven surfaces, use a block, wedge, or ladder foot;

xi) on wet or oily pavement, a smooth floor, or an icy or metal surface, the ladder footing must be lashed, blocked, or otherwise secured;

xii) do not lean a ladder against unsafe backing, such as loose boxes or barrels;

xiii) when using a ladder for access to high places, securely lash or otherwise fasten the ladder to prevent its slipping; and

xiv) to gain access to the top of a tank, extend the ladder at least 3 rungs (3 feet) above the point of support.

Ascending or Descending of Ladders

i) maintain three points of contact at all times when going up or down. If material must be handled, raise or lower it with a rope;

ii) always face the ladder when ascending or descending; and

iii) maintain clean, dry footwear as much as possible to prevent slipping on the rungs.

6.2.15 FLAMMABLE AND COMBUSTIBLE LIQUIDS

The storage, dispensing, and handling of flammable and combustible liquids must be in accordance with OSHA 29 CFR 1910.106 and National Fire Protection Association (NFPA) guidelines. The specific flammable or combustible liquids used at the Site may include gasoline, diesel, kerosene, oils, and solvents.

Flammable and combustible liquids are classified according to flash point. This is the temperature at which the liquid gives off sufficient vapors to readily ignite. Flammable liquids have flash points below 100 degrees Fahrenheit (°F) (37.8 degrees Centigrade [°C]). Combustible liquids have flash points above 100°F (37.8°C) and below 200°F (93.3°C).

Storage

Many flammables can ignite at temperatures at or below room temperature. They are far more dangerous than combustibles when they are heated. As a result, these products must be handled very carefully. At normal temperatures, these liquids can release vapors that are explosive and hazardous to employee health. Exposure to heat can cause some of these liquids to break down into acids, corrosives, or toxic gases.

For this reason, flammable/combustible liquids should be stored in cool, well ventilated areas away from any source of ignition. Always consult the MSDS of the product for specific information.

Flammable and combustible liquids must be stored in designated areas. Such areas must be isolated from equipment and work activity, which may produce flames, sparks, heat, or any form of ignition, including smoking. The most practical method is the use of one or more approved (commercially available) flammable/combustible liquid storage cabinets.

Cabinets must be labeled "Flammable - Keep Fire Away". Doors must be kept closed and labeled accordingly. Containers must be kept in the cabinet when not in use.

General Requirements

i) keep containers of flammable/combustible liquids closed when not in use;

ii) keep flammable/combustible liquids in designated areas and approved cabinets;

iii) do not allow use of unapproved containers for storage or transfer. Use only approved safety cans (5-gallon maximum) with a spring closing lid and spout cover, designated to safely relieve internal pressure when exposed to heat or fire;

iv) use only approved self-closing spigots, faucets, and manual pumps when drawing flammable/combustible liquids from larger containers/barrels;

v) use only approved metal waste cans with lids for disposal of shop towels/oily rags;

vi) designate "Smoking" and "No Smoking" areas;

vii) designate fueling areas; and

viii) observe all signs indicating "No Smoking", "No Flames", "No Ignition".

Transferring Flammable/Combustible Liquids

i) this seemingly routine task can be hazardous if certain precautions are not followed. Grounding and bonding must be observed at all times to prevent the accumulation of static electricity when transferring containers/barrels one to another;

ii) drums should be grounded (#4 copper conductor) to a grounding rod; and

iii) bonding is necessary between conductive containers (e.g., a barrel and a 5-gallon container).

6.2.16 HEAT STRESS

Recognition and Symptoms

Temperature stress is one of the most common illnesses at hazardous waste sites. Acclimatization and frequent rest periods must be established for conducting activities where temperature stress may occur. Below are listed signs and symptoms of heat stress. Project personnel should follow appropriate guidelines if any personnel exhibit these symptoms:

i) **Heat Rash** – Redness of skin. Frequent rest and change of clothing;

ii) **Heat Cramps** – Painful muscle spasms in hands, feet, and/or abdomen. Administer lightly salted water by mouth, unless there are medical restrictions;

iii) **Heat Exhaustion** – Clammy, moist, pale skin, along with dizziness, nausea, rapid pulse, fainting. Remove to cooler area and administer fluids; and

iv) **Heat Stroke** – Hot dry skin; red, spotted or bluish; high body temperature of 104°F, mental confusion, loss of consciousness, convulsions, or coma. Immediately cool victim by immersion in cool water. Wrap with wet sheet while fanning, sponge with cool liquid while fanning; treat for shock. DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.

Work Practices

The following procedures will be carried out to reduce heat stress:

i) acclimatization;

ii) work/rest regimes;

iii) training on the requirements of CRA's Heat Stress SOP;

iv) liquids that replace electrolytes/salty foods available during rest; and
v) use of the "buddy system".

Acclimatization

The level of heat stress at which excessive heat strain will result depends on the heat tolerance capabilities of the worker. Each worker has an upper limit for heat stress beyond which the resulting heat strain can cause the worker to become a heat casualty. In most workers, appropriate repeated exposure to elevated heat stress causes a series of physiologic adaptations called acclimatization, whereby the body becomes more efficient in coping with the heat stress. Work/rest regimes will be partially determined by the degree of acclimatization provided.

Worker Information and Training

All project personnel who work in areas where there is a reasonable likelihood of heat injury or illness should be kept informed, through continuing education programs:

i) heat stress hazards;
ii) predisposing factors and relevant signs and symptoms of heat injury and illness;
iii) potential health effects of excessive heat stress and first aid procedures;
iv) proper precautions for work in heat stress areas;
v) worker responsibilities for following proper work practices and control procedures to help protect the health and safety of themselves and their fellow workers, including instruction to immediately report to the CRA the development of signs or symptoms of heat stress overexposure; and
vi) the effects of therapeutic drugs, over-the-counter medications, or social drugs may increase the risk of heat injury or illness by reducing heat tolerance.

6.2.17 COLD STRESS

When decreased ambient air temperatures and/or wind are present during project activities, project personnel can experience cold stress conditions. Cold stress can range from minor frostbite to hypothermia.

6.2.17.1 RECOGNITION AND SYMPTOMS

The signs and symptoms of cold stress are listed below. CRA will follow the appropriate guidelines if any personnel exhibit any of the following symptoms:

i) **Frostbite** – Pain in the extremities and loss of manual dexterity. "Frostnip" or reddening of the tissue, accompanied by a tingling or loss of sensation in the extremities. Continuous shivering;

ii) **Hypothermia** – Pain in the extremities and loss of manual dexterity. Severe, uncontrollable shivering. Inability to maintain level of activity. Excessive fatigue, drowsiness, irritability, or euphoria; and

iii) **Severe Hypothermia** – clouded consciousness, low blood pressure, pupil dilation, cease of shivering, unconsciousness, and possible death.

Remove the individual to a warm, dry place. If clothing is wet, remove and replace with dry clothing. Keep the individual warm. Re-warming of the individual should be gradual to avoid stroke symptoms. Dehydration and the loss of body fluids may result in cold injury due to a significant change in blood flow to the extremities. If the individual is conscious and alert, provide warm sweet liquids. Avoid coffee and other caffeinated liquids because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Apply moist compresses; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the individual warm and calm; remove to a medical facility as soon as possible.

6.2.17.2 WORK PRACTICES

To reduce the adverse health affects from cold exposure CRA will adopt the following work practices:

i) providing adequate insulating dry clothing to maintain core temperature above 98.6°F to workers if work is performed in air temperature below 40°F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required;

ii) if the air temperature is of 32°F or less, hands should be protected;

iii) if only light work is involved and if the clothing on the worker may become wet on the job Site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outerwear should be changed, as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of inner layer by sweat.

iv) if available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve;

v) heated warming shelters should be available nearby (e.g., use of project vehicles). CRA personnel will be encouraged to use these at regular intervals; the frequency depending on the severity of the environmental exposure. When entering heated shelter, remove the outer layer of clothing and loosen the remainder of the clothing to permit heat evaporation;

vi) warm sweet drinks and soups should be provided at the Site to provide caloric intake and fluid volume. The intake of coffee should be limited because of the diuretic and circulatory effect;

vii) the weight and bulk of clothing should be included in estimating the required work performance and weights to be lifted by the worker;

viii) implementing a "buddy system" in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress; and

ix) unacclimatized personnel should not be required to work full-time in cold until they become accustomed to the working conditions and required protective clothing.

6.2.18 COMPRESSED AIR

Project activities may require Site personnel to work with high-pressure compressed air. The hazards usually associated with compressed air are explosive hazards and hazards presented by objects propelled by compressed air. The potential for injury from these hazards can be minimized by following basic safe work procedures, performing regular equipment maintenance and by inspections, and using PPE. CRA will develop energy control procedures for the safe handling of compressed air. These written procedures will be available on-Site during project activities. The SS/SSO will be responsible for training all required project personnel to the appropriate safety procedures.

6.2.19 ADVERSE WEATHER CONDITIONS

The SS/SSO will decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, tornado warnings, and strong winds are examples of conditions that would call for the discontinuation of work and evacuation of Site. CRA will not permit any work on elevated structures (e.g., ladders or working on rooftops) during any type of electrical storm.

6.2.20 VEHICLE TRAFFIC AND CONTROL

The following safety measures are to be taken by CRA project personnel that have the potential to be exposed to vehicle traffic:

- A high visibility safety vest meeting ANSI Class II garment requirements is to be worn at all times.
- Employees will work using the "buddy system".
- Cones, etc. will be used to demarcate a safe work zone around the work areas.
- Appropriate signage will be posted as necessary to inform roadway/parking lot users of any additional control measures necessary to protect the public and CRA project personnel.

Additionally, **for the work that will be done on the active roadway next to the Site,** project personnel must follow the requirements presented in the Manual on Uniform Traffic Control Devices (MUTCD), which is found at: http://mutcd.fhwa.dot.gov/kno-millennium.htm. This will include the development and implementation of a Temporary Traffic Control Plan (TTCP) and discussion with the local municipality as to the responsible party who will implement the TTCP. The TTCP has four components: The Advanced Warning Area; the Transition Area; the Activity Area; and the Termination Area. A copy of the TTCP will be available at the Site during periods of time when work is occurring on the road.

6.3 BIOLOGICAL HAZARDS

Biological hazards can include unfortunate contact with insects, poisonous plants, and reptiles. The following information provides the foundation for prevention and care during the potential contact with these hazards.

6.3.1 INSECTS

Ticks

Lyme disease is caused by a bacterial parasite called spirochete, and is spread by infected ticks that live in and near wooded areas, tall grass, and brush. Once the tick deposits the spirochete, it must feed on the host blood for 12 to 24 hours before it can transmit the disease. The ticks that cause the disease in the Northeast and Midwest are often no bigger than a poppy seed or a comma in a newsprint. The peak months for human infection are June through October. There are many other tick-borne diseases such as Rocky Mountain Spotted Fever, which can be carried by a variety of ticks. The prevention and treatment of these diseases are similar to those of Lyme disease.

Prevention

Ticks hang on blades of grass or shrub waiting for a host to come by. When a host brushes against the vegetation, the tick grabs on. They usually first climb onto a persons legs and then crawl up looking for a place to attach. Preventative measures include wearing light-colored clothing; keeping clothing buttoned, tucking pant legs in socks, and keeping shirttails tucked in. Periodic checks for ticks should be made during the day, and especially at night. Hair should also be checked by parting it and combing through it to make sure that no ticks have attached to the scalp. Also, check clothing when it is first removed, before ticks have a chance to crawl off.

The most common repellent recommended for ticks is N,N-dimethyl-m-toluamide or DEET. It is important to follow the manufacturer's instructions found on the container for use with all insecticides especially those containing DEET.

In general, DEET insect repellent should only be applied to clothing, not directly on the skin. Do not apply to sunburns, cuts, or abrasions. Use soap and water to remove DEET once indoors.

Removal

The best way to remove a tick is removal by tweezers. If tweezers are not available, cover your fingers (tissue paper) while grasping the tick. It is important to grasp the tick as close as possible to the site of attachment and use a firm steady pull to remove it. When removing the tick, be certain to remove all the mouth parts from your skin so as not to cause irritation or infection. Wash hands immediately after with soap and water, and apply antiseptic to the area where tick was removed.

Testing and Symptoms of Lyme Disease

A variety of tests exist for determining Lyme Disease infection. However, most of these tests are not exact. The first symptoms of Lyme Disease usually appear from 2 days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick attached. The rash is often bull's eye-like with red on the outside and clear in the center. The rash may be warm, itchy, tender, and/or "doughy." Unfortunately, this rash appears in only 60 to 80 percent of infected persons. An infected person also has flu-like symptoms of fever, fatigue, chills, headaches, a stiff neck, and muscle aches and pains (especially knees). Rashes may be found some distance away from original rash. These symptoms often disappear after a few weeks.

Bees, Wasps, and Yellow Jackets

Insects that sting are members of the order Hymenoptera of the class Insecta. There are two major subgroups: aphids (honeybees, bumblebees) and vespids (wasps, yellow jackets, hornets). Aphids are docile and usually do not sting unless provoked. The stinger of the honeybee has multiple barbs, which usually detaches after a sting. Vespids have few barbs and can inflict multiple stings.

Types of stinging insects that might be encountered on this project site may include:

- Carpenter Bees
- Bumblebees
- Mud Dauber Wasps
- Yellow Jackets
- Cicada Killer Wasps
- Giant Hornets
- Honeybees
- Paper Wasps

Symptoms

If you are stung there are three types of reactions you can have, a normal, a toxic, or an allergic reaction.

- Normal reaction - only lasts a few hours and consists of pain, redness, swelling, itching, and warmth near the sting area.
- Toxic reaction - will last for several days and results from multiple stings and may cause cramps, headaches, fever, and drowsiness.
- Allergic reaction - might cause hives, itching, swelling, tightness in the chest area and a possibility of breathing difficulties, dizziness, unconsciousness, and cardiac arrest.

The stingers of many ***Hymenoptera*** may remain in the skin and should be removed as quickly as possible without concern for the method of removal. An ice cube placed over the sting will reduce pain; aspirin may also be useful. Persons with known hypersensitivity to such stings should carry a kit containing epinephrine in a prefilled syringe. Antihistamines may help decrease hives and angioedema. Persons who have severe symptoms of anaphylaxis, have positive venom skin test results, and are at risk for subsequent stings should receive immunotherapy regardless of age or time since anaphylaxis.

Precautions

The following precautions can help you avoid stings. Try to wear light colored clothing and shy away from dark or floral prints. Avoid wearing perfumes, hairsprays, colognes, and scented deodorants while working outside. If eating outside, keep all food and drinks covered; sweet foods and strong scents attract stinging insects as well. Never swat or swing at the insect, it is best to wait for it to leave, softly blow it away, or gently brush it aside. Seek medical attention when the reaction to a sting includes swelling, itching, dizziness or shortness of breath.

If physical control measures are not effective, use a pesticide that will have a minimal impact on both you and the environment.

Fire Ants

Fire ants are reddish-brown in color and range from 1/8 inch to 3/8 inch in length. When a fire ant stings an individual, the individual is rarely only stung once. Most fire ant stings result in a raised welt with a white pustule. If stung by a fire ant, continue to observe the welt and try to prevent secondary infection by keeping the welt intact. However, some individuals may have an allergic reaction to a fire ant sting and require immediate medical attention. Pesticides and even hot water can be used to kill fire ant colonies. **Fire ants are normally seen in the southern states.**

Mosquitoes

Mosquitoes are common pests that can be found in any state and any work environment where warm, humid conditions exist. Mosquitoes can pass along diseases such as West Nile virus and Malaria. Several different methods can be used to control adult mosquito populations: repellants such as DEET, mosquito traps, foggers, and vegetation and water management. **Mosquitoes are found from the tropics to the Arctic Circle and from lowlands to the peaks of high mountains.**

6.3.2 POISONOUS PLANTS

Common Poison Ivy (*Rhus radicans*) grows as a small plant, a vine, and a shrub. Poison Ivy occurs in every state. The leaves always consist of three glossy leaflets. Poison Sumac (*Rhus vernix*) grows as a woody shrub or small tree 5 to 25 feet tall. It usually contains nine leaves, with eight paired leaves and one on top, and is common in swampy areas. The plants are potent sensitizers and can cause mild to severe allergic reaction. This reaction is called contact dermatitis.

Dermatitis, in Rhus-sensitive persons, can result from contact with the milky sap found in the roots, stems, leaves, and fruit. The sap may retain its potency for months or years in a dry atmosphere, and can occur during any time of the year. The sap may also be carried by animals, equipment, or apparel.

The best form of prevention is to avoid contact. This can occur by wearing long sleeves and gloves if necessary. Disposal clothing, such as Tyvek®, is recommended in high-risk areas to avoid exposure from contaminated apparel. Barrier creams and cleaners are also recommended.

6.3.3 THREATENING DOGS

If you are approached by a frightened or menacing dog:

- Do not attempt to run and don't turn your back.
- Stay quiet, and remember to breathe.
- Be still, with arms at sides or folded over chest with hands in fists.
- Slowly walk away sideways.
- Don't stare a dog in the eyes, as this will be interpreted as a threat.
- Avoid eye contact.
- If you have a jacket, you could wrap it around your arm and should he snap, take the bite harmlessly.
- Try calling its bluff. Yell "sit!", "stay!", or "go home!". You might convince the dog that you are the stronger in the situation.

6.3.4 RODENTS

Rodentia: (rats, mice, beavers, squirrels, guinea pigs, capybaras, coypu)

Rodents, or Rodentia, are the most abundant order of mammals. There are hundreds of species of rats; the most common being the black and brown rat.

The **Brown Rat** has small ears, blunt nose, and short hair. It is approximately 14 to 18 inches long (with tail). They frequently infest garbage/rubbish, slaughterhouses, domestic dwellings, warehouses, shops, supermarkets, in fact anywhere there is an easy meal and potential nesting sites.

The **Black Rat** can be identified by it's tail, which is always longer than the combined length of the head and body. It is also slimmer and more agile than the Norwegian or Brown rat. Its size varies according to its environment and food supply.

The **House Mouse** has the amazing ability to adapt and it now occurs more or less in human dwellings. In buildings, mice will live anywhere and they are very difficult to keep out. Mice are also totally omnivorous; in other words, they will eat anything.

Rats and mice often become a serious problem in cold winter months when they seek food and warmth inside buildings. They may suddenly appear in large numbers when excavation work disturbs their in-ground nesting locations or their food source is changed.

There are six potential problems caused by rats and mice:

1. They eat food and contaminate it with urine and excrement.
2. They gnaw into materials such as paper, books, wood, or upholstery, which they use as nest material. They also gnaw plastic, cinder blocks, soft metals such as lead and aluminum, and wiring, which may cause a fire hazard.
3. Rats occasionally bite people and may kill small animals.
4. They, or the parasites they carry (such as fleas, mites, and worms), spread many diseases such as salmonella, trichinosis, rat bite fever, Hantavirus, Weils disease, and the bubonic plague.
5. Rats can damage ornamental plants by burrowing among the roots or feeding on new growth or twigs. They also eat some garden vegetables, such as corn and squash.

6. Rats and mice are socially unacceptable. These rodents have been a problem for centuries, chiefly because they have an incredible ability to survive and are so difficult to eliminate. In addition, they are extremely compatible with human behavior and needs.

7.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE is required to safeguard project personnel from various hazards. Varying levels of protection may be required depending on the level of chemicals and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level.

7.1 LEVELS OF PROTECTION

Protection levels are determined based upon chemicals present in the work area. The specific protection levels to be employed at the Site for each work task are presented on each activity hazard analysis form that are found in Attachment A-1.

7.1.1 LEVEL D PROTECTION

The minimum level of protection that will be required for all project personnel will be Level D. The following equipment will be used:

i) work clothing as prescribed by the weather;

ii) steel toe work boots, meeting American National Standard Institute (ANSI) Z41;

iii) safety glasses or goggles, meeting ANSI Z87;

iv) cotton or leather work gloves;

v) high visibility Class II safety vest (as required);

vi) hardhat, meeting ANSI Z89; and

vii) hearing protection (if noise levels exceed 85 dBA, then hearing protection with a United States Environmental Protection Agency (USEPA) NRR of at least 20 dBA must be used).

7.1.2 MODIFIED LEVEL D PROTECTION

Modified Level D will be used when airborne chemicals are not present at levels of concern, but project activities present an increased potential for skin contact with hazardous materials. Modified Level D consists of:

i) Tyvek® coveralls;
ii) steel toe work boots;
iii) neoprene or polyvinyl chloride (PVC) overboots;
iv) safety glasses or goggles;
v) hardhat;
vi) face shield in addition to safety glasses or goggles when projectiles and/or splashing liquids pose a hazard;
vii) nitrile gloves;
viii) hearing protection (if necessary); and
ix) high visibility Class II safety vest (as required).

7.1.3 LEVEL C PROTECTION

When the airborne concentration of suspected chemicals are present at sustained levels of greater than or equal to 1.0 parts per million (ppm), Level C protection will be required. This action level is driven by the potential presence of benzene at the Site. If it is determined that benzene is not present via low volume personal air sampling and/or colorimetric tube sampling, then the action level necessitating Level C protection may be revised by the SS/SSO.

The following equipment will be used for Level C protection:

i) full-face air purifying respirator (APR) equipped with combination organic vapor cartridges and particulate filters (P-100) which are National Institute of Occupational Safety and Health (NIOSH) approved;
ii) polyethylene coated Tyvek® suit (if liquids/splash hazards are present) or Tyvek® coveralls, ankles, and cuffs taped to boots and gloves;
iii) outer nitrile gloves worn over inner nitrile gloves;
iv) steel toe work boots, ANSI approved;
v) neoprene or polyvinyl chloride (PVC) overboots;
vi) hardhat, ANSI approved;
vii) hearing protection (if necessary); and
viii) high visibility Class II safety vest (as required).

It is not anticipated that Level B protection will be required; however, if it becomes necessary to wear Level B personal protective equipment then it will consist of Level C equipment plus supplied air respiratory protection.

7.2 TYPES OF PERSONAL PROTECTIVE EQUIPMENT

The following types of PPE will be available for use at the Site:

i) **Hardhats** - Regulated by 29 CFR Part 1910.135; specified in the ANSI Z89.1, Safety Requirements for Industrial Head Protection;

ii) **Face Shields, Safety Glasses, and Safety Goggles** - Regulated by 29 CFR Part 1910.133(a); specified in ANSI Z87.1, Eye and Face Protection;

iii) **Hand Protection;**

iv) **Hearing Protection;** and

v) **Protective Clothing.**

7.2.1 TYPES OF PROTECTIVE MATERIAL

Protective clothing is constructed of a variety of different materials for protection against exposure to specific chemicals. No universal protective material exists. All will decompose, be permeated, or otherwise fail to protect under certain circumstances.

Fortunately most manufacturers list guidelines for the use of their products. These guidelines usually concern gloves or coveralls and, generally, only measure the rate of degradation (failure to maintain structure). It should be noted that a protective material may not necessarily degrade but may allow a particular chemical to permeate its surface. For this reason, guidelines must be used with caution. When permeation tables are available, they will be used in conjunction with degradation tables.

The following is a partial list of protective materials that may be used during this project:

i) **Tyvek®.** Product of duPont Company. Spun-bonded, non-woven polyolefinfibers. It has reasonable tear, puncture, and abrasion resistance. Provides protection against particulate contaminants. Inexpensive and suitable for disposable garments;

ii) **Polyethylene.** Used as a coating on polyolefin material such as Tyvek®, increasing resistance to acids, bases, and salts. Good general purpose disposable product;

iii) **Viton®:** Offers outstanding chemical resistance and a high degree of impermeability to many strong solvents. It is a flexible material designed for handling chlorinated and aromatic solvents;

iv) **Nitrile.** Also referred to as Buna-N, NBR, and acrylonitrile. Resists degradation by petroleum compounds, alcohols, acids, and caustics. Used in boots and gloves. Commonly available and inexpensive;

v) **Butyl Rubber.** Resists degradation by many chemicals. Especially resistant to permeation by toxic vapors and gases. Expensive material used in boots, gloves, splash suits, aprons, and fully encapsulating suits; and

vi) **Neoprene.** Resists degradation by caustics, acids, and alcohols. Used in boots, gloves, splash suits, and fully encapsulating suits. Considered to be a good all-around protective material.

7.3 RESPIRATORY PROTECTION

Respiratory protection may be required to be worn by project personnel who are conducting project activities at the Site. Personnel will follow the procedures and guidelines as described below and also follow CRA's written Respiratory Protection Program.

The air-purifying respirator cartridges selected for use during work at this Site are a combination organic vapor and particulate filter cartridges, which have the ability to protect against total organic vapor concentration up to 1,000 parts per million (ppm). The cartridges also contain an attached HEPA (P-100) filter, which will protect against dust, mist and fumes having a TWA greater than 0.05 mg/m^3, asbestos-containing dusts and mists, and radionuclides.

A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp will be used to determine if organic vapors are present. A background reading will be established prior to commencing work activities at each active work area.

Action levels to determine the level of respiratory protection necessary for organic vapors are based on the concentration of Site chemicals measured within the breathing zone. The action levels and appropriate protection are as follows:

Sustained Organic Vapor Reading Above Background Within Worker Breathing Zone (ppm)	*Action Taken*
<1.0 ppm or Background	Full-Face Respirator Available
≥1.0 ppm and ≤ 50 ppm	Wear Full-Face Respirator
> 50 ppm	Wear Supplied Air Respirator, Implement Additional Engineering Controls

7.3.1 RESPIRATOR FIT TEST

All project personnel who may be required to wear a respirator will have been properly fit tested. Personnel will have the opportunity to handle the respirators, and wear them in normal air for a long familiarity period. Following the familiarity period, each person will test the face piece-to-face seal by use of the positive and negative pressure tests:

i) Positive Pressure Test - with the exhaust port(s) blocked, the positive pressure of slight exhalation should remain consistent for several seconds and

ii) Negative Pressure Test - with the intake ports blocked, the negative pressure of slight inhalation should remain constant for several seconds.

Air-purifying respirators shall not be worn when conditions prevent a seal of the respirator to the wearer. Such conditions may be the growth of a beard, sideburns, a skullcap that projects under the face piece or temple pieces on glasses. No one may wear a beard if it interferes with the fit of the respirator. Also, the absence of one or both dentures can seriously affect the fit of a face piece, and should be worn at all times that respirators are being used. The worker's diligence in observing these factors shall be evaluated by periodic checks.

7.3.2 CARTRIDGE CHANGES

All cartridges will be changed a minimum of once daily. Changes will also be made when personnel begin to experience increased inhalation resistance.

7.3.3 RESPIRATOR CLEANING, MAINTENANCE, AND INSPECTION

All respirators used on Site shall be cleaned and maintained in the following manner:

i) remove filters and cartridges;

ii) visually inspect face piece and parts, discard faulty items;

iii) remove all elastic headbands;

iv) remove exhalation cover and inhalation valves;

v) wash, sanitize, and rinse face piece. Wash any parts that were removed separately;

vi) dry the mask. Wipe face pieces and valves;

vii) disassemble and clean the exhalation valve;

viii) visually inspect face piece and all parts for deterioration, distortion, or other faults that might affect the performance of the respirator;

ix) replace any questionable or faulty parts;

x) reassemble mask and visually inspect completed assembly; and

xi) seal mask in plastic bag.

All CRA personnel required to use an air-purifying respirator are instructed in how to properly fit a respirator to achieve the required face piece-to-face seal for respiratory protective purposes. Conditions that could affect this face seal are the presence of beards, sideburns, eyeglasses, and the absence of upper or lower dentures. All CRA project personnel are subjected to a preliminary fit test with annual fit tests thereafter in accordance with OSHA regulations 29 CFR Part 1910.134. In addition, CRA project personnel are also required to be medically fit to wear a respirator as determined by a licensed physician.

7.4 LEVELS OF PROTECTION

The level of protection must correspond to the level of hazard known, or suspected, in the specific work area. PPE has been selected with specific considerations to the hazards associated with project activities. The specific PPE to be used for each activity is identified on each activity hazard analysis form (Attachment A-1).

Eating, drinking, and chewing gum or tobacco is prohibited while working in area where the potential for chemical and/or explosive hazards may be present. Personnel must wash thoroughly before initiating any of the aforementioned activities.

8.0 AIR MONITORING

During the progress of pre-design and remedial work activities, periodic monitoring of particulate levels and organic vapors will be taken by the SS/SSO. Monitoring for particulates will only be required during work activities which may lead to chemical excursions from the Site. Such activities may include: trenching, soil borings, monitoring well installations, staging and vehicular traffic on Site. The particulate monitoring frequency may be reduced during periods where potential excursions are limited by precipitation or no wind.

All monitoring equipment will be calibrated on a daily basis in accordance with the manufacturer's guidelines, and such calibrations will be recorded in the Site daily log book. The results of air monitoring programs shall be reported to CRA's SS/SSO daily and shall include the following information as applicable:

- i) Site location/date;
- ii) work process/operation name;
- iii) temperature, wind speed, and wind direction;
- iv) area sampling location diagram; and
- v) field notes including the following:
  - a) description of operations and complaints/symptoms,
  - b) chemicals/materials/equipment in use,
  - c) engineering/administration controls in effect,
  - d) personal protective equipment in use, and
  - e) sampling observations/comments.

All daily air monitoring activities shall be recorded in a hard cover log book which shall be maintained on Site at all times by each employer's SS/SSO. The air monitoring equipment shall be operated by project personnel trained in the use of the specific equipment provided and shall be under the control of each employer's SS/SSO.

Air monitoring for organic vapors will be conducted in the breathing zone of workers in the EZ on an hourly basis, or as requested by project personnel, or as deemed necessary by each employer's SS/SSO and/or CRA's SS/SSO. Background measurements immediately upwind of the EZ will be taken before activities commence. Respiratory action levels for organic vapors are discussed in Section 7.3.

Immediately upon identifying sustained elevated levels of organic vapors (greater than 50 ppm) within the work zone, the air monitoring results will be reported to CRA's SS/SSO and all pre-design and remedial work activities will be stopped. The SS/SSO will determine the cause of the sustained elevated levels of organic vapors and alternate work methods or engineering controls will be implemented to rectify the release of elevated concentrations of organic vapors, or upgrade levels of PPE as required.

8.1 COMMUNITY AIR MONITORING

Air monitoring will be performed during project activities to ensure that the community will not be adversely impacted during Site activities. The community air monitoring plan is described below.

8.1.1 COMMUNITY AIR MONITORING PLAN

This Community Air Monitoring Plan will be implemented during all ground intrusive activities at the Site. Real-time air monitoring for volatile organic compounds (VOCs) and respirable dust levels will be performed at the perimeter of the EZ. Monitoring will be conducted during ground invasive activities and any other activity, which may potentially create an airborne hazard.

Fence line and/or property line air monitoring locations will be selected based on the work zone location, wind direction, and proximity of potential receptors.

The frequency and locations to provide representative air monitoring will be evaluated on a day-to-day basis by the SS/SSO and adjusted for the weather conditions and the locations of remedial work.

Community air monitoring will be conducted in accordance with the following:

i) VOCs will be monitored continuously at the downwind perimeter of the EZ. Readings will be recorded at 15-minute intervals or sooner if an action level has been exceeded. If total VOC levels exceed 5 ppm above background, work activities will be halted and monitoring continued under the provisions of the Vapor Emission Response Plan (see Section 8.1.4). All monitoring readings will be recorded and available for review; and

ii) a fugitive dust suppression and particulate monitoring program will be conducted in accordance with the procedures presented in Section 8.1.5.

8.1.2 STEP 1 VAPOR EMISSION MONITORING

If the ambient air concentrations of VOCs exceeds 5 ppm above background at the downwind perimeter of the EZ, then a check of the downwind Site perimeter will be made to verify that the level is less than 5 ppm. Activities will be halted and monitoring at the downwind perimeter of the Site will be continued if levels at the downwind perimeter are greater than 5 ppm. If the VOC level decreases below 5 ppm above background at the downwind perimeter of the Site, work activities can resume.

If the VOC level is above 25 ppm at the downwind perimeter of the EZ, air monitoring at 200 feet downwind of the Site perimeter or half the distance to the nearest residential or commercial structure, whichever is less, will be performed to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Step 2 Vapor Emission Monitoring section (Section 8.1.3).

8.1.3 STEP 2 VAPOR EMISSION MONITORING

If any VOC levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, then the air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source are unsuccessful, and if any of the VOC levels persist at 5 ppm above background or greater for more than 30 minutes in the 20 Foot Zone, then the Vapor Emission Response Plan (see Section 8.1.4) will automatically be placed into effect.

Additionally, the Vapor Emission Response Plan will be immediately placed into effect if VOC levels are greater than 10 ppm above background at the 20 Foot Zone for any one time.

8.1.4 VAPOR EMISSION RESPONSE PLAN

Upon activation, the following activities will be undertaken:

i) all New York State Department of Environmental Conservation (NYSDEC) contacts, Client contacts and CRA contacts will be notified so that evacuation procedures may begin and/or the Emergency Response Plan will go into effect; and

ii) frequent air monitoring will be conducted at 30 minute intervals within the 20-Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the SS/SSO.

8.1.5 FUGITIVE DUST SUPPRESSION AND PARTICULATE MONITORING PROGRAM

The following fugitive dust suppression and particulate monitoring program will be employed at the Site during ground invasive activities or during other activities which may potentially create an airborne hazard:

i) reasonable fugitive dust suppression techniques will be employed during all Site activities which may generate fugitive dust;

ii) particulate monitoring will be employed during ground invasive activities or activities which may generate fugitive dust;

iii) particulate monitoring will be performed using a real-time particulate monitor that is capable of monitoring particulate matter less than 10 microns in size. Particulate levels will be monitored at the downwind side of the EZ. Readings will be based on the 15-minute average concentrations;

iv) particulate monitoring will be performed by a trained technician who fully understands the operation of the monitoring equipment and the necessary calibration procedures. The technician will be responsible for keeping the air monitoring log book which will contain records of equipment calibration and all air monitoring readings;

v) the action level will be set at 150 micrograms per cubic meter ($\mu g/m^3$) based on a 15 minute average. If particulate levels are detected in excess of 150 $\mu g/m^3$, the upwind background level will be measured immediately using the same portable monitor. If the working Site particulate measurement is greater than 100 $\mu g/m^3$ above the background level, additional dust suppression techniques will be implemented to reduce the generation of fugitive dust and corrective actions will be taken to protect project personnel and reduce the potential for chemical migration. Corrective measures may include increasing the level of personal protection and implementing additional dust suppression techniques. These may include:

a) applying water on haul roads;

b) wetting equipment and excavation faces;

c) spraying water on buckets during excavation and dumping;

d) hauling materials in tarped containers;

e) restricting vehicle speed;

f) immediately covering excavation areas or materials upon completion; and

g) reducing the size and/or number of excavations;

vi) if dust is observed leaving the working Site, additional dust suppression techniques will be employed; and

vii) if the dust suppression techniques being utilized at the Site do not lower particulates to an acceptable level (below 150 $\mu g/m^3$) work will be suspended until appropriate corrective measures are approved to remedy the situation.

While project activities are ongoing, work other than RD/RA activities may impact dust levels. If dust levels at the fence line exceed 150 $\mu g/m^3$ while work other than remedial construction is underway, then dust readings will be obtained at the downwind boundary of the remedial work area to determine if the remedial work is contributing to the fence line measured dust levels.

If it is apparent that the source of dust that exceeds 150 $\mu g/m^3$ is due to work other than the RD/RA activities, then NYSDEC will be notified of this occurrence and project activities will continue without implementing dust control measures.

9.0 DECONTAMINATION

It is the responsibility of the SS/SSO to ensure that all project personnel and pieces of equipment are properly decontaminated according to the procedures outlined below.

9.1 CONTAMINATION PREVENTION

One of the most important aspects of decontamination is the prevention of the spread of Site-related chemicals. CRA project personnel will adhere to the following methods of contamination avoidance:

i) do not walk through areas of obvious or known chemical impact;

ii) do not handle or touch impacted materials directly;

iii) fasten all closures on suits, covering with tape if necessary;

iv) take particular care to protect any skin injuries; and

v) stay upwind of airborne chemicals, when possible.

9.2 PERSONAL DECONTAMINATION

CRA project personnel will dispose of and/or decontaminate all PPE at the conclusion of each workday as described below. The most contaminated PPE will be decontaminated first.

CRA project personnel will remove all disposable equipment before meal breaks and at the conclusion of the workday and replace them with new equipment prior to commencing work. Respiratory equipment and other non-disposables will be fully decontaminated and then placed in a clean storage area. Respirator decontamination will be conducted daily as described in Section 7.3.3. CRA project personnel will inspect their respirator on a daily basis to ensure its proper operation.

9.2.1 LEVEL D/MODIFIED LEVEL D DECONTAMINATION

Level D decontamination procedures are as follows:

i) **Step 1** - Remove all visible contamination and loose debris by washing with clean, water;

ii) **Step 2** - Remove all outer clothing that came in contact with the chemicals (i.e., boot covers and outer gloves) and either dispose of in waste container or wash in detergent solution and rinse;

iii) **Step 3** - Remove protective clothing; dispose of in waste container; and

iv) **Step 4** - Wash and rinse hands.

9.2.2 LEVEL C DECONTAMINATION

Level C decontamination procedures are as follows:

i) **Step 1** - Remove all visible contamination and loose debris by washing with clean water;

ii) **Step 2** - Remove all outer clothing that came in contact with the chemicals (i.e., boot covers and outer gloves) and either dispose of in waste container or wash in detergent solution and rinse;

iii) **Step 3** - Remove protective clothing; dispose of in waste container;

iv) **Step 4** - Remove respirator, sanitize prior to reuse;

v) **Step 5** - Remove inner gloves; dispose of in waste container; and

vi) **Step 6** - Wash and rinse hands with soap and water.

9.2.3 EQUIPMENT DECONTAMINATION

All equipment shall be decontaminated with Alconox/Liquinox solution or discarded upon exit from the contaminated area in a well-ventilated area. A temporary decon pad with a low-volume high-pressure washer will be setup on site during drilling operations. All potentially impacted materials will be drummed for subsequent disposal.

10.0 EMERGENCY RESPONSE

It is essential that Site personnel be prepared in the event of an emergency. Emergencies can take many forms: illnesses or injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful chemicals, or sudden changes in the weather. The following sections outline the general procedures for emergencies. Emergency information should be posted as appropriate.

10.1 EMERGENCY CONTACTS

Fire:		911
Police:		911
Ambulance:		911
Hospital	New Island Hospital, 4295 Hempstead Turnpike	516-579-6000

Directions to the Hospital: Start out heading West on Picone Blvd. toward NY-110 N/ Broadhollow Road. Turn left onto NY-110 S/Broadhollow Road. Turn Right onto Conklin Street/NY-24. Continue to follow NY-24 W. End at New Island Hospital: 4295 Hempstead Turnpike, Bethpage, NY 11714. Figure A.10.1 provides the route to the Hospital.

10.2 ADDITIONAL EMERGENCY NUMBERS

CRA Accident Reporting Number	866-529-4886
National Response Center (NRC)	800-424-8802
Agency for Toxic Substances and Disease Registry	888-422-8737 (24 Hours)
USEPA Emergency Response	800-424-8802
Underground Utilities Location Service	800-272-4480
Client Contact (John Uruskyj)	518-862-2717
Client Contact (Paul Brookner)	651-687-2673
CRA Project Manager – Jamie Puskas	519-884-0510
CRA Project Coordinator – Robert Medsger	519-884-0510
CRA Regional Safety and Health Manager - Craig Gebhardt	716-297-6150
CRA SS/SSO - To Be Determined	

10.3 EMERGENCY EQUIPMENT AVAILABLE ON SITE

Communication Equipment	Location
Emergency Alarms/Horns	CRZ
Medical Equipment	
OSHA Approved First Aid Kit Sized for a Minimum of 10 people Portable Emergency Eyewash	CRZ or Support Zone
Fire Fighting Equipment Two 20-Pound ABC Type Dry Chemical Fire Extinguishers Two SCBAs	CRZ

10.4 ACCIDENT, INJURY, AND ILLNESS REPORTING AND INVESTIGATION

Any work-related incident, accident, injury, illness, exposure, or property loss must be reported to the SS/SSO, and **within 1 hour** through the CRA Accident Reporting System. Motor vehicle accidents must also be reported through this system. CRA's Accident Report Form, located in Attachment A-2, must also be filled out and provided to the SS/SSO. The report must be filed for the following circumstances:

- accident, injury, illness, or exposure of an employee;
- injury of a subcontractor;
- damage, loss, or theft of property; and/or
- any motor vehicle accident, regardless of fault, which involves a company vehicle, rental vehicle, or personal vehicle while the employee is acting in the course of employment.

Occupational accidents resulting in employee injury or illness will be investigated by the SS/SSO. This investigation will focus on determining the cause of the accident and modifying future work activities to eliminate the hazard.

All project personnel have the obligation and right to report unsafe work conditions, previously unrecognized safety hazards, or safety violations of others.

10.5 PROJECT PERSONNEL RESPONSIBILITIES DURING EMERGENCIES

Site Supervisor/Site Safety Officer (SS/SSO)

As the administrator of the HASP, the SS/SSO has primary responsibility for responding to and correcting emergency situations. The SS/SSO will:

i) take appropriate measures to protect personnel, including withdrawal from the EZ, total evacuation and securing of the Site, or upgrading or downgrading the level of protective clothing and respiratory protection. The current Emergency Evacuation Routes will be communicated to all project personnel on a daily basis at the Daily Safety Meeting. The SS/SSO will use the figure of the Site Layout to help communicate the proper evacuation routes;

ii) take appropriate measures to protect the public and the environment including isolating and securing the Site, preventing runoff to surface waters, and ending or controlling the emergency to the extent possible;

iii) ensure that appropriate Federal, State, and local agencies are informed, and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. In the event of an air release of toxic materials, the local authorities should be informed in order to assess the need for evacuation. In the event of a spill, sanitary districts and drinking water systems may need to be alerted;

iv) ensure that appropriate decontamination treatment or testing for exposed or injured personnel is obtained;

v) determine the cause of the incident and make recommendations to prevent the recurrence; and

vi) ensure that all required reports have been prepared.

10.6 MEDICAL EMERGENCIES

CRA project personnel will decontaminate any person who becomes ill or injured in the EZ to the maximum extent possible. If the injury or illness is minor, full decontamination will be completed and first aid administered prior to transport. If the individual's condition is serious, at least partial decontamination will be completed as much as possible without causing further harm to the individual. First aid will be administered while awaiting an ambulance or paramedics. All injuries and illnesses will immediately be reported to the SS/SSO, CRA's Accident Hotline and to CRA's Project Manager.

CRA project personnel will bring the directions to the hospital and a list of the chemicals of concern when transporting an injured/exposed person to a clinic or hospital for treatment.

Project personnel will also then clean or decontaminate any vehicle used to transport contaminated personnel.

10.7 FIRE OR EXPLOSION

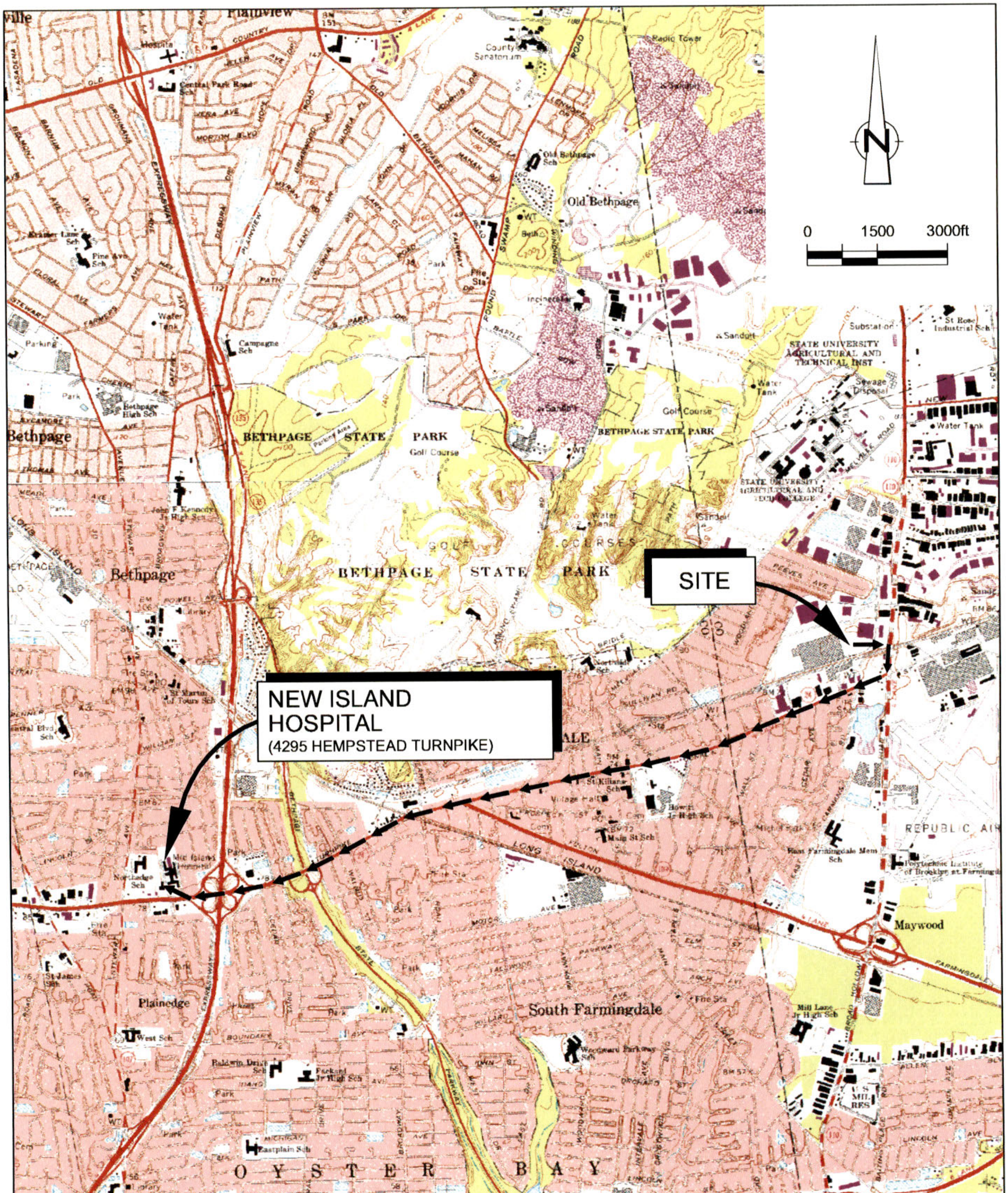
In the event of a fire or explosion, CRA project personnel will immediately call the local fire department. Upon their arrival, the SS/SSO or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on Site.

If it is safe to do so, CRA project personnel will:

i) if hazardous, report to the Agency On-Scene Coordinator and/or Project Manager;

ii) use fire fighting equipment available on Site; or

iii) remove or isolate flammable or other hazardous materials which may contribute to the fire.



SOURCE: USGS 7.5 MINUTE SERIES, TOPO QUAD: AMITYVILLE, NY 1979
USGS 7.5 MINUTE SERIES, TOPO QUAD: HUNTINGTON, NY 1979
CONTOUR INTERVAL = 10'

figure A10.1

EMERGENCY HOSPITAL ROUTE
REMEDIAL DESIGN / REMEDIAL ACTION
Farmingdale, New York

50138-00(002)GN-BU001 OCT 18/2007

TABLE A2.1

SUMMARY OF DETECTED COMPOUNDS IN SOIL AND GROUNDWATER
ROD REMEDY IMPLEMENTATION
HWD SITE
FARMINGDALE, NEW YORK
PAINESVILLE, OHIO

Chemical Compound	Maximum Detected Concentration in Various Media	
	Soil (ppm)	*Groundwater (ppb)*
Volatile Organic Compounds		
Benzene	0.31	NA
Tetrachloroethylene (Perchloroethylene) (PCE)	440	2600
Toluene	12	NA
Trichloroethene	3.5	130
Xylene (total)	110	NA
1,2- Dichloroethylene	NA	59

Notes:

ppm - parts per million
ppb - parts per billion

TABLE A2.2

EXPOSURE ROUTES AND EXPOSURE LEVELS FOR THE CHEMICAL COMPOUNDS OF CONCERN ROD REMEDY IMPLEMENTATION HWD SITE FARMINGDALE, NEW YORK

Chemical Compound	*Ionization Potential*	*Exposure Routes*	*Acceptable Exposure Levels in Air*
Benzene	9.2	Inhalation, Ingestion, Skin Absorption, Human Carcinogen	0.5 ppm (1) 1 ppm (2) 5 ppm (4) 500 ppm (3)
Trichloroethene	9.5	Inhalation, Ingestion	50 ppm (1) 100 ppm (2) 1000 ppm (3) 300 ppm (5)
Tetrachloroethene (Perchloroethylene) (PCE)	9.3	Inhalation, Ingestion, Animal Carcinogen	25 ppm (1) 100 ppm (2) 150 ppm (3)
1,2-Dichloroethene	9.8	Inhalation, Ingestion	200 ppm (1) 200 ppm (2) 1000 ppm (3)
Xylene	8.5	Inhalation, Ingestion	100 ppm (1) 100 ppm (2) 900 ppm (3)
Toluene	8.8	Inhalation, Ingestion, Skin Absorption	50 ppm (1) 200 ppm (2) 500 ppm (3) 500 ppm (6)

Notes:

(1) 2007 Values, American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs).
(2) Federal Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL).
(3) Immediately Dangerous to Life and Health (IDLH).
(4) Federal OSHA 15 minute ceiling standard.
(5) Federal OSHA 5 minute exposure limit.
(6) Federal OSHA 10 minute exposure limit.
ppm Parts Per Million.

ATTACHMENT A-1

ACTIVITY/HAZARD ANALYSIS FORMS

TASK HAZARD ANALYSIS
CRA

Activity: MOBILIZATION AND DEMOBILIZATION ACTIVITIES

Description of Task	Potential Hazards	Preventative Measures and Controls	PPE and Action Levels
Mobilization and Demobilization	Slip, Trip, Falls	Use three points of contact to mount/dismount machinery. Continuously inspect work areas for slip, trip, and fall hazards. Be aware of surroundings.	Level D: Hardhat; safety glasses; hearing protection (as necessary); work gloves; safety vest (as necessary); and steel toed boots.
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Utilities	Maintain proper utility clearances. All utilities will be located prior to conducting work.	
	Pinch Points	Keep hands, feet, and clothing away from moving parts/devices. Provide barriers and/or signage indicating swing radius of equipment, according to SOPs.	
	Heavy Lifting	Follow safe lifting practices found in the HASP. Lift items within your capabilities. Ask for assistance.	
	Use of Hand and Power Tools	Follow manufacturer's safety precautions, inspect tools daily prior to use, replace defective tools, and wear the appropriate eye and foot protection.	
	Heat/Cold Stress	Dress appropriately and follow guidelines found in the HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather.	
	Biological Hazards	Survey area for potential biological hazards that might impact the project. Use appropriate measures to remove hazard or evacuate area until rendered safe.	
	Fueling Equipment	No smoking, allow device to cool before refueling, and follow proper storage requirements.	
	Electrical Hazards	GFCIs will be used to reduce electric shock. All electrical equipment will be inspected prior to use and according to SOPs.	

Training Requirements

- Inspect Site daily to recognize and correct hazards (inspect equipment and hand/power tools daily/before use);
- Hazard Communication;
- Personal Protective Equipment ; and
- Site-specific training on specific Site tasks.

TASK HAZARD ANALYSIS
CRA

Activity: SUBCONTRACTOR OVERSIGHT

Description of Task	Potential Hazards	Preventative Measures and Controls	PPE and Action Levels
Oversight of Subcontractor	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather.	Modified D: Safety glasses; hardhat; earplugs/muffs; safety vest; work gloves; Neoprene or PVC overboots as necessary and steel-toed boots. Contingency – Level C: Modified Level D plus full-face APR when sustained readings greater than 1 ppm but less than 50 ppm.
	Proximity to excavating, geoprobe or drilling, and heavy equipment	Maintain adequate distance from subcontractor equipment.	
	Vehicle Traffic	Use proper traffic barricades and Class 2 safety vests.	
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA. Establish proper hand signals as a means of communication in high noise environments.	
	Biological Hazards	Survey area for potential biological hazards that might impact the project. Use appropriate measures to remove hazard or evacuate area until rendered safe.	
	Heat/Cold Stress	Dress appropriately and follow guidelines found in the HASP.	
	Chemical Hazards	Wear proper PPE and conduct air monitoring.	
	Slip/Trip/Falls	Continuously inspect the work areas for slip, trip and fall hazards. Be aware of surroundings.	
	Utilities	Maintain proper utility clearances. All utilities will be located prior to conducting work.	

Training Requirements

- Excavation safety;
- 40-Hour Hazardous Waste Operations and Emergency Response;
- Hazard Communication;
- Personal Protective Equipment; and
- Mobil Equipment Operations.

TASK HAZARD ANALYSIS
CRA

Activity: SOIL SAMPLING ACTIVITIES

Description of Task	Potential Hazards	Preventative Measures and Controls	PPE and Action Levels
Collection of Soil Samples	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather.	Modified D: Safety glasses; hardhat; earplugs/muffs; safety vest; tyvek® or polycoated tyvek® suit; nitrile gloves; Neoprene or PVC overboots as necessary; and steel toed boots. Contingency – Level C: Modified Level D plus full-face APR when sustained readings greater than 1 ppm are present but less than 50 ppm.
	Vehicle Traffic	Use proper traffic barricades and Class 2 safety vests.	
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA. Establish proper hand signals as a means of communication in high noise environments.	
	Biological Hazards	Survey area for potential biological hazards that might impact the project. Use appropriate measures to remove hazard or evacuate area until rendered safe.	
	Heat/Cold Stress	Dress appropriately and follow guidelines found in the HASP.	
	Heavy Lifting	Follow safe lifting practices found in the HASP. Lift items within your capabilities. Ask for assistance.	
	Slip/Trip/Falls	Continuously inspect the work areas for slip, trip and fall hazards. Be aware of surroundings.	
	Chemical Hazards	Wear proper PPE and conduct air monitoring.	
	Utilities	Maintain proper utility clearances. All utilities will be located prior to conducting work.	

Training Requirements

- Soil Sampling Procedures;
- 40 HR Hazardous Waste Operations and Emergency Response;
- Hazard Communication; and
- Personal Protective Equipment.

TASK HAZARD ANALYSIS
CRA

Activity: DECONTAMINATION OF PERSONNEL AND EQUIPMENT

Description of Task	Potential Hazards	Preventative Measures and Controls	PPE and Action Levels
Personnel/Equipment Decontamination Activities	Slip, Trip, Falls	Use three points of contact to mount and dismount equipment. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings. Practice good housekeeping.	Modified D: Hardhat; safety glasses; steel toed boots; tyvek® or polycoated tyvek® suit (as needed); inner/outer gloves; Neoprene or PVC overboots and faceshield (as needed). Contingency - Level C: Modified Level D plus full-face APR when sustained readings greater than 1 ppm are present.
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Pinch Points	Keep hands, feet, and clothing away from moving parts/devices.	
	Heavy Lifting	Follow safe lifting practices in the HASP. Lift items within your capabilities. Ask for assistance if necessary.	
	Moving heavy equipment and vehicles	Inspect work area and be aware of surroundings at all times.	
	Heat/Cold Stress	Dress appropriately and follow guidelines in the HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce work during sever weather.	
	Fueling Equipment	No smoking, allow device to cool before refueling, and follow storage requirements.	
	Biological Hazards	Survey area for potential biological hazards that might impact the project. Use appropriate measures to remove hazard or evacuate area until rendered safe.	
	Chemical Hazards	PID will be used where potential for exposure to contaminated materials exit. Air monitoring will be conducted at regular intervals.	

Training Requirements

- Inspect site daily to recognize and correct hazards (inspect equipment before using);
- Hazard Communication;
- 40-Hour Hazardous Waste Operations and Emergency Response;
- Personal Protective Equipment; and
- Site specific training on specific site tasks (i.e., use of pressure washer).

TASK HAZARD ANALYSIS
CRA

Activity: DRILLING AND/OR GEOPROBE ACTIVITIES

Description of Task	Potential Hazards	Preventative Measures and Controls	PPE and Action Levels
Installation of monitoring well and soil borings	Slip, Trip, Falls	Use three to board machinery. Continuously inspect work areas for slip, trip & fall hazards. Be aware of surroundings.	Initiate in Modified Level D Upgrade to Level C if PID measurements are greater than 1 ppm but less than 50 ppm.
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Pinch Points	Keep hands, feet, and clothing away from moving parts/devices.	
	Heavy Lifting	Follow safe lifting practices in the HASP. Lift items within your capabilities. Ask for assistance if necessary.	
	Operating drilling equipment	Keep clear of augers, do not wear loose clothing, jewelry, instruct personnel on use of emergency kill switch, follow guidelines in HASP.	
	Moving drilling equipment	Inspect work area and secure the drill rig before moving to other location.	
	Heat/Cold Stress	Dress appropriately and follow guidelines in the HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Use of hand and power tools	Follow the manufacturer's safety precautions, inspect tools regularly, replace defective tools, and wear the appropriate eye and foot protection.	
	Biological Hazards	Inspect work areas carefully; avoid contact with insect and poisonous plants. Follow procedures in HASP.	
	Chemical Hazards	Monitor with PID during drilling operations and wear appropriate PPE.	

Personal Protective Equipment	Training Requirements
Modified Level D: Hard hat, safety glasses, steel toed boots, hearing protection, Neoprene or Nitrile gloves, □yvek® or polycoated □yvek® suit and Neoprene or PVC overboots.	40-Hour Hazardous Waste Operations and Emergency Response Safety introduction/briefing, safety meetings Hazard Communication Personal Protective Equipment
Level C: Modified Level D plus an air-purifying respirator with an organic vapor and particulate cartridge and Nitrile inner gloves and Outer Neoprene gloves.	Use of emergency kill switch on drill rig Respiratory Protection Mobile Equipment Operation

TASK HAZARD ANALYSIS
CRA

Activity: GROUNDWATER SAMPLING

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Collection of groundwater samples, including purging wells and obtaining water levels.	Slip, Trip, Fall	Continuously inspect work areas for slip, trip, and fall hazards. Be aware of surroundings.	Initiate in Modified Level D Upgrade to Level C if PID measurements are greater than 1 ppm but less than 50 ppm.
	Chemical Hazard	Wear appropriate PPE.	
	Pinch Points	Keep hands, feet, and clothing away from tight areas.	
	Heavy Lifting	Follow safe lifting practices. Lift items within your capabilities. Ask for assistance with heavy items.	
	Use of Hand and Power Tools	Follow manufacturer's safety precautions, inspect tools regularly, replace defective tools, and wear the appropriate eye and foot protection. Use of GFCI when necessary.	
	Heat / Cold Stress	Dress appropriately and follow guidelines in HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather.	
	Biological Hazards	Inspect work areas carefully; avoid contact with insects and poisonous plants.	
	Heat and Electrical Hazards from the Use of Generators/Refueling Hazards	Use GFCIs for all electrical connections and ensure that the generator is grounded. Let equipment cool before moving it. Shut engine down and let it cool before it is refueled to prevent fires.	
	Hazards Associated with Compressed Gas Cylinders.	Following the procedures identified in the HASP.	

Personal Protective Equipment:	Training Requirements:
__Modified Level D:__ Hardhat, safety glasses, steel-toed boots, tyvek® or polycoated □yvek® suit, neoprene or nitrile gloves and neoprene or butyl rubber overboots as necessary.	Safety Introduction/Briefing, Safety Meetings Hazard Communication Personal Protective Equipment Respiratory Protection 40-Hour Hazardous Waste Operations and Emergency Response
__Level C:__ Modified Level D plus an air purifying respirator equipped with an organic vapor cartridge and a polycoated Tyvek® suit.	

TASK HAZARD ANALYSIS
CRA

Activity: PIPE HANDLING/MOVING/FUSING ACTIVITIES

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Lifting/moving/fusing pipe and operating fusing machine	Slip, Trip, Fall	Use three points to board machinery. Continuously inspect work areas for slip, trip, and fall hazards. Be aware of surroundings.	Initiate in Modified Level D Upgrade to Level C if PID measurements are greater than 1 ppm but less than 50 ppm.
	Pinch Points	Keep hands, feet, and clothing away from moving parts/devices.	
	Heavy Lifting	Follow safe lifting practices in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Moving Pipe with Heavy Equipment (Forklift, Loader, etc.)	Complete daily heavy equipment inspections. Ensure that operator is trained to operate equipment. Use safe material handling protocols (tie-down load, inspect rigging before use, clear travel pathway, store safely, etc.)	
	Moving Heavy Equipment and Vehicles	Inspect work areas; secure the equipment before moving to next location. Be aware of surroundings at all times. Use signal person as needed.	
	Rough/Sharp Surfaces (on the pipe and on the fusion unit)	Train all personnel on safe operating techniques and potential hazards of the fusing unit. Wear proper PPE and review material handling techniques with personnel.	
	Hot Surface (on the pipe and on the fusion unit)	Train all personnel on safe operating techniques and potential hazards of the fusing unit. Keep welder in heat resistant "boot" when not in use.	
	Heat / Cold Stress	Dress appropriately and follow guidelines presented in HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather.	

Personal Protective Equipment:	Training Requirements:
<u>Level D:</u> Hardhat, safety glasses, steel-toed boots, hearing protection, reflective safety vest, and work gloves. <u>Modified Level D:</u> Hardhat, high visibility safety vest, safety glasses, steel-toed boots, tyvek® or polycoated □yvek® suit, hearing protection, neoprene or nitrile gloves and neoprene or butyl rubber overboots.	Safety Introduction/Briefing, Safety Meetings Hazard Communication Personal Protective Equipment Review Manufacturer's Operating Instructions with Welders, Forklift Operations Confined Space Entry Fall Protection 40-Hour Hazardous Waste Operations and Emergency Response

TASK HAZARD ANALYSIS
CRA

Activity: CONSTRUCTION ACTIVITIES ASSOCIATED WITH THE INSTALLATION OF EQUIPMENT

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Installation of equipment, potential metal fabrication, including piping supports, equipment supports. Installation of bollards; painting; and electrical installations, which include wiring and grounding.	Slip, Trip, Fall	Use three points to board machinery. Continuously inspect work areas for slip, trip, and fall hazards. Be aware of surroundings.	Initiate in Level D. Air monitoring is not required.
	Electrical Hazards/Stored Energy	Use GFCIs to reduce electrical shock. Inspect all equipment prior to use. Do not stand in water when using electrical equipment. Ensure LOTO procedures are implemented.	
	Noise	Wear appropriate hearing protection if noise levels exceed 85 dBA.	
	Utilities	Maintain proper utility clearance. Locate all utilities prior to conducting work.	
	Pinch Points/Sharp Objects	Keep hands, feet, and clothing away from moving parts/devices.	
	Heavy Lifting	Follow safe lifting practices. Lift items within your capabilities. Ask for assistance with heavy items.	
	Operating Heavy Equipment	Keep clear of boom and buckets; establish eye contact with operator prior to crossing in front of excavators. Use spotters.	
	Moving Heavy Equipment	Inspect work area; secure the equipment before moving to next location.	
	Moving Heavy Materials and Structures	Complete daily heavy equipment inspections. Ensure that operator is trained to operate equipment. Use safe material handling protocols (tie-down load, inspect rigging before use, clear travel pathway, store safely, etc.)	
	Heat / Cold Stress	Dress appropriately and follow guidelines in HASP.	
	Elevated Fall Hazards	Maintain a 100 percent tie-off at/above 6 feet, follow a fall protection program in accordance with 29 CFR 1926 - Subpart M, and provide appropriate training to affected personnel. See guidelines contained in the HASP. Follow CRA's Standard Operating procedure for Fall Protection.	
	Setup and Moving of Crane/Heavy Equipment	Raise and lower masts slowly. Maintain proper utility clearances. Do not wear loose clothing or jewelry. Follow guidelines in HASP. Inspect work area and secure crane before moving to another location. Use a spotter when working in close quarters or near power lines.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc. Suspend or reduce operations during severe weather.	
	Biological Hazards	Inspect work areas carefully; avoid contact with insects and	

TASK HAZARD ANALYSIS
CRA

Activity: CONSTRUCTION ACTIVITIES ASSOCIATED WITH THE INSTALLATION OF EQUIPMENT

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
		poisonous plants.	

Personal Protective Equipment:	Training Requirements:
Level D: Hardhat, leather work gloves, safety glasses, steel-toed boots, hearing protection, reflective safety vest. Modified Level D: Hardhat, high visibility safety vest, safety glasses, steel-toed boots, tyvek® or polycoated tyvek® suit, hearing protection, neoprene or nitrile gloves and neoprene or butyl rubber overboots.	Safety Introduction/Briefing, Safety Meetings Hazard communication Personal Protective Equipment Heavy Equipment Operations Fall Protection Control of Hazardous Energy (Lockout/Tagout)

TASK HAZARD ANALYSIS
CRA

Activity: EXCAVATION ACTIVITIES

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Inspection, cleaning, repairing, and testing of the installed system and equipment.	Slip, Trip, Fall	Use three points to board machinery. Continuously inspect work areas for slip, trip, and fall hazards. Be aware of surroundings.	Initiate in Level D. Air monitoring is not required.
	Heavy Lifting	Follow safe lifting practices outlined in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Use of Hand and Power Tools	Follow manufacturer's safety precautions, inspect tools regularly, replace defective tools, and wear the appropriate eye and foot protection.	
	Heat / Cold Stress	Dress appropriately and following guidelines in the HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Biological Hazards	Inspect work areas carefully; avoid contact with insects and poisonous plants. Follow procedures in HASP.	
	Proximity to Vehicular Traffic	Prepare and then follow the Temporary Traffic Control Plan.	

Personal Protective Equipment:	**Training Requirements:**
<u>Level D:</u> Hardhat, high visibility safety vest, safety glasses, steel-toed boots, and leather work gloves.	Safety Introduction/Briefing, Safety Meetings Hazard Communication Personal Protective Equipment Daily Safety Meeting Understanding the Use of the Manual on Uniform Traffic Control Devices.

TASK HAZARD ANALYSIS
CRA

Activity: EXCAVATION ACTIVITIES

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Soil excavation for installation of a potential soil vapor extraction system.	Slip, Trip, Fall	Use three points to board machinery. Continuously inspect work areas for slip, trip, and fall hazards. Be aware of surroundings.	Initiate in Modified Level D
	Use of Hand and Power Tools	Follow manufacturer's safety precautions, inspect tools regularly, replace defective tools, and wear the appropriate eye and foot protection.	
	Utilities	Maintain proper utility clearances as specified in HASP.	
	Pinch Points	Keep hands, feet, and clothing away from moving parts/devices.	
	Heavy Lifting	Follow safe lifting practices in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Operating Heavy Equipment	Keep clear of boom and buckets; establish eye contact with operator prior to crossing in front of excavators.	
	Moving Heavy Equipment	Inspect work area; secure the equipment before moving to next location.	
	Heat/Cold Stress	Dress appropriately and follow guidelines in HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Biological Hazards	Inspect work areas carefully; avoid contact with insects and poisonous plants. Follow procedures in HASP.	
	Excavation Hazards such as Trench Cave-ins	Barricade the area around the excavation to keep personnel out of the area. Place all excavated soils at least 2 feet back from the sides of the excavations. Provide personnel protection measures (i.e., trench boxes, shoring, or slope the banks). Follow CRA's Standard Operating Procedure for excavation work.	

Personal Protective Equipment:	Dangerous Weather Conditions
<u>Level D:</u> Hardhat, safety glasses, steel-toed boots, hearing protection, reflective safety vest and work gloves. Review MSDS for PPE requirements when working with concrete.	Biological Hazards
<u>Modified Level D:</u> Hardhat, high visibility safety vest, safety glasses, steel-toed boots, tyvek® or polycoated tyvek® suit, hearing protection, neoprene or nitrile gloves and neoprene or butyl rubber overboots.	

TASK HAZARD ANALYSIS
CRA

Activity: EXCAVATION ACTIVITIES

Description of Task	*Potential Hazards*	*Preventive Measures and Controls*	*Action Levels*
Inspection, cleaning, repairing, and testing of the installed system and equipment.	Electrical Hazards	GFCIs will be used to reduce electric shock. All electrical equipment will be inspected prior to use and according to CRA SOPs.	
	Slip, Trip, Fall	Continuously inspect work areas for slip, trip, and fall hazards. Be aware of surroundings.	Initiate in Modified Level D Upgrade to Level C if PID measurements are greater than 1 ppm but less than 50 ppm.
	Pinch Points	Keep hands, feet, and clothing away from moving parts/devices.	
	Heavy Lifting	Follow safe lifting practices in HASP. Lift items within your capabilities. Ask for assistance with heavy items.	
	Heat/Cold Stress	Dress appropriately and follow guidelines in HASP.	
	Dangerous Weather Conditions	Consult local weather reports daily, watch for signs of severe weather, etc.	
	Elevated Fall Hazards	Maintain a 100 percent tie-off at/above 6 feet, follow a fall protection program in accordance with 29 CFR 1926 - Subpart M, and provide appropriate training to affected personnel. See guidelines contained in the HASP. Follow CRA's Standard Operating procedure for Fall Protection.	
	Hazardous Energy	Follow the Energy Control Procedures when working on the equipment.	

Personal Protective Equipment:	**Training Requirements:**
Level D: Hardhat, leather work gloves, safety glasses, steel-toed boots, hearing protection.	Safety Introduction/Briefing, Safety Meetings Hazard Communication Personal Protective Equipment Use of Emergency Kill Switch Control of Hazardous Energy (Lockout/Tagout) 40-Hour Hazardous Waste Operations and Emergency Response

ATTACHMENT A-2

FORMS:

- TRAINING ACKNOWLEDGMENT FORM
- DAILY SAFETY MEETING LOG
- CRA ACCIDENT REPORTING FORM

TRAINING ACKNOWLEDGMENT FORM

I have attended the mandatory Site-specific initiation session and understand the information presented in the HASP. I fully understand the known potential hazards present on Site, the required levels of PPE to complete my work, and the emergency procedures for the Site. I further confirm that I have the required training to participate in the Work Plan activities that I will be involved with. I agree to work in accordance with the guidelines presented in the HASP and I understand that failure to do so could result in removal from the Site.

Date	*Printed Name*	*Signature*	*Position*	*Company Name*

DAILY SAFETY MEETING LOG

PROJECT: ______________________ LOCATION: ______________________

DATE/TIME: ______________________

Safety Issues or Topics Discussed:

Signatures of Attendees:	

CONESTOGA-ROVERS & ASSOCIATES (CRA) ACCIDENT REPORTING FORM

Report all accidents immediately by calling 1-866-529-4886

Instructions: For Personal Injuries, Occupational Illnesses, and Property Damage, complete Sections 1 and 2. For Vehicle Accidents, Complete Sections 1, 2, and 4. Form must be completed within 24 hours.

SECTION 1

A. Employee Identification ( ) CRA Employee ( ) Temporary Employee ( ) Subcontractor

Employee No.	Last Name	First Name	Middle Name/Initial	M or F

Area Code ( )	Telephone Number	Address (Street, City, State, Province, Zip Code)
Date of Hire / /	Position/Title	Supervisor	Employee's Company/Office Location

B. General Information

Where did the accident occur?	Type of Occurrence
( ) Office ( ) Project Site ( ) Canada ( ) United States	( ) Employee Injury/Illness ( ) Vehicle Accident ( ) Property Damage Only

Date and Hour of Accident	Date and Hour Reported to Employer	Date and Hour Last Worked	Time Employee Began Work
Month Day Year ( ) a.m. ( ) p.m.	Month Day Year ( ) a.m. ( ) p.m.	Month Day Year ( ) a.m. ( ) p.m.	( ) a.m ( ) p.m.

Normal Work Hours on Last Day Worked	Witnesses?	Witness Name and Telephone Number
From: ( ) a.m. To: ( ) p.m.	( ) Yes ( ) No	

C. Project Information (Project Related Accidents Only)

Project #	Project Name	Project Manager	Site Telephone Number	Employee Cell Number
			( )	( )

Was the Client Advised of the Accident?	Project Address (Street, City, State, Province, Zip Code)
( ) Yes ( ) No Name:	Specific Location of Accident

SECTION 2

A. Details of the Accident

1. What job/task was being performed when the accident occurred? (Example: collecting groundwater samples).
2. Provide a detailed description of the employee's specific activities at the time of the accident. Include details of equipment/materials being used, including the size and weights of objects being handled. If necessary, attach additional pages to the report.
3. For injuries, identify the specific part of body injured, and specify left or right side. For illnesses, identify and describe the affected area/body part.
4. Identify the object or substance that directly injured employee and how. Include size and weight of object, quantity of substance, etc.
5. Identify property damaged and how it was damaged (include owner of property, nature and source of damage, model and serial number, if appropriate).

B. Health Care/Medical Treatment

Employee received health care?	Identify the type of health care provided and where it was performed. (Check all that apply).
( ) Yes ( ) No	( ) First Aid ( ) Medical treatment other than first aid (sutures, etc.) ( ) Hospitalized ( ) Clinic ( ) Hospital emergency room ( ) On location by self or CRA employee) ( ) On site by EMT

Name of Health Care Provider, Physician's Name, Address (Street, City, Province/State, and Postal/Zip Code)

Section 2 (Continued)

C. Accident Investigation	
H&S plan prepared and on site? ( ) Yes ( ) Not applicable	Did the safety plan identify and provide safety procedures for the specific tasks the employee was conducting when injured? ( ) Yes ( ) No If no, why not? (Explain) Did the employee utilize the STAR process before initiating the task? ( ) Yes ( ) No If no, why not? (Explain)
Did the employee have the proper safety training to conduct these tasks or use the equipment? ( ) Yes ( ) No If not, why not?	
Identify all of the potential contributing factors and how they led to the occurrence of the accident. (Lack of attention, wrong use of equipment, lack of training, hurrying/rushing, sort-cutting, environmental conditions, time of day, etc.)	
What contributing factor(s) above was the underlying root cause of the accident.	
Is any training or retraining recommended? If yes, describe.	
What actions have been or will be taken to correct this accident from reoccurring? Verify that these actions will be taken with the PM and/or employee supervisor.	
Additional information: Attach photos, witness statement(s), affected employee statement, accident diagrams, as applicable, to the end of this document.	

Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

Fax Completed Form to CRA's Accident Reporting Fax: (716) 297-3389
Send Original to CRA's Accident Reporting Department, Niagara Falls, New York

SECTION 3

D. Agency Reporting and Recording Information (To be completed by the Regional Safety and Health Manager)			
CANADA			
Form 7 Sent to WSIB? ( ) Yes ( ) Not required	Employee Injury Information (Injury met the following criteria) ( ) First Aid ( ) Medical Treatment ( ) Critical Injury ( ) Modified Duty ( ) Lost Time Injury If medical treatment, what?		
Joint Safety and Health Committee Notified? ( ) Yes ( ) No	Total days of modified duty If exceeds 7 days, report to WSIB.	Total days of lost time (if any)	Date employee returned to work Month Day Year
UNITED STATES			
OSHA Recordable Injury? ( ) Yes ( ) No	Employee Injury Information (Injury met the following OSHA 300 Log criteria) ( ) First Aid ( ) Medical Treatment ( ) Restricted Duty ( ) Lost Time Injury If medical treatment, what?		
Total days of restricted duty	Total days of lost time (if any)		Date employee returned to work Month Day Year

VEHICLE ACCIDENT SECTION

(Complete this Section for all Vehicle Accidents)

SECTION 4

CRA Vehicle

cense Plate No.	State/Province	Police Department City State/Province	
Vehicle Year/Make/Model	Odometer Reading at Time of Accident	Police Report Number	Weather Conditions

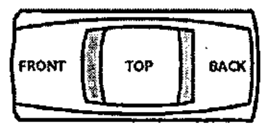
Name of Person Operating Vehicle

Address

City State/Province Zip Code

Telephone: Area Code ( )

"X" IN AREA OF VEHICLE DAMAGE



CIRCLE
0 No Damage
1 Light
2 Moderate
3 Heavy
4 Rolled
5 Burned

Vehicle Type: ( ) Personal ( ) Rental ( ) CRA-Own

Description of Vehicle Damage:

B. Other Vehicles Involved

Name of Owner	Address	City/State/Prov./Zip	Area Code and Telephone Number ( )
Operator's Name (if different from above)	Address	City/State/Prov./Zip	Area Code and Telephone Number ( )

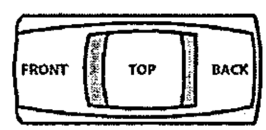
Year/Make/Model

Description of Property Damage:

Insurance Co. Name & Telephone

License Plate No./State/Province

"x" IN AREA OF VEHICLE DAMAGE



CIRCLE
0 No Damage
1 Light
2 Moderate
3 Heavy
4 Rolled
5 Burned

C. Injured Persons

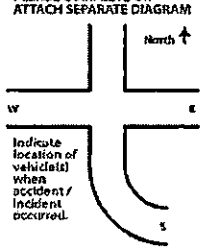
Name	Address Street, City, State/Prov./Zip Code	Phone Number	Nature of Injury	Indicate if Injured was a Vehicle Driver/ Passenger, CRA Employee, Other, or Pedestrian
1.				
2.				
3.				

D. Witnesses

Name	Address Street, City, State/Prov./Zip Code	Area Code and Telephone Number
1.		( )
2.		( )

E. Description of Accident

PLEASE COMPLETE OR ATTACH SEPARATE DIAGRAM



Was Ticket Issued:
Other Operator ☐
CRA Operator ☐

Reason:

Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

Note: If Additional Space is Required to Complete this Report, Use Separate Sheet of Paper and Attach.

Fax Completed form to CRA's Accident Reporting Fax: (716) 297-3389

Send Original to CRA's Accident Reporting Department, Niagara Falls, New York

050138 (2) APPB

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES
(Following Text)

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is Site-specific and has been prepared for the Remedial Design/Remedial Action (RD/RA) for the Hazardous Waste Disposal (HWD) Site, located at 11A Picone Boulevard in the Village of Farmingdale, Suffolk County, New York.

The objectives of this QAPP are to provide data and documentation for the development and implementation of final plans and specifications for implementing the remedial alternative set forth in the New York State Department of Environmental Conservation (NYSDEC) December 2004 Record of Decision (ROD). This QAPP provides comprehensive information regarding the project personnel responsibilities, and sets forth specific procedures to be used during the analysis of soil, water and air samples.

2.0 PROJECT BACKGROUND

A detailed description of the history and background information for the Site is presented in the RD/RA Work Plan, October 2007.

2.1 GENERAL

This QAPP provides quality assurance/quality control (QA/QC) criteria for work efforts associated with sample analyses of groundwater, soil, and air. Methods for sample analyses have been selected to provide results which characterize the samples, such that the sampling objectives can be met.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

A brief description of the duties of the key project personnel is presented below.

Project Manager - Jamie Puskas

i) provides day-to-day project management;

ii) provides managerial guidance to the QA/QC Officer - Sampling and Analytical Activities;

iii) prepares and reviews reports;

iv) conducts preliminary chemical data interpretation and assessment; and

v) responsible for overall project completion in accordance with the approved design.

QA/QC Officer - Sampling and Analytical Activities - Susan Scrocchi

i) oversees and reviews laboratory activities;

ii) determines laboratory data corrective action;

iii) performs analytical data validation and assessment;

iv) reviews laboratory QA/QC;

v) assists in preparation and review of final report;

vi) provides technical representation for analytical activities; and

vii) provides managerial and technical guidance to the Field Sampling Supervisor.

Field Sampling Supervisor

i) provides immediate supervision of all on-Site activities;

ii) provides field management of sample collection and field QA/QC;

iii) provides technical representation for field activities; and

iv) is responsible for maintenance of the field equipment.

Laboratory - Project Manager, Analytical Contractor

i) ensures resources of laboratory are available on an as-required basis;

ii) coordinates laboratory analyses;

iii) supervises laboratory's in-house chain of custody;

iv) schedules analyses of samples;

v) oversees review of data;

vi) oversees preparation of analytical reports; and

vii) approves final analytical reports.

Laboratory - QA/QC Officer, Analytical Contractor

i) overviews laboratory QA/QC;

ii) overviews QA/QC documentation;

iii) conducts detailed data review;

iv) decides laboratory corrective actions, if required; and

v) provides technical representation for laboratory QA/QC procedures.

Laboratory - Sample Custodian - Analytical Contractor

i) receives and inspects the sample containers;

ii) records the condition of the sample containers;

iii) signs appropriate documents;

iv) verifies chain of custody and their correctness;

v) notifies laboratory Project Manager and laboratory QA/QC Officer of sample receipt and inspection;

vi) assigns a unique laboratory identification number correlated to the field sample identification number, and enters each into the sample receiving log;

vii) initiates transfer of samples to the appropriate lab sections with assistance from the laboratory project manager; and

viii) controls and monitors access to and storage of samples and extracts.

The analytical laboratory selected to perform the environmental analyses will be performed by a New York State Department of Health (NYSDOH)-approved laboratory, under the National Environmental Laboratory Approval Program (NELAP).

4.0 PROJECT OBJECTIVES

4.1 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for sample collection and analyses which will provide data with an acceptable level of accuracy and precision.

Quality assurance measures for this project will begin with sample containers. Sample containers for waters will be purchased from a certified manufacturer and will be precleaned (I-Chem Series 200 or equivalent).

4.2 LABORATORY QUALITY ASSURANCE

The following subsections define the QA goals required to meet the Data Quality Objectives (DQOs) of the project.

4.2.1 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSES

The fundamental QA objective with respect to the accuracy, precision, and sensitivity of analytical data is to meet the QC acceptance criteria of each analytical protocol. Analytical methods and targeted detection limits listed have been specified to meet the groundwater quality standards.

A summary of the targeted detection limits is provided in Tables B.4.1 and B.4.2. It should be noted that these limits are targeted detection limits only; limits are highly matrix dependent and may not always be achieved.

The method accuracy (percent recovery) will be determined by spiking selected samples (matrix spikes) with the method recommended spiking compounds. Accuracy will be reported as the percent recovery of the spiking compound(s) and will compare with the criteria given in the appropriate methods, as identified in Section 7.0.

The method(s) precision (reproducibility between duplicate analyses) will be determined based on the duplicate analysis of matrix spike samples for organic parameters and duplicate sample analyses for inorganic parameters. Precision will be reported as Relative Percent Differences (RPDs) between duplicate analyses; acceptance criteria will be as specified in the appropriate methods identified in Section 7.0.

4.2.2 COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

A completeness requirement of 90 percent will be targeted for the program (see Section 13.1.3 for definition of completeness).

The quantity of samples to be collected has been estimated in an effort to effectively represent the population being studied. A summary of the sampling and analysis programs is presented in Table 4.3.

5.0 SAMPLING PROCEDURES

The sample collection procedures are described in the RD/RA Field Sampling Plan, October 2007.

The sample container, preservation, shipping, and packaging requirements are identified in Table 5.1 and Section 6.3.

6.0 SAMPLE CUSTODY AND DOCUMENT CONTROL

The following documentation procedures will be used during sampling and analysis to provide chain of custody control during transfer of samples from collection through storage. Recordkeeping documentation will include use of the following:

i) field logbooks (bound with numbered pages) to document sampling activities in the field;
ii) labels to identify individual samples;
iii) chain of custody record sheet to document analyses to be performed; and
iv) laboratory sample custody logbook.

6.1 FIELD LOGBOOK

The field team may use bound notebooks, sample collection logs, or electronic journals to record daily logs, sampling events, and field observations. Regardless of the media, entries should be dated and signed (or initialed) by the person making the entry. Entries on paper should be made with waterproof ink. The type of information to be recorded in the field includes:

i) date;
ii) time;
iii) field calibrations performed during the sampling;
iv) location and sample ID;
v) pertinent health and safety concerns;
vi) up/downgradient or clean/contaminated designation;
vii) physical condition of well;
viii) depth of well (both installed and measured);
ix) weather conditions (temperature, cloud cover, humidity, wind, etc.);
x) sample crew and/or Agency names;
xi) work progress;
xii) measuring point elevation;
xiii) depth to water;
xiv) purge volume;

xv) purge time (start/stop);

xvi) recharge time;

xvii) time of sample collection;

xviii) important field observations regarding purge or sample water or conditions related to sample integrity;

xix) QA/QC samples;

xx) name of laboratory(ies) performing analysis;

xxi) delays; and

xxii) comments (e.g., unusual situations, well damage, departure from established QA/QC field procedures, instrument problems, accidents, etc.)

6.2 SAMPLE NUMBERING

A sample numbering system will be used to uniquely identify each collected sample. This system will provide a tracking number to allow retrieval and cross-referencing of sample information. An example sample numbering system is described as follows:

Example: GW-081007 – AA – LLL - XXX

Where:

GW:	Designates sample type (GW=Groundwater) (S=Soil) (SE=Sediment)
081007:	Date of collection (mm/dd/yy)
AA:	Sampler initials
LLL:	Location ID
XXX:	Unique sample number

QC samples will also be numbered with a unique well ID, with the exception of matrix spikes and matrix spike duplicates.

Sample labels shall be affixed to each sample container (not the caps). The labels shall be completed in waterproof ink. All labels (except weatherproof labels) should be taped to the sample containers with clear package sealing tape. The labels will include the following information:

i) sample number/identification code;

ii) name/initials of sampler;

iii) date and time of sample collection;

iv) site name;

v) project number;

vi) required analysis; and

vii) type of preservation (if applicable).

6.3 CHAIN OF CUSTODY RECORDS

Chain of custody forms will be completed for all samples collected during the program.

The chain of custody form will document the transfer of sample containers. Custody seals will be placed on each cooler. The cooler will then be sealed with packing tape. Sample container labels will include sample number, place of collection and date and time of collection. All samples will be refrigerated using wet ice at 4°C (±2°C) and delivered to the analytical laboratory within 24 to 48 hours of collection. All samples will be delivered to the laboratory by commercial courier or Contractor personnel. All samples will be stored at 4°C (±2°C) at the laboratory.

The chain of custody record, completed at the time of sampling, will contain, but not be limited to, the sample number, date and time of sampling, and the name of the sampler. The chain of custody document will be signed, timed, and dated by the sampler when transferring the samples.

Each sample cooler being shipped to the laboratory will contain a chain of custody form. The chain of custody form will consist of two originals which will be distributed as follows:

i) the shipper will maintain one original while the other will be enclosed in a waterproof envelop within the cooler with the samples;

ii) the cooler will then be sealed properly for shipment;

iii) the laboratory, upon receiving the samples, will complete the original and make copies;

iv) the laboratory will maintain a copy for their records;

v) one copy will be returned to the Laboratory QA/QC Officer upon receipt of the samples by the laboratory; and

vi) the laboratory original will be returned to the Data Management Consultant with the data deliverables package.

6.4 SAMPLE DOCUMENTATION IN THE LABORATORY

Upon receipt of the cooler at the laboratory, the shipping cooler and the custody seal will be inspected by the Sample Custodian. The condition of the cooler and the custody seal will be noted on the chain of custody record sheet by the Sample Custodian. The Sample Custodian will record the temperature of one sample (or temperature blank) from each cooler and the temperature will be noted on the chain of custody. If the shipping cooler seal is intact, the sample containers will be accepted for analyses. The Sample Custodian will document the date and time of receipt of the container, and sign the form.

If damage or discrepancies are noticed (including sample temperature exceedances), they will be recorded in the remarks column of the record sheet, dated and signed. Any damage or discrepancies will be reported to the Laboratory Project Manager and Laboratory QA/QC Officer before samples are processed.

Each sample or group of samples shipped to the laboratory for analysis will be given a unique identification number. The Sample Custodian will record the client name, number of samples and date of receipt of samples in the Sample Control Logbook. Samples removed from storage for analyses will be documented in the Sample Control Logbook.

The laboratory will be responsible for maintaining analytical logbooks and laboratory data as well as a sample (on hand) inventory for submittal to Glenn Springs Holdings, Inc. (GSHI) on an as-required basis. Raw laboratory data produced from the analysis of samples submitted for this program will be inventoried and maintained by the laboratory for a period of 5 years at which time GSHI will advise the laboratory regarding the need for additional storage.

6.5 STORAGE OF SAMPLES

After the Sample Custodian has completed the chain of custody forms and the incoming sample log, the chain of custody will be checked to ensure that all samples are stored in the appropriate locations. All samples will be stored within an access controlled custody room and will be maintained at 4°C (±2°C) until all analytical work is complete.

7.0 ANALYTICAL PROCEDURES FOR CHEMICAL ANALYSES

Samples collected for laboratory chemical analyses will be analyzed for the parameters listed in Tables B.4.1 and B.4.2, using the methods cited in Table B.4.3. These methods have been selected to meet the DQOs for each sampling activity.

Data deliverables for this program will include final results for the investigative samples and corresponding QC parameters as specified in Section 9.2.

All sample results will be calculated using external standards with the exception of the samples analyzed by gas chromatograph/mass spectrometer (GC/MS); these methods employ the use of internal standards or isotopic dilution for analyte quantitation. The specific procedures for target analyte quantitation are detailed in the appropriate analytical methods.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

Calibration of instrumentation is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established reporting limits. Each instrument is calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The frequency of calibration and the concentration of calibration standards is determined by the manufacturers guidelines, the analytical method, or the requirements of special contracts.

A bound notebook will be kept with each instrument requiring calibration in which the activities associated with QA monitoring and repairs program will be recorded. These records will be checked during periodic equipment review and internal and external QA/QC audits.

8.1 GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

It is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria prior to initiating any ongoing data collection. This is accomplished through the analyses of tuning compounds as specified in the analytical methods.

Calibration of the GC/MS system will be performed daily at the beginning of the day or with each 12 hours of instrument operating time. All method-specified calibration criteria must be met prior to sample analyses. All calibrations must be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of ≥ 0.995). Higher order fits will not be allowed.

8.2 HIGH RESOLUTION GAS CHROMATOGRAPHY/ HIGH RESOLUTION MASS SPECTROMETRY (HRGC/HRMS)

All calibration and quantitation will be in accordance with the cited method.

8.3 GAS CHROMATOGRAPHY (GC)

Quantification of samples that are analyzed by GC/MS with element selective detectors shall be performed by external standard calibration. Standards containing the compounds of interest will be analyzed at a minimum of three concentrations to establish the linear range of the detector. Single point calibration will be performed at the beginning of each day and at every tenth injection. The response factors from the single point calibration will be checked against the average response factors from multi-level calibration. If deviations in response factors are greater than those allowed by the analytical method protocols, then system recalibration will be performed. Alternatively, fresh calibration standards will be prepared and analyzed to verify instrument calibration.

All method-specified calibration criteria must be met prior to sample analyses. All calibrations must be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of ≥0.995). Higher order fits will not be allowed.

8.4 INSTRUMENTATION FOR INORGANIC ANALYSES

Inductively coupled argon plasma (ICAP) instrumentation, including inductively coupled plasma/mass spectrometer (ICP/MS), will be calibrated using a minimum of a blank and one standard. Mercury and cyanide instrumentation will be calibrated using a blank and a minimum of three calibration standards (four for mercury), with a correlation coefficient requirement of ≥0.995. All remaining method-specified calibration procedures will be performed and acceptance criteria will be met prior to sample analyses.

9.0 DATA REDUCTION, VALIDATION, ASSESSMENT, AND REPORTING

9.1 GENERAL

The contract laboratory will perform analytical data reduction and validation in-house under the direction of the Laboratory QA/QC Officer. The Laboratory QA/QC Officer will be responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other qualifications based on the QC criteria outlined in the relevant methods, which would caution the data user of possible unreliability. Data reduction, validation, and reporting by the laboratory will be conducted as detailed in the following:

i) raw data produced and checked by the responsible analysts is turned over for independent review by another analyst;

ii) the area supervisor reviews the data for attainment of quality control criteria presented in the referenced analytical methods;

iii) upon completion of all reviews and acceptance of the raw data by the laboratory operations manager, a computerized report will be generated and sent to the Laboratory QA/QC Officer;

iv) the Laboratory QA/QC Officer will complete a thorough inspection of all reports;

v) the Laboratory QA/QC Officer and area supervisor will decide whether any sample reanalysis is required; and

vi) upon acceptance of the preliminary reports by the Laboratory QA/QC Officer, final reports will be generated and signed by the Laboratory Project Manager.

Validation of the analytical data will be performed by the QA/QC Officer - Sampling and Analytical Activities. The data validation will be performed in accordance with the following documents: "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", United States Environmental Protection Agency (USEPA) 540/R-99/008, October 1999; and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", USEPA 540-R-04-004, October 2004.

Assessment of analytical and in-house data will include checks on data consistency by looking for comparability of duplicate analyses, comparability to previous data from the same sampling location (if available), adherence to accuracy and precision control criteria detailed in this QAPP and anomalously high or low parameter values. The results of these data validations will be reported to the Project Manager and the contract laboratory, noting any discrepancies and their effect upon acceptability of the data.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified and appended to the report. Where data have been reduced or summarized, the method of reduction will be documented in the report. Field data will be audited for anomalously high or low values that may appear to be inconsistent with other data.

9.2 LABORATORY REPORTING, DATA, PRESENTATION AND FINAL REPORT

Reporting and deliverables for the volatile organic analyses shall include, but not be limited to, all items listed in Table B.9.1. Reporting and deliverables for the waste characterization samples (Toxicity Characteristic Leaching Procedure (TCLP) and Resource Conservation and Recovery Act (RCRA) analyses) shall include, but not be limited to, all items listed in Table B.9.2.

All sample data and corresponding QA/QC data as specified in the analytical methods, shall be maintained accessible either in hard copy or on magnetic tape or disk (computer data files).

The laboratory will submit one copy of the final analytical report within 14 calendar days of receipt of the final sample included in the sample delivery group (SDG). An electronic copy of the results and QC in EQuIS format will also be required with the hard copy.

9.3 DOCUMENT CONTROL SYSTEM

A document control system ensures that all documents are accounted for when the project is complete.

A project number will be assigned to the project. This number will appear on sample identification tags, logbooks, data sheets, control charts, project memos and analytical reports, document control logs, corrective action forms and logs, QA plans, and other project analytical records.

9.4 QC CHECK POINTS AND DATA FLOW

The following specific QC check points will be common to all metals, GC, and GC/MS analyses. They are presented with the decision points.

Chemist - bench level checks:

- systems check: sensitivity, linearity, and reproducibility within specified limits;
- duplicate analyses within control limits;
- matrix spike results within control limits;
- surrogate spike results within control limits (organics only); and
- calculation/data reduction checks: calculations cross-checked, any discrepancies between forms and results evident, results tabulated sequentially on the correct forms.

Laboratory Project Manager:

- systems operating within limits;
- data transcription correct;
- data complete; and
- data acceptable.

Sample Control:

- samples returned to sample control following analysis.

Laboratory QA/QC Officer:

- QA objectives met;
- QC checks are completed; and
- final data and report package is complete.

10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

10.1 QC FOR LABORATORY ANALYSES

Specific procedures related to internal laboratory QC samples are described in the following subsections.

10.1.1 REAGENT BLANKS

A reagent blank will be analyzed by the laboratory at a frequency of one blank per analytical batch. The reagent blank, an aliquot of analyte-free water or solvent, will be carried through the entire analytical procedure.

10.1.2 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD)/ ANALYSES

An MS/MSD sample will be analyzed for organic parameters and a duplicate and MS will be analyzed for inorganic parameters at a minimum frequency of one per analytical batch. Acceptable criteria and analytes that will be used for MS are identified in the methods. Where method specified limits were not available, general control limits were used. Percent spike recoveries will be used to evaluate analytical accuracy while percent relative standard deviation or the RPD between duplicate analyses will be used to assess analytical precision.

10.1.3 SURROGATE ANALYSES

Surrogates are organic compounds which are similar to the analytes of interest, but which are not normally found in environmental samples. Surrogates are added to samples to monitor the effect of the matrix on the accuracy of the analysis. Every blank, standard and environmental sample analyzed by GC or GC/MS, including MS/MSD samples, will be spiked with surrogate compounds prior to sample preparation.

The compounds that will be used as surrogates and the levels of recommended spiking are specified in the methods. Surrogate spike recoveries must fall within the control limits specified in the methods. If surrogate recoveries are excessively low (<10 percent), the laboratory will contact the QA/QC Officer-Sampling and Analytical Activities for further instructions. Dilution of samples to bring the analyte concentration into the linear range of calibration may dilute the surrogates out of the quantification limit. Reanalysis of these samples is not required. Assessment of analytical quality in these cases will be based on the MS/MSD sample analysis results.

10.2 QC FOR FIELD SAMPLING

To assess the quality of data resulting from the field sampling program, field duplicate and field blank samples will be collected (where appropriate) and submitted to the analytical laboratory as samples.

10.2.1 FIELD (RINSE) BLANKS

When well-dedicated equipment is not used and/or on the first sampling event in which non-certified clean equipment is used, field blanks will be used during the sampling programs to detect contamination introduced through sample collection procedures and equipment, external field conditions, sample transport, sample container preparation, sample storage, and/or the analytical process.

10.2.2 TRIP BLANKS

Trip blanks for volatile analyses will be prepared by the laboratory using analyte-free water and submitted with the sample collection containers. Trip blanks will be kept unopened in the field with sample bottles. Two trip blanks will be transported to the laboratory on a daily basis with each batch of aqueous volatile samples. The laboratory will analyze trip blanks as samples.

10.2.3 FIELD DUPLICATE SAMPLES

Field duplicate samples will be collected and used to assess the aggregate precision of sampling techniques and laboratory analysis. For every 20 investigative samples, a field duplicate sample will be collected using standard sampling procedures. This duplicate will be packed and shipped to the laboratory for analysis.

11.0 PERFORMANCE AND SYSTEM AUDITS

For the purpose of external evaluation, performance evaluation check samples are analyzed periodically by the laboratory. Internally, the evaluation of data from these samples is done on a continuing basis over the duration of a given project.

The QA/QC Officer-Sampling and Analytical Activities may carry out performance and/or systems audits to insure that data of known and defensible quality are consistently produced during this program.

Systems audits are qualitative evaluations of all components of field and laboratory quality control measurement systems. They determine if the measurement systems are being used appropriately. The audits may be carried out before all systems are operational, during the program, or after completion of the program. Such audits typically involve a comparison of the activities given in the QA/QC Plan described herein, with activities actually scheduled or performed. A special type of systems audit is the data management audit. This audit addresses only data collection and management activities.

The performance audit is a quantitative evaluation of the measurement systems used for a monitoring program. It requires testing the measurement systems with samples of known composition or behavior to quantitatively evaluate precision and accuracy. A performance audit may be carried out by or under the auspices of the QA/QC Officer-Sampling and Analytical Activities without the knowledge of the analyst during each sampling event for this program.

It should be noted, however, that any additional external QA audits will only be performed if deemed necessary.

12.0 PREVENTATIVE MAINTENANCE

This section applies to both field and laboratory equipment. Specific preventive maintenance procedures for field equipment will be consistent with the manufacturer's guidelines. Specific preventive maintenance protocols for laboratory equipment will be consistent with the contract laboratory's Standard Operating Procedures (SOPs).

All analytical instruments to be used in this project will be serviced by laboratory personnel at regularly scheduled intervals in accordance with the manufacturers' recommendations. Instruments may also be serviced at other times due to failure. Requisite servicing beyond the abilities of laboratory personnel will be performed by the equipment manufacturer or their designated representative.

Routine maintenance of the instruments will be performed as per manufacturers' recommendations. The Laboratory Project Manager is responsible for the preventive maintenance of the instruments.

13.0 SPECIFIC ROUTINE PROCEDURES USES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

13.1 QA MEASUREMENT QUALITY INDICATORS

13.1.1 PRECISION

Precision will be assessed by comparing the analytical results between duplicate spike analyses. Precision as percent relative difference will be calculated as follows for values significantly greater than the associated detection limit:

$$\text{Precision} = \left| \frac{(D_2 - D_1)}{(D_1 + D_2)/2} \right| \times 100$$

- D_1 = matrix spike recovery
- D_2 = matrix spike duplicate spike recovery

For results near the associated detection limits, precision will be assessed based on the following criteria:

$$\text{Precision} = \left| \text{original result - duplicate result} \right| < \text{CRDL}^{1}$$

13.1.2 ACCURACY

Accuracy will be assessed by comparing a set of analytical results to the accepted or "true" values that would be expected. In general, MS/MSD and check sample recoveries will be used to assess accuracy. Accuracy as percent recovery will be calculated as follows:

$$\text{Accuracy} = \frac{A - B}{C} \times 100$$

- A = the analyte determined experimentally from the spike sample
- B = the background level determined by a separate analysis of the unspiked sample
- C = the amount of spike added

1 CRDL - Contract Required Detection Limit.

In some cases, MS and/or MSD recoveries may not be available due to elevated levels of the spiked analyte in the investigative sample. In such cases, accuracy will be assessed based on surrogate spike recoveries and/or laboratory control samples.

13.1.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions.

To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. In addition, all data are reviewed in terms of stated goals in order to determine if the database is sufficient.

When possible, the percent completeness for each set of samples will be calculated as follows:

$$\text{Completeness} = \frac{\text{usable data obtained}}{\text{total data planned}} \times 100 \text{ percent}$$

13.1.4 OUTLIERS

Procedures discussed previously will be followed for documenting deviations. In the event that a result deviates significantly from method established control limits, this deviation will be noted and its effect on the quality of the remaining data assessed and documented.

14.0 CORRECTIVE ACTION

The need for corrective action may be identified by system or performance audits or by standard QC procedures. The essential steps in the corrective actions system will be:

i) checking the predetermined limits for data acceptability beyond which corrective action is required;

ii) identifying and defining problems;

iii) assigning responsibility for investigating the problem;

iv) investigating and determining the cause of the problem;

v) determination of a corrective action to eliminate the problem (this may include reanalysis or resampling and analyses);

vi) assigning and accepting responsibility for implementing the corrective action;

vii) implementing the corrective action and evaluating the effectiveness;

viii) verifying that the corrective action has eliminated the problem; and

ix) documenting the corrective action taken.

For each measurement system, the laboratory QA/QC Officer will be responsible for initiating the corrective action and the Laboratory Project Manager will be responsible for implementing the corrective action.

15.0 QUALITY ASSURANCE REPORTS

Final reports will contain a discussion on QA/QC summarizing the quality of the data collected and/or used as appropriate for each phase of the project. The Project Manager who has responsibility for these summaries, will rely on written reports/memoranda documenting the data assessment activities, performance and systems audits and footnotes identifying qualifications to the data, if any.

Each summary of sampling activities will include a tabulation of the data including:

i) field blank and field duplicate sample results;

ii) maps showing well locations; and

iii) an explanation of any sampling conditions or quality assurance problems and their effect on data quality.

QA reports will be prepared by the QA/QC Officer - Sampling and Analytical Activities following receipt of all analytical data. These reports will include discussions of the following and their effects on the quality of the data reported:

i) sample holding times;

ii) laboratory/reagent blank data;

iii) surrogate spike, MS and MSD data;

iv) field QA/QC data;

v) pertinent instrument performance per method protocols; and

vi) audit results (if performed).

In addition, the QA reports will summarize all QA problems, and give a general assessment of QA results versus control criteria for such parameters as accuracy, precision, etc.

The QA reports will be forwarded to the Project Manager.

TABLE B.4.1

ANALYTICAL PARAMETERS - WATER, SOIL, AIR
REMEDIAL DESIGN/REMEDIAL ACTION
HAZARDOUS WASTE DISPOSAL SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

	CAS Number	*Groundwater Quantitation Limits (µg/L)*	*Soil Quantitation Limits (µg/kg)*	*Air Quantitation Limits (ppbv)*
Volatiles				
1,1,2,2-Tetrachloroethane	79-34-5	10	10	0.20
1,1,2-Trichloroethane	79-00-5	10	10	0.20
1,1-Dichloroethane	75-34-3	10	10	0.20
1,1-Dichloroethylene	75-35-4	10	10	0.20
1,2-Dibromo-3-chloropropane	96-12-8	10	10	-
1,2-Dibromoethane	106-93-4	10	10	0.20
1,2-Dichloroethane	107-06-2	10	10	0.20
1,2-Dichloropropane	78-87-5	10	10	0.20
Bromodichloromethane	75-27-4	10	10	0.20
Bromoform	75-25-2	10	10	0.20
Carbon tetrachloride	56-23-5	10	10	0.20
Chlorobenzene	108-90-7	10	10	0.20
Chloroethane	75-00-3	10	10	0.50
Chloroform	67-66-3	10	10	0.20
cis-1,3-Dichloropropene	10061-01-5	10	10	0.20
Dibromochloromethane	124-48-1	10	10	0.20
Dichlorodifluoromethane	75-71-8	10	10	0.50
m-Dichlorobenzene	541-73-1	10	10	0.20
Bromomethane	74-83-9	10	10	0.20
Chloromethane	74-87-3	10	10	0.50
Methylene chloride	75-09-2	10	10	0.50
o-Dichlorobenzene	95-50-1	10	10	0.20
p-Dichlorobenzene	106-46-7	10	10	0.20
Tetrachloroethylene	127-18-4	10	10	0.20
trans-1,2-Dichloroethylene	156-60-5	10	10	0.20
trans-1,3-Dichloropropene	10061-02-6	10	10	0.20
Trichloroethylene	79-01-6	10	10	0.20
Trichlorofluoromethane	75-69-4	10	10	0.20
Vinyl chloride	75-01-4	10	10	0.20
4-Methyl-2-pentanone	108-10-1	10	10	0.50
2-Butanone	78-93-3	10	10	0.50
Benzene	71-43-2	10	10	0.20
Ethylbenzene	100-41-4	10	10	0.20
Styrene	100-42-5	10	10	0.20
Toluene	108-88-3	10	10	0.20
Xylene(total)	1330-20-7	10	10	0.50
1,1,1-Trichloroethane	71-55-6	10	10	0.20
2-Hexanone	591-78-6	10	10	-
Acetone	67-64-1	10	10	5.0
Carbon disulfide	75-15-0	10	10	0.50
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	10	10	0.20
Methyl Acetate	79-20-9	10	10	-
Methyl tert-Butyl Ether	1634-04-4	10	10	0.50
cis-1,2-Dichloroethene	156-59-2	10	10	0.20
Cyclohexane	110-82-7	10	10	0.20
Methylcyclohexane	108-87-2	10	10	-
Isopropylbenzene	98-82-8	10	10	-
1,2,4-Trichlorobenzene	120-82-1	10	10	0.50

Note:

- Not applicable.

TABLE B.4.2

ANALYTICAL PARAMETERS - WASTE CHARACTERIZATION
REMEDIAL DESIGN/REMEDIAL ACTION
HAZARDOUS WASTE DISPOSAL SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

Parameters	*Regulatory Limits*
TCLP Volatiles (mg/L)	
Vinyl chloride	0.2
1,1-Dichloroethene	0.7
Chloroform	6.0
1,2-Dichloroethane	0.5
2-Butanone	200
Carbon Tetrachloride	0.5
Trichloroethene	0.5
Benzene	0.5
Tetrachloroethene	0.7
Chlorobenzene	100
TCLP Semi-Volatiles (mg/L)	
Pyridine	5.0
1,4-Dichlorobenzene	7.5
2-Methylphenol	200
3- and/or 4-Methylphenol	200
Hexachloroethane	3.0
Nitrobenzene	2.0
Hexachlorobutadiene	0.5
2,4,6-Trichlorophenol	2.0
2,4,5-Trichlorophenol	400
2,4-Dinitrotoluene	0.13
Hexachlorobenzene	0.13
Pentachlorophenol	100
TCLP Metals (mg/L)	
Silver	5.0
Arsenic	5.0
Barium	100
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
RCRA Characteristics	
Ignitability (° F)	<140
Cyanide, Reactive (mg/kg)	250
Corrosivity by pH (S. U.)	2.0-12.5
Sulfide, Reactive (mg/kg)	500
Polychlorinated Biphenyls (ug/kg)	
Aroclor-1016	33
Aroclor-1221	67
Aroclor-1232	33
Aroclor-1242	33
Aroclor-1248	33
Aroclor-1254	33
Aroclor-1260	33

Note:

TCLP - Toxicity Characteristic Leaching Procedures.

TABLE B.4.3

SAMPLING AND ANALYSIS SUMMARY
REMEDIAL DESIGN/REMEDIAL ACTION
HAZARDOUS WASTE DISPOSAL SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

Analytical Parameter	*Matrix*	*Analytical Method*	*Estimated No. of Samples/Event*	*Field Duplicates*	*Trip Blanks*	*MS/MSD*	*No. of Events*
Predesign Activities							
TCL VOCs	Soil	SW-846-8260B(1)	6	1	-	1/1	1
TCL VOCs	Groundwater	SW-846-8260B(1)	20	1	1 per day	1/1	1
Baseline							
TCL VOCs	Groundwater	SW-846-8260B(1)	15	1	1 per day	1/1	1
Groundwater Monitoring - first year							
TCL VOCs	Groundwater	SW-846-8260B(1)	15	1	1 per day	1/1	4
TCL VOCs	Groundwater	SW-846-8260B(1)	6	1	1 per day	1/1	2
Groundwater Monitoring - second year							
TCL VOCs	Groundwater	SW-846-8260B(1)	15	1	1 per day	1/1	4
TCL VOCs	Groundwater	SW-846-8260B(1)	6	1	1 per day	1/1	2
Groundwater Monitoring - third year							
TCL VOCs	Groundwater	SW-846-8260B(1)	15	1	1 per day	1/1	2
Confirmatory Sampling							
TCL VOCs	Soil	SW-846-8260B(1)	12	1	-	1/1	2
Soil Vapor Extraction							
TCL VOCs	Air	TO-15	1	-	-	-	13
Waste Characterization							
TCLP VOCs	Soil Cuttings/Purge Water	SW-846 1311/8260	3	-	-	-	1
TCLP SVOCs	Soil Cuttings/Purge Water	SW-846 1311/8270	3	-	-	-	1
TCLP Metals	Soil Cuttings/Purge Water	SW-8461311/6010/7470	3	-	-	-	1
TCL PCBs	Soil Cuttings/Purge Water	SW-846 8082	3	-	-	-	1
RCRA Character	Soil Cuttings/Purge Water	ignit, corr, react	3	-	-	-	1

Notes:

- \- Not applicable.
- MS Matrix Spike.
- MSD Matrix Spike Duplicate.
- PCB Polychlorinated Biphenyl.
- RCRA Resource Conservation and Recovery Act.
- TCL Target Compound List.
- TCLP Toxicity Characteristic Leaching Procedure.
- VOC Volatile Organic Compound.

TABLE B.5.1

SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME PERIODS
REMEDIAL DESIGN/REMEDIAL ACTION
HAZARDOUS WASTE DISPOSAL SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

Analyses	*Samples Containers*	*Preservation*	*Maximum Holding Time*	*Notes*
Groundwater				
VOCs	Three 40 mL glass vials Teflon-lined septum	Cool 4°C pH<2 HCl	14 days from collection to analysis	Fill completely with no head space
TCLP VOCS	Three 40 mL glass vials Teflon-lined septum	Cool 4°C	7 days from collection to leaching 14 days from leaching to analysis	Fill completely with no head space
TCLP SVOCS	1 L Amber	Cool 4°C	7 days from collection to leaching 7 days from leaching to extraction 40 days from extraction to analysis	Fill completely
TCLP Metals	1-500 ml HDPE	Cool 4°C	180 days from collection to leaching 180 days from leaching to analysis	Fill completely
RCRA Characteristics	2-500ml HDPE	Cool 4°C	Analyze immediately	Fill completely
Soil				
VOCs	1-2oz jar	Cool 4°C	14 days from collection to analysis	Fill completely with no head space
TCLP VOCS	1-2oz jar	Cool 4°C	14 days from collection to leaching 14 days from leaching to analysis	Fill completely with no head space
TCLP SVOCS	1-8 oz jar	Cool 4°C	14 days from collection to leaching 7 days from leaching to extraction 40 days from extraction to analysis	Fill completely
TCLP Metals	1-8 oz jar	Cool 4°C	180 days from collection to leaching 180 days from leaching to analysis	Fill completely
RCRA Characteristics	1-8 oz jar	Cool 4°C	Analyze immediately	Fill completely
Air				
VOCs	summa cannister	-	30 days from collection to analysis	Fill completely

Notes:

- \- Not applicable.
- RCRA Resource Conservation and Recovery Act.
- SVOC Semi-Volatile Organic Compound.
- TCLP Toxicity Characteristic Leaching Procedure.

TABLE B.9.1

LABORATORY REPORTING DELIVERABLES - FULL
REMEDIAL DESIGN/REMEDIAL ACTION
HAZARDOUS WASTE DISPOSAL SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

A detailed report narrative should accompany each submission, summarizing the contents and results.

A. Chain of Custody Documentation and Detailed Narrative [(1)]

B. Sample Information
1. date collected
2. date extracted or digested
3. date analyzed
4. analytical method and reference

C. Data (including all raw data and CLP-like summary forms)
1. samples
2. laboratory duplicates [(2)]
3. method blanks
4. spikes, spike duplicates [(2)] [(3)]
5. surrogate recoveries [(2)]
6. internal standard recoveries
7. calibration
8. any other applicable quality control (QC) data (e.g., serial dilution)
9. tentatively identified compounds (TICs) (if applicable)

D. Miscellaneous
1. method detection limits and/or instrument detection limits
2. percent solids (where applicable)
3. metals run logs
4. standard preparation logs
5. sample preparation logs

All sample data and its corresponding quality assurance/quality control (QA/QC) data shall be maintained accessible to CRA either in hard copy or on magnetic tape or disc (computer data files). All solid sample results must be reported on a dry-weight basis.

Notes:

(1) Any QC outliers must be addressed and corrective action taken must be specified.
(2) Laboratory must specify applicable control limits for all QC sample results.
(3) A blank spike must be prepared and analyzed with each sample batch.
(4) Tentatively Identified Compounds (TICs).

TABLE B.9.2

LABORATORY REPORTING DELIVERABLES-STANDARD
REMEDIAL DESIGN/REMEDIAL ACTION
HAZARDOUS WASTE DISPOSAL SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

A detailed report narrative should accompany each submission, summarizing the contents and results.

A. Chain of Custody Documentation and Detailed Narrative (1)

B. Sample Information
   1. date collected
   2. date extracted or digested
   3. date analyzed
   4. analytical method and reference

C. Final Results
   1. samples
   2. laboratory duplicates (2)
   3. method blanks
   4. spikes, spike duplicates (2) (3)
   5. surrogate recoveries (2)
   6. internal standard recoveries
   7. tentatively identified compounds (TICs) (if applicable)

D. Miscellaneous
   1. method detection limits and/or instrument detection limits
   2. percent solids (where applicable)
   3. metals run logs
   4. sample preparation logs

All sample data and its corresponding quality assurance/quality control (QA/QC) data shall be maintained accessible to CRA either in hard copy or on magnetic tape or disc (computer data files). All solid sample results must be reported on a dry-weight basis.

Notes:

(1) Any QC outliers must be addressed and corrective action taken must be specified.
(2) Laboratory must specify applicable control limits for all QC sample results.
(3) A blank spike must be prepared and analyzed with each sample batch.

APPENDIX C

FIELD SAMPLING PLAN

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This appendix presents the Field Sampling Plan (FSP) for the Remedial Design/ Remedial Action (RD/RA) Work Plan for the Hazardous Waste Disposal (HWD) Site located at 11A Picone Boulevard in the Village of Farmingdale, Suffolk County, New York (Site). This report outlines the protocols which will be followed during the following activities:

- Installation of soil borings;
- Collection of subsurface soil samples;
- Collection of hydropunch groundwater samples;
- Installation of groundwater monitoring wells;
- Sampling of groundwater monitoring wells;
- Equipment cleaning; and
- Waste handling.

2.0 GENERAL SAMPLING PROTOCOLS

The following general sampling procedures will be conducted for all sampling activities presented in this FSP.

1) Prior to sampling at each location, all sampling instruments and equipment will be cleaned in accordance with the protocols presented in Section 8.0.
2) Disposable gloves will be worn by samplers and changed between sampling points. Additional glove changes will be undertaken as necessary.
3) All sampling generated wastes such as gloves, tyveks, etc., will be collected and consolidated with the waste material for proper disposal.
4) Samples will be labeled noting the location and/or interval, analysis required, preservative added, date, time, and sampler's initials. A hardcover bound field book will be maintained to record all samples and sampling events. Details regarding recordkeeping and labeling are presented in the QAPP (Appendix B).
5) Sample containers will be packed loosely in laboratory-supplied coolers to allow for placement of cushioning materials (i.e., vermiculite) between bottles to prevent breakage.
6) Following packing of the sample cooler, the completed chain-of-custody (see Section 7.0) will be placed in a watertight plastic bag and attached to the inside of the cooler lid.
7) A signed custody seal will be placed across the cooler closure and the cooler will then be sealed with packing tape. The packing tape will not completely cover the seal.
8) Samples will be handled and shipped in accordance with the protocols described in the QAPP.
9) All samples will be delivered to the laboratory via an overnight courier.
10) At the laboratory, all samples will be stored at 4°C (±2°C).

3.0 GEOPROBE® SOIL SAMPLING

As presented in the RD/RA Work Plan, seven Geoprobe® boreholes will be advanced during the pre-design investigation and additional borings will be advanced to collect confirmation samples from the soil treatment area. Pre-design borehole locations are presented on Figure 5.3 of the RD/RA Work Plan.

During advancement of the Geoprobe® boreholes, soil samples will be collected using a MacroCore™ soil sampler (or equivalent). The operation of the direct-push/ MacroCore™ soil sampler (or equivalent) consists of using a direct-push soil probing machine to drive the sampler into the subsurface and then retrieving the sampler by using the rig to pull on the rod attached to the sampler. The collected soil core is contained within an internal soil liner (acetate, polyethylene, or Teflon®) and removed from the sampler once returned to the ground surface. Sampler length is variable depending on equipment available (2 feet, 4 feet, 5 feet). Once the soil liner has been removed and the outer sampler decontaminated, a new liner is inserted and the sampler reassembled. The clean sampler is then driven back down the same hole to collect the next soil sample.

The Macro-Core™ sampler can be used in either the open-tube or closed-point sampling mode. The open-core sample mode is most commonly used in stable soil conditions. In unstable soils, the piston rod point system prevents collapsed soil from entering the sampler as it is advanced back down the hole. Once at the sample depth, the piston rod is unthreaded and released. The sampler is then driven into the subsurface to fill the sampler with soil, the piston point rides on top of the soil, as it enters the sampler.

Once recovered, the soil liner with collected soils will be opened (cut lengthwise) and examined to collect soil screening information (PID screening), soil logging information, and collect soils for laboratory analysis. For the pre-design soil investigation, one soil samples will be collected from each borehole location (i.e., a total of six samples from six locations). Soil samples will be collected from the intervals with the highest PID reading and submitted for analyses. For the confirmatory soil sampling, one soil sample will be collected from each borehole from the interval with the highest PID reading and submitted for analyses. EnCore samplers will be used to collect soil samples for VOC analyses. Soil samples will be visually described and classified according to the Unified Soil Classification System by the field geologist or engineer.

4.0 HYDROPUNCH GROUNDWATER SAMPLING

During the pre-design investigation, a total of ten boreholes will be advanced at the locations presented on Figure 5.1 of the RD/RA Work Plan and two groundwater samples will be collected at each location. The groundwater samples will be collected near the groundwater table and at a depth of approximately 20 feet below the groundwater table. At each location, boreholes will be advanced using a Geoprobe® as described in Section 3.0. Once the borehole has been advanced to the required sampling depth, a Hydropunch or suitable equivalent sampling technique will be used to collect groundwater samples. At these locations, upon penetrating the groundwater table with the Geoprobe®, the probe rods will be retrieved and replaced with a lead rod equipped with a PVC well screen. Following re-insertion of the rods and well screen to the bottom of the borehole, the rods will be raised approximately 1.5 feet to expose the well screen. A foot valve/Teflon® tubing assembly will be lowered through the rods to the top of the well screen and a sufficient volume of groundwater will be collected for the required analyses.

At the completion of the soil boring, the borehole annulus will be abandoned by grouting to the ground surface with bentonite grout.

5.0 MONITORING WELL INSTALLATION AND DEVELOPMENT

A total of four new monitoring wells are proposed to be installed at the approximate locations shown on Figure 5.2 of the RD/RA Work Plan. Final new monitoring well locations will be presented in the Remedial Design. At each new monitoring well location, a borehole will be advanced to the required depth using hollow-stem augers with a minimum inside diameter of 3 1/4 inches. Continuous split-spoon sampling will be performed during augering. The split-spoon sampler will be attached to the drill rod and driven into the soil the full depth (24 inches) using a 140-pound hammer, free-falling 30 inches. The driving resistance (number of hammer blows) will be recorded for each 6-inch increment of penetration. If the soil is loose, wet, or in any way unconsolidated, clean basket retainers will be used to retain the soil in the split spoon. Between samples, the split spoon will be cleaned as described in Section 7.0.

Each split spoon will be visually examined for chemical presence and logged for geologic stratigraphy according to the Unified Soil Classification System by an experienced field geologist or engineer. Soil descriptions will be written on stratigraphic log sheets, as presented in Attachment C-2.

Each monitoring well will be constructed with 2-inch diameter, No. 10 slotted PVC well screen, and 2-inch diameter PVC riser pipe. The well screen may vary in length from 5 to 10 feet depending upon the depth of the monitoring well. A sand pack consisting of No. 4 silica sand will be placed around the well screen to a height of approximately 2 feet above the top of the screen. A 2± foot thick bentonite plug will be placed above the sand pack. The remainder of the borehole annulus will be grouted to the surface with bentonite-cement grout tremied in place using the positive displacement method. All wells will be constructed as flush-mount wells. A typical well construction detail is presented on Figure C.1. Following the installation of each monitoring well, the location and riser pipe elevation will be surveyed. Monitoring well details will be presented on well construction logs, as presented in Attachment C-2. Also, all samples will be recorded on sample log sheets.

All newly installed groundwater monitoring wells will be developed to a silt-free condition of 50 nephelometric turbidity units (NTUs) or less, if possible, prior to the first sampling round in accordance with the following protocol:

1) All personnel involved in well development will wear protective clothing including Tyvek coveralls, rubber boots and rubber gloves.

2) All wells will be developed to a silt-free condition of 50 NTUs or less, if possible, following installation, by bailing, pumping or air lift pumping.

3) Water levels in all wells will be measured to ±0.01 foot prior to development utilizing an electronic water level meter in accordance with Section 6.1.

4) After each well volume is removed, a sample will be collected and analyzed for turbidity, temperature, pH, and conductivity. Development will continue until two consecutive and consistent readings of temperature, pH, and conductivity are obtained and the turbidity is less than 50 NTUs, if possible. Readings will be considered consistent if consecutive conductivity, temperature, and pH values are within 10 percent of each other. In the event that these field conditions cannot be met, development will continue to a silt-free condition of less than 50 NTUs, if possible, or until a maximum of ten well volumes have been removed.

5) In wells where recharge is insufficient to conduct the development protocol described in Item 4 above, the well will be pumped/bailed to dryness on three consecutive days.

6) Acceptable methods of water extraction during development include bailers, peristaltic pumps, bladder pumps, Waterra pumps, centrifugal and submersible pumps. The development method selected will be based upon the well depth, the water level in the well, and the recharge characteristics.

7) All water extraction equipment will be cleaned in accordance with the protocols presented in Section 7.0.

8) All development water will be collected, stored, analyzed, and disposed of in accordance with State and Federal regulations.

6.0 MONITORING WELL SAMPLING

6.1 WATER LEVEL MEASUREMENTS

Water level measurements will be taken prior to well development, purging, and sampling.

Prior to measuring water levels, a survey mark will be placed on the riser pipe for use as a measuring point and the elevation of this measuring point will be surveyed to an accuracy of 0.01 feet.

The water levels will be obtained by measuring the distance from the top of the well riser to the top of the water column using a electronic water level meter. Measurements will be obtained to ±0.01-foot accuracy.

Water level measurements taken for the determination of groundwater flow direction and hydraulic gradient will be measured within a 24-hour period for all wells. Water levels will be allowed to stabilize for a minimum of 24 hours after well construction and development, prior to measurement. Recovery may take longer for low yield wells.

Water level measuring equipment that comes in contact with well water will be cleaned in accordance with Section 7.0 to ensure that cross-contamination does not occur.

6.2 MONITORING WELL PURGING AND GROUNDWATER SAMPLING

Groundwater sampling will be conducted using low-flow purge and sampling methods as described in EPA/540/S-95/504, dated April 1996 (see Attachment C-1 to this Appendix). During purging of the well, turbidity will be measured in the field with a nephelometer and the field indicator parameters temperature, conductivity, and pH will be measured by a multi-meter monitor.

All monitoring wells will be sampled, and groundwater samples will be analyzed for VOCs using Method 8260.

7.0 SAMPLING EQUIPMENT CLEANING

Prior to mobilization of the drill rig it shall be thoroughly cleaned to remove oil, grease, mud, and other foreign matter. Subsequently, before initiating drilling at each borehole, samplers, drill steel, and associated equipment will be cleaned to prevent cross-contamination from the previous drilling location. All cleaning will be conducted at the on-Site decontamination pad. Cleaning will be accomplished by flushing and wiping the components to remove all visible sediments followed by thorough high pressure water wash. Special attention will be given to the threaded sections of the drill rods and the soil samples.

Reusable sampling equipment will be cleaned between sampling events using the following rinse sequence.

1) Wash and scrub with tap water and low phosphate detergent.
2) Rinse with tap water.
3) Rinse with methanol.
4) Thoroughly rinse with deionized demonstrated analyte-free water. The volume of water used must be at least five times the volume of solvent used in step 3).
5) Air dry for 15 minutes.
6) Following the final rinse, sampling equipment will be visually inspected to verify that it is free of particulates and other solid material which may contribute to possible sample cross-contamination. Fluids used for cleaning will not be recycled. Washwater, rinse water, and decontamination fluids will be collected and disposed of in accordance with applicable regulations.

8.0 CHAIN OF CUSTODY

Samples will remain under the control of the sampling personnel in the field until relinquished to the delivery firm or directly to the laboratory. Chain-of-custody documents will be completed for each cooler. The original and two copies will be placed within the cooler. The fourth copy will be retained by the sampler. In addition, Field Sampling Data Sheets and a sample log of samples collected and shipped off Site will be maintained on Site. A sample chain-of-custody is presented in Attachment C-2.

9.0 WASTE HANDLING

All soil cuttings brought to the surface will be collected in 55-gallon DOT-approved drums and transferred to an on-Site interim drum staging area. Any borehole fluid will also be contained, collected, and transferred to an on-Site drum staging area. All wastes will be sampled and analyzed, and will be disposed of in accordance with State and Federal regulations.

All coveralls, gloves, etc., will be collected in plastic bags for disposal.

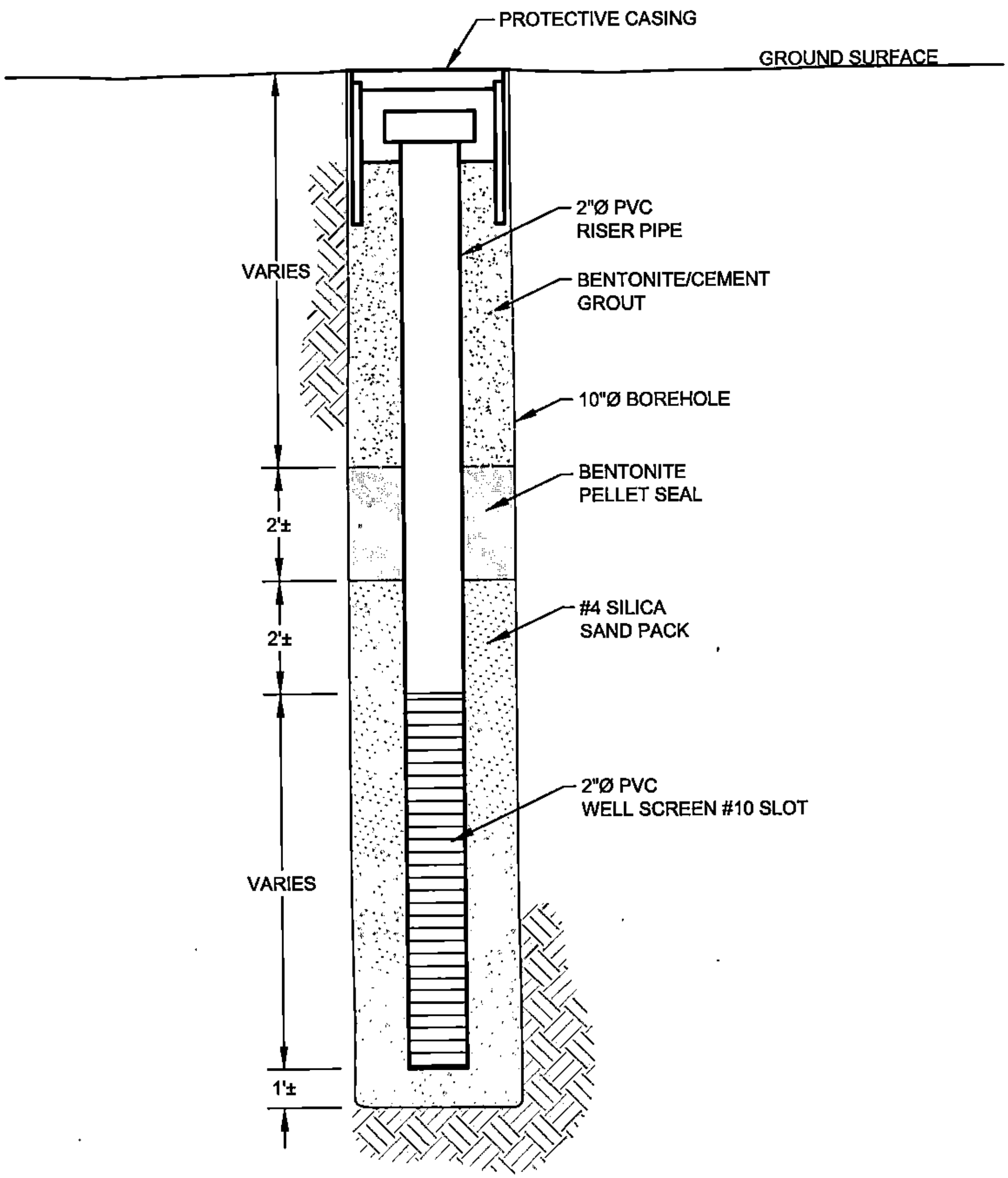


figure C.1

TYPICAL OVERBURDEN GROUNDWATER
MONITORING WELL DETAIL
RD/RA WORK PLAN
Farmingdale, New York

50138-00(002)GN-WA013 OCT 19/2007

ATTACHMENT C-1

LOW-FLOW (MINIMUM DRAWDOWN) GROUNDWATER SAMPLING PROCEDURES
EPA/540/S-95/504, APRIL 1996

United States Environmental Protection Agency
Office of Research and Development
Office of Solid Waste and Emergency Response
EPA/540/S-95/504
April 1996

EPA Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls[1] and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

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I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it became apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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Superfund Technology Support Center for Ground Water

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chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

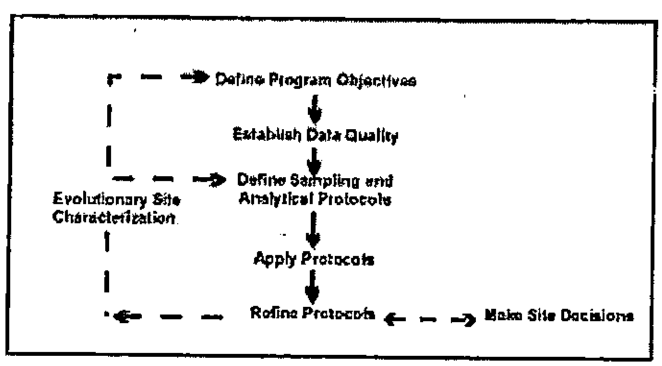


Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action.*

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g., pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over <u>any</u> other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO_2 composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 µm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

   a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

   b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop – A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described herein as part of its in-house research program and under Contract No. 68-C4-0031 to Dynamac Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

VIII. References

Backhus, D.A., J.N. Ryan, D.M. Groher, J.K. McFarlane, and P.M. Gschwend. 1993. Sampling Colloids and Colloid-Associated Contaminants in Ground Water. *Ground Water*, 31(3):466-479.

Barcelona, M.J., J.A. Helfrich, E.E. Garske, and J.P. Gibb. 1984. A laboratory evaluation of groundwater sampling mechanisms. *Ground Water Monitoring Review*, 4(2):32-41.

Barcelona, M.J. and J.A. Helfrich. 1986. Well construction and purging effects on ground-water samples. *Environ. Sci. Technol.*, 20(11):1179-1184.

Barcelona, M.J., H.A. Wehrmann, and M.D. Varljen. 1994. Reproducible well purging procedures and VOC stabilization criteria for ground-water sampling. *Ground Water*, 32(1):12-22.

Buddemeier, R.W. and J.R. Hunt. 1988. Transport of Colloidal Contaminants in Ground Water: Radionuclide Migration at the Nevada Test Site. *Applied Geochemistry*, 3: 535-548.

Danielsson, L.G. 1982. On the Use of Filters for Distinguishing Between Dissolved and Particulate Fractions in Natural Waters. *Water Research*, 16:179.

Enfield, C.G. and G. Bengtsson. 1988. Macromolecular Transport of Hydrophobic Contaminants in Aqueous Environments. *Ground Water*, 26(1): 64-70.

Gschwend, P.M. and M.D. Reynolds. 1987. Monodisperse Ferrous Phosphate Colloids in an Anoxic Groundwater Plume, *J. of Contaminant Hydrol.*, 1: 309-327.

Herzog, B., J. Pennino, and G. Nielsen. 1991. Ground-Water Sampling. In **Practical Handbook of Ground-Water Monitoring** (D.M. Nielsen, ed.). Lewis Publ., Chelsea, MI, pp. 449-499.

Horowitz, A.J., K.A. Elrick, and M.R. Colberg. 1992. The effect of membrane filtration artifacts on dissolved trace element concentrations. *Water Res.*, 26(6):753-763.

Laxen, D.P.H. and I.M. Chandler. 1982. Comparison of Filtration Techniques for Size Distribution in Freshwaters. *Analytical Chemistry*, 54(8):1350.

McCarthy, J.F. and J.M. Zachara. 1989. Subsurface Transport of Contaminants, *Environ. Sci. Technol.*, 5(23):496-502.

McCarthy, J.F. and C. Degueldre. 1993. Sampling and Characterization of Colloids and Ground Water for Studying Their Role in Contaminant Transport. In: Environmental Particles (J. Buffle and H.P. van Leeuwen, eds.), Lewis Publ., Chelsea, MI, pp. 247-315.

Parker, L.V. 1994. The Effects of Ground Water Sampling Devices on Water Quality: A Literature Review. *Ground Water Monitoring and Remediation*, 14(2):130-141.

Penrose, W.R., W.L. Polzer, E.H. Essington, D.M. Nelson, and K.A. Orlandini. 1990. Mobility of Plutonium and Americium through a Shallow Aquifer in a Semiarid Region, *Environ. Sci. Technol.*, 24:228-234.

Puls, R.W. and M.J. Barcelona. 1989. Filtration of Ground Water Samples for Metals Analyses. *Hazardous Waste and Hazardous Materials*, 6(4):385-393.

Puls, R.W., J.H. Eychaner, and R.M. Powell. 1990. Colloidal-Facilitated Transport of Inorganic Contaminants in Ground Water: Part I. Sampling Considerations. EPA/600/M-90/023, NTIS PB 91-168419.

Puls, R.W. 1990. Colloidal Considerations in Groundwater Sampling and Contaminant Transport Predictions. *Nuclear Safety*, 31(1):58-65.

Puls, R.W. and R.M. Powell. 1992. Acquisition of Representative Ground Water Quality Samples for Metals. *Ground Water Monitoring Review*, 12(3):167-176.

Puls, R.W., D.A. Clark, B.Bledsoe, R.M. Powell, and C.J. Paul. 1992. Metals in Ground Water: Sampling Artifacts and Reproducibility. *Hazardous Waste and Hazardous Materials*, 9(2): 149-162.

Puls, R.W. and C.J. Paul. 1995. Low-Flow Purging and Sampling of Ground-Water Monitoring Wells with Dedicated Systems. *Ground Water Monitoring and Remediation*, 15(1):116-123.

Ryan, J.N. and P.M. Gschwend. 1990. Colloid Mobilization in Two Atlantic Coastal Plain Aquifers. *Water Resour. Res.*, 26: 307-322.

Thurnblad, T. 1994. Ground Water Sampling Guidance: Development of Sampling Plans, Sampling Protocols, and Sampling Reports. Minnesota Pollution Control Agency.

U. S. EPA. 1992. RCRA Ground-Water Monitoring: Draft Technical Guidance. Office of Solid Waste, Washington, DC EPA/530/R-93/001, NTIS PB 93-139350.

U. S. EPA. 1995. Ground Water Sampling Workshop -- A Workshop Summary, Dallas, TX, November 30 - December 2, 1993. EPA/600/R-94/205, NTIS PB 95-193249, 126 pp.

U. S. EPA. 1982. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846. Office of Solid Waste and Emergency Response, Washington, D.C.

ATTACHMENT C-2

FIELD FORMS

STRATIGRAPHY LOG (OVERBURDEN)

PAGE ____ OF ____

PROJECT NAME ______________________
PROJECT NUMBER ______________________
CLIENT ______________________
LOCATION ______________________

DRILLING CONTRACTOR ______________________
DRILLER ______________________
SURFACE ELEVATION ______________________
WEATHER (A.M.) ______________________
(P.M.) ______________________

HOLE DESIGNATION ______________________
DATE/TIME STARTED ______________________
DATE/TIME COMPLETED ______________________
DRILLING METHOD ______________________
CRA SUPERVISOR ______________________

STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS)			SAMPLE DESCRIPTION	SAMPLE DETAILS										
FROM	AT	TO	ORDER OF DESCRIPTORS: SOIL TYPE SYMBOL(S) – MAIN COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/CONSISTENCY, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT).	SAMPLE #	SAMPLING METHOD	PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES) 6"	6"	6"	6"	SAMPLE INTERVAL	PID/FID (ppm)	CHEMICAL ANALYSIS	GRAIN SIZE	

NOTES AND COMMENTS

DEPTH OF BOREHOLE CAVING ________ DEPTH OF FIRST GROUNDWATER ENCOUNTER ________ TOPSOIL THICKNESS ________
WATER LEVEL IN OPEN BOREHOLE ON COMPLETION ________, AFTER ____ HOURS ____
COMPLETION DETAILS: ______________________

CRA

NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.

OVERBURDEN INSTRUMENTATION LOG

PROJECT NAME ____________ HOLE DESIGNATION ____________

PROJECT NUMBER ____________ DATE COMPLETED ____________

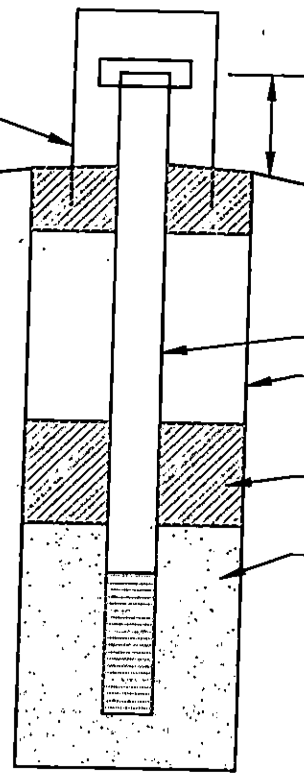
CLIENT ____________ DRILLING METHOD ____________

LOCATION ____________ CRA SUPERVISOR ____________

CAP TYPE ____________

PROTECTIVE CASING

GROUND



STICK UP = ____________ ft/m

SURFACE SEAL TYPE ____________

WELL CASING

ANNULUS BACKFILL TYPE: ____________

TOP OF SEAL* AT ________ ft/m ________

SEAL TYPE: ____________

BOTTOM OF SEAL* AT ________ ft/m ________

TOP OF SCREEN* AT ________ ft/m ________

PACK TYPE: –SAND, SIZE ____________
–GRAVEL
–NATURAL

BOTTOM OF SCREEN* AT ________ ft/m ________

BOTTOM OF HOLE* AT ________ ft/m ________

* NOTE:
ALL DIMENSIONS ARE BELOW GROUND SURFACE (BGS)

SCREEN TYPE: ☐ continuous slot ☐ perforated ☐ louvre ☐ other: ____________

SCREEN MATERIAL: ☐ stainless steel ☐ plastic ☐ other: ____________

SCREEN LENGTH: ________ ft/m SCREEN DIAMETER: ________ in/cm SCREEN SLOT SIZE: ________

WELL CASING MATERIAL: ____________ WELL CASING DIAMETER: ____________ in/cm

HOLE DIAMETER: ____________

DEVELOPMENT: METHOD: ____________ DURATION: ____________

CRA

WELL DEVELOPMENT AND STABILIZATION FORM

PROJECT NAME: ____________________ PROJECT NO.: __________

DATE OF WELL DEVELOPMENT: ____________________

DEVELOPMENT CREW MEMBERS: ____________________

PURGING METHOD: ____________________

SAMPLE NO.: ____________________

SAMPLE TIME: ____________________

WELL INFORMATION

WELL NUMBER: ____________________

WELL TYPE (diameter/material) ____________________

MEASURING POINT ELEVATION: ____________________

STATIC WATER DEPTH: ____________________ ELEVATION: __________

BOTTOM DEPTH: ____________________ ELEVATION: __________

WATER COLUMN LENGTH: ____________________

SCREENED INTERVAL: ____________________

WELL VOLUME: ____________________

Note: For 2-inch diameter well: 1 foot = 0.14 gallons (imp) or 0.16 gallons (us)
1 meter = 2 liters

	UNITS	1	2	3	4	5	*TOTAL/ AVERAGE*
VOLUME PURGED (volume/total volume):							
FIELD pH:							
FIELD TEMPERATURE:							
FIELD CONDUCTIVITY:							
CLARITY/TURBIDITY VALUES:							
COLOR:							
ODOR:							
COMMENTS:							

COPIES TO: ____________________

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: ______________________

Ref. No.: ______________________

Date: ______________________

Personnel: ______________________

____

Monitoring Well Data:

Well No.: ______________________

Measurement Point: ______________________

Constructed Well Depth (ft): ______________________

Measured Well Depth (ft): ______________________

Depth of Sediment (ft): ______________________

Screen Length (ft): ______________________

Depth to Pump Intake (ft)[1]: ______________________

Well Diameter, D (in): ______________________

Well Screen Volume, V_s (mL)[2]: ______________________

Initial Depth to Water (ft): ______________________

Time	*Pumping Rate (mL/min)*	*Depth to Water (ft)*	*Drawdown from Initial Water Level[3] (ft)*	*pH*	*Temperature °C*	*Conductivity (mS/cm)*	*ORP (mV)*	*DO (mg/L)*	*Turbidity (NTU)*	*Volume Purged, V_P (mL)*	*No. of Well Screen Volumes Purged[4]*

Notes:

(1) The pump intake will be placed at the well screen mid-point or at a minimum of 2 ft above any sediment accumulated at the well bottom.

(2) The well screen volume will be based on a 5-foot screen length, $V_s=p*(D/2)^2*(5*12)*(2.54)^3$

(3) The drawdown from the initial water level should not exceed 0.3 ft.

(4) Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stablization criteria and appear to be stablizing), No. of Well Screen Volumes Purged= Vp/Vs.

SAMPLE COLLECTION DATA SHEET - GROUNDWATER SAMPLING PROGRAM

PROJECT NAME ______________________ PROJECT NO. ______________________

SAMPLING CREW MEMBERS ______________________ SUPERVISOR ______________________

DATE OF SAMPLE COLLECTION ______________________

[Note: For 2" dia. well, 1 ft. = 0.14 gal (imp) or 0.16 gal (us)]

Sample I.D. Number	Well Number	Measuring Point Elev. (ft. AMSL)	Bottom Depth (ft. btoc)	Water Depth (ft. btoc)	Water Elevation (ft. AMSL)	Well Volume (gallons)	Bailer Volume No. Bails	Volume Purged (gallons)	Field pH	Field Temp.	Field Cond.	Time	Sample Description & Analysis

Additional Comments: ______________________

Copies to: ______________________

CRA

APPENDIX D

OPERATION, MAINTENANCE, AND MONITORING PLAN

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF ATTACHMENTS

1.0 INTRODUCTION

The Hazardous Waste Disposal (HWD) Site is located at 11A Picone Boulevard in the Village of Farmingdale, Suffolk County, New York as shown on Figure 1.1 of the RD Report. In December 2004, New York State Department of Environmental Conservation (NYSDEC) issued a Record of Decision (ROD) that selected remedy for the Site that included soil treatment using either in situ chemical oxidation (ISCO) or soil vapor extraction (SVE) and groundwater treatment using either ISCO or air sparging. In June 2007, the HWD Group and NYSDEC entered into a Consent Order to conduct and implement a Remedial Design/Remedial Action (RD/RA) Work Plan for the Site. The objective of the RD/RA Work Plan is to provide for the development and implementation of final plans and specifications for implementing the remedial alternative set forth in the NYSDEC December 2004 ROD. The Operations, Maintenance, and Monitoring Work Plan is a support plan for the RD/RA Work Plan.

This Operations, Maintenance, and Monitoring (OM&M) Work Plan was prepared to fulfill the HWD Group's requirement for a RD/RA Work Plan under the Consent Order. The requirements for the OM&M Work Plan are set forth in Exhibit K of the Consent Order.

The OM&M Work Plan is organized as follows:

Section 1.0 – Introduction;

Section 2.0 – Background Information;

Section 3.0 – Description of Active Sub-Slab Depressurization System;

Section 4.0 – Operations of Existing and Future Systems;

Section 5.0 – Equipment for Existing and Future Systems;

Section 6.0 – Inspections and Maintenance of Existing and Future Systems;

Section 7.0 – Contingency Plan; and

Section 8.0 – Determination That Remedial Action Objectives are Achieved.

2.0 BACKGROUND INFORMATION

The Site is located at 11A Picone Boulevard in the Village of Farmingdale, Suffolk County, New York and is identified as part of Tax Lot 31.004 in the Suffolk County, New York tax maps. A Site location map is presented as Figure 1.1. The Site is approximately 0.5 acres in size and includes an approximately 10,000-square-foot area where hazardous waste storage, transfer, and recycling operations were historically conducted. The Site is currently owned by Little Joseph Realty, Inc. Guaranteed Overnight Delivery, Inc., an overnight delivery service, currently leases the property from Little Joseph Realty for use as a truck/tractor-trailer parking lot. The Site is covered by a concrete slab that is approximately 6 to 8 inches thick. Select areas of the slab have been repaired/replaced with bituminous asphalt pavement.

Access to the Site is limited by a chain-link fence to the north, east, and south of the Site, and a concrete wall associated with a storage yard west of the Site. The Site is accessible from Picone Boulevard through a gate along the southern Site boundary, and from a paved driveway that enters the northwestern portion of the Site.

Land use in the vicinity of the Site is predominantly commercial/industrial. South of the Site, across Picone Boulevard, is a one-story commercial building occupied by R&D Carpet and Tile (R&D) and Ryder Truck. The R&D side of the building includes a garage area used to store new carpet and various adhesives, coatings/sealers, base fillers, cleaners, paints/stains, etc., and an office area/showroom. Ryder Truck operations make up the west side of the R&D building. The Ryder Truck portion of the building is primarily used as a service garage for medium- and heavy-duty trucks. A one-story building occupied by Ford Brand Service is located west of the Site, immediately west of the storage yard. The Fort Brand Service building is primarily used as a service garage for heavy equipment used in connection with the aviation industry. A furniture warehouse is located west of the Fort Brand Service building. Parking lots for trucking companies/commercial facilities border the Site to the north, east, and southeast.

HWD, Inc. operated as a hazardous waste storage, transfer, and recycling facility at the Site from approximately 1979 to 1982. Hazardous wastes (primarily spent solvents and acidic wastes) were collected from off-Site generators, transported to the Site by HWD, Inc. and stored on Site prior to off-Site transport and disposal. Spent solvents were also recycled for resale. Hazardous wastes stored on the Site were managed in 55-gallon drums, one or more aboveground storage tanks and a "sludge pit". This operation area of the Site is now covered by a concrete slab or asphalt paving and is currently used as a truck/tractor-trailer parking lot.

In November 1982, HWD entered into a Consent Order with NYSDEC that required HWD to cease hazardous waste management operations at the Site. All remaining wastes and waste management tanks were reportedly removed from the Site during 1984. As the result of a 1985 property inspection by NYSDEC, the Site was listed on the New York State Registry of Inactive Hazardous Waste Sites as a Class 2a site, which is a temporary classification assigned by NYSDEC for sites that have inadequate and/or insufficient data for inclusion in any of the other site classifications.

In October 1999, the Potentially Responsible Parties (PRPs) entered into a Consent Order with NYSDEC to conduct a Remedial Investigation (RI) and Feasibility Study (FS). The RI identified elevated concentrations of tetrachloroethene (PCE) and its breakdown products in the soils and groundwater at the Site. Elevated concentrations of PCE were also identified in samples collected from the indoor air of an adjacent building (R&D Carpet and Tile Building) located southwest and downgradient of the Site. The FS evaluated potential remedial alternatives for the Site and recommended an alternative consisting of ISCO for treatment of the soils and groundwater, sub-slab depressurization for the R&D Carpet and Tile Building, and Site controls and monitoring. The active sub-slab depressurization (ASD) system was installed at the R&D Carpet and Tile Building as an Interim Remedial Measure (IRM) in September 2004.

NYSDEC issued a ROD in December 2004. In the ROD, NYSDEC selected a remedy that included soil treatment using either ISCO or soil vapor extraction (SVE) and groundwater treatment using either ISCO or air sparging. The components of the remedy as specified in the ROD are as follows:

- A remedial design program to provide the details necessary to implement the remedial program;
- Treatment of source area soils to SCGs (defined in Section 5.1 of the ROD) to protect groundwater and reduce migration of volatile organic compounds (VOCs) through the soil gas using one of the following methods: in situ chemical oxidation using potassium permanganate, or similar oxidant; or SVE with off-gas treatment to meet applicable discharge requirements;
- Treatment of on-Site and off-Site groundwater to reduce total VOC concentrations to upgradient concentrations by either of the following methods: in situ chemical oxidation; using potassium permanganate, or similar oxidant; or air sparging with off-gas treatment to meet applicable discharge requirements;

- A pre-design investigation to determine the extent of the downgradient groundwater plume and the optimum location for the injection/air sparging wells and performance monitoring wells;
- Verification sampling of treated soil and groundwater to confirm the effectiveness of the remedial actions;
- Continued operation, maintenance, and monitoring of the ASD system IRM to reduce PCE concentrations in indoor air at the former R&D Carpet and Tile Building to ambient background levels;
- Development of a Site management plan to address residual VOCs and any use restrictions;
- Imposition of an environmental easement; and
- Annual certification of the institutional and engineering controls.

In June 2007, the HWD Group and NYSDEC entered into a Consent Order to conduct and implement a RD/RA Work Plan. The objective of the RD/RA Work Plan is to provide for the development and implementation of final plans and specifications for implementing the remedial alternative set forth in the NYSDEC ROD, dated December 2004.

3.0 DESCRIPTION OF ACTIVE SUB-SLAB DEPRESSURIZATION SYSTEM

The former R&D building is a one-story commercial building that includes a garage area formerly used to store new carpet and various adhesives, coatings/sealers, base fillers, cleaners, paints/stains, etc., and an office area/showroom. The layout of the building is shown on BBLES Figure 1 (Attachment D-1). PCE was previously identified in indoor air samples collected from the building. As an Interim Remedial Measure (IRM), the ASD System was installed in September 2004.

The active sub-slab depressurization system consists of a 3-inch PVC suction pipe imbedded approximately 6 inches in the fill material below the floor slab. The riser extends up through the lavatory to the roof were it connects to a roof-mounted RadonAway Model HS3000 fan. A direct reading vacuum gage attached to the riser between the floor slab and the fan measures the vacuum induced by the fan. A pressure sensor emits and audible alarm if the vacuum falls below a predetermined set point. The sensor is attached to the suction pipe. The objective of the ASD is to maintain a pressure differential of 0.025 inches of water between the sub-slab air and the office air in accordance with ASTM E2121 in order to prevent migration of PCE vapors from the soil into the office. The New York State SCG for PCE is 100 micrograms per cubic mete ($\mu g/m^3$). To measure the differential pressure, a HM28 Digital Manometer is located on the floor in the closet of the office at the northwestern side of the building. The location of the manometer is labeled TH-2 on BBLES Figure 1. Air sampling results taken after the installation and startup of the ASD indicated that PCE levels in the office space are below the 100 $\mu g/m^3$ standard.

4.0 OPERATIONS OF EXISTING AND FUTURE SYSTEMS

The ASD operates continuously. The fan is connected to a electrical panel that is located in the same closet as the manometer described in Section 3.0. At startup, the fan induced an air flow of 20.8 standard cubic feet per minute (scfm) at a vacuum of 25.5 inches WC. The ASD will continue to operate until soil gas levels close to the building have been reduced as a result of the implementation of the proposed remedial components (SVE and in situ oxidation of groundwater).

The pressure sensor will alarm if the fan is turned off or is the vacuum levels decreases below the set point. The occupants of the building will notify the landlord's representative if the alarm goes off. The representative will notify CRA who will take action necessary to fix the fan. The occupants will be instructed to open doors and windows in case of an alarm in order to adequately ventilate the office space.

The operations of the proposed SVE system will be detailed in the updated OM&M Plan provided with the RD Report and will include details on the startup, operating procedures, controls, and alarms.

5.0 EQUIPMENT FOR EXISTING AND FUTURE SYSTEMS

The ASD equipment is described in Section 4.0. Specification sheets are provided in Attachment D-2 for the fan and the digital manometer.

The equipment for the SVE system will be described in the OM&M Plan provided in the updated RD Report.

6.0 INSPECTIONS AND MAINTENANCE OF EXISTING AND FUTURE SYSTEMS

The ASD System will be inspected quarterly to confirm that is operating as designed. This will include the following:

- Checking the fan operation and noting the vacuum pressure in the suction pipe;
- Checking the manometer and recording the differential pressure.

To test the pressure sensor alarm the fan will be turned off briefly. Once it is determined that the alarm is triggered, the fan will be turned back on and the sensor reset.

Maintenance of the ASD equipment will be performed if needed to effect repairs.

Inspections will be recorded on inspection logs (Figure D.6.1) and maintenance activities will be recorded on maintenance logs (Figure D.6.2).

The inspections and maintenance requirements for the SVE system will be detailed in updated OM&M Plan provided in the RD Report.

7.0 CONTINGENCY PLAN

In the ASD System is damaged due to a storm or due to vandalism, repairs will be completed by CRA and/or a mechanical contractor. In the case of a prolonged power outage, no contingency measures are required if the building will be unoccupied. During periods of building occupancy when the power is out, the doors and windows will have to be opened to provide ventilation.

A Contingency Plan will be developed that will address how to maintain operations of the proposed remedial equipment such as the SVE system in case of an emergency or vandalism. This will be included in the updated OM&M Plan provided in the RD Report.

8.0 DETERMINATION THAT REMEDIAL OBJECTIVES ACHIEVED

Soil and groundwater confirmatory samples will be collected to verify that the remedial objectives have been achieved as described in the RD/RA Work Plan. Once the remediation of the source is completed, the ASD system will no longer be required.

DATE OF REPAIR	SPARE PARTS USED				DESCRIPTION OF REPAIR
	DESCRIPTION	PART NO.	QTY.	ORDERED	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	
				YES/NO	

Note:

These records are to be retained for a minimum of 2 years.

figure D.6.1

EQUIPMENT MAINTENANCE LOG

HWD SITE

11A PICONE BOULEVARD

FARMINGDALE, NEW YORK

CRA

Date: ____________	Time: ________	Name: ______________

ASD FAN

Belts	Pass	Fail
Noise/Vibration	Pass	Fail
Grease Bearings	Yes	No
Vacuum P-01		

DIFFERENTIAL METER Vacuum ("WC)

1

ODOUR OBSERVATIONS

Any VOC odors outside of building?	Yes	No

MISCELLANEOUS

Inspect Breakers	Pass	Fail
Pressure Alarm	Pass	Fail
Check Supplies	Pass	Fail
Check for Leaks	Pass	Fail

Comments:

____

____

____

____

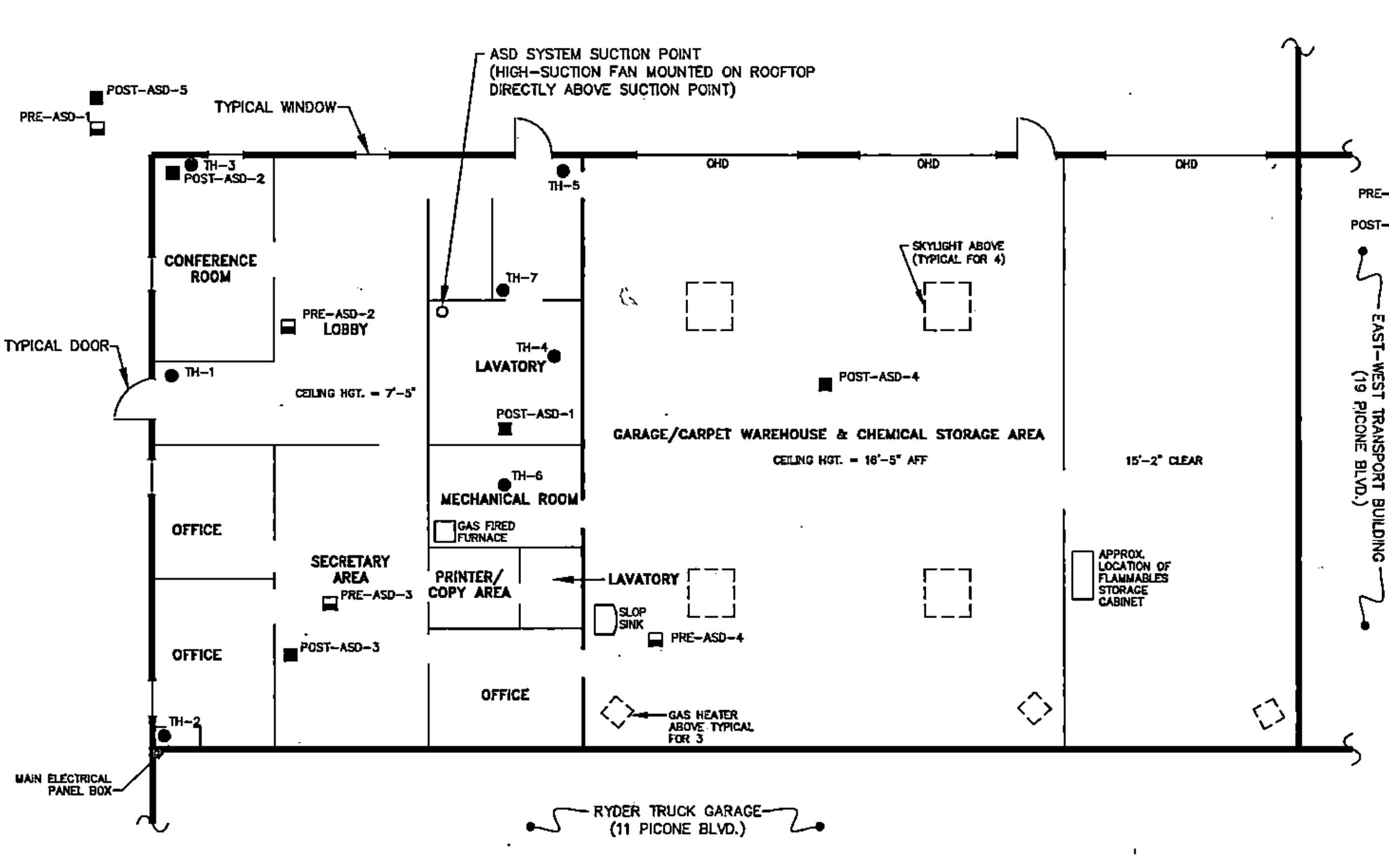
____

____

figure D.6.2
EQUIPMENT INSPECTION LOG
ASD SYSTEM
HWD SITE

ATTACHMENT D-1

BBL FIGURE 1 – BUILDING FLOOR PLAN



LEGEND:

- PRE-ASD-1 □ PRE-ASD AIR SAMPLING LOCATION
- POST-ASD-1 ■ POST-ASD AIR SAMPLING LOCATION
- TH-1 ● DIFFERENTIAL PRESSURE MEASUREMENT

SOURCE:

ALL BASE MAP INFORMATION UNLESS OTHERWISE NOTED WAS TAKEN FROM A MAP ENTITLED, "FLOOR PLAN OF EXISTING BUILDING – BUILDING LOCATED AT 20 PICONE BOULEVARD, FARMINGDALE, NY," PREPARED BY LITTLE JOSEPH REALTY, INC., JOB NO. 91-117, SCTM# 100-35-1-31.4, LAST REVISED 5/29/91.

NOTES:

1. OHD = OVERHEAD DOOR
2. AFF = ABOVE FINISHED DOOR
3. SAMPLE LOCATION DESIGNATION PREFIX "PRE-ASD" INDICATES SAMPLING AT THIS LOCATION WAS CONDUCTED PRIOR TO INSTALLATION AND OPERATION OF THE ACTIVE SLAB DEPRESSURIZATION (ASD) SYSTEM.
4. SAMPLE LOCATION DESIGNATION PREFIX "POST-ASD" INDICATES SAMPLING AT THIS LOCATION WAS CONDUCTED FOLLOWING INSTALLATION AND OPERATION OF THE ASD SYSTEM.

0 10' 20'

GRAPHIC SCALE

FORMER R&D CARPET AND TILE BUILDING
20 PICONE BOULEVARD
FARMINGDALE, NEW YORK

ASD SYSTEM SUMMARY REPORT

AIR SAMPLING LOCATIONS & DIFFERENTIAL PRESSURE MEASUREMENT LOCATIONS

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
1

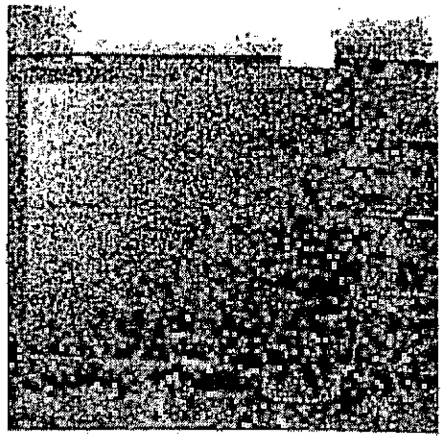
X: NONE
L: ON=*, OFF=REF, (FRZ)
P: PAGESET/PLT-BL
5/2/05 SYR-54-PCL RCB PGL
N/60426002/60426B03.DWG

ATTACHMENT D-2

ASD EQUIPMENT SPECIFICATION SHEETS

High Suction Series

Proven solution to tough mitigations: up to 25 times the suction of inline tube fans to deal with sand, dirt or clay sub-slab material.



Features:

- **Internal condensate bypass**
- **Brackets for vertical mount indoors or outdoors**
- **Inlet: 3.0" PVC/Outlet: 2.0" PVC**
- **Weight: 18 lbs.**
- **Size: 15"W x 13"H x 8"D**
- **Warranty: 1 year (3 year option available - see below)**

Model Selection Guidelines:

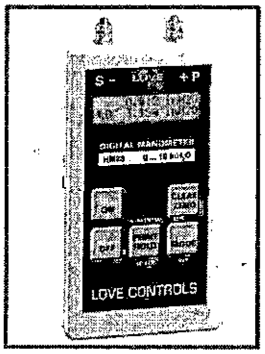
HS2000 - High suction and high flow for large areas such as schools and commercial buildings.
HS3000 - Single family homes with very tight sub-slab material.
HS5000 - For extremely tight sub-slab material or where the number of holes is restricted. Also useful for high altitudes.

Model	P/N	Watts	Max. Pressure "WC	Typical CFM vs. Static Pressure WC					
				0"	10"	15"	20"	25"	35"
HS2000	23004-1	150-270	18	110	72	40	-	-	-
HS3000	23004-2	105-195	27	40	33	30	23	18	-
HS5000	23004-3	180-320	50	53	47	42	38	34	24

Each fan includes 6ft. 18 ga. power cord with 3 prong plug.

HM28 Hand Held Digital Manometer

The Love Controls Series HM28 Digital Hand-Held Manometer is a precision instrument designed to measure a wide range of pressures to a very high accuracy. The unit incorporates a variety of features in an easy to use format that makes it useful in a wide variety of applications. Features include: measurement in all common pressure ranges, display resolution to 0.001, differential or relative measurement, two line liquid crystal display, and adjustable auto power off to conserve battery.



We are so proud of the accuracy of the HM28 that we provide a certificate of calibration with the unit at no additional cost. Depending on your application, the HM28 can be used as a secondary calibration standard for your other pressure instrumentation.

STANDARD FEATURES

- Microprocessor based
- Differential, Gage, or Absolute
- High accuracy, 0.2%, 0.1%, or 0.05% with Calibration Certificate
- Selectable Scales
- Resolution to 0.000 of selected unit
- Peak and Valley indication
- Hold Function
- Programmable Display
- Memory for up to 964 readings
- Output for Optional Printer or Computer Interface

Input Ranges

RANGE US	RANGE METRIC	OVERPRESSURE
gauge, underpressure and differential pressure		
0...10 inH_2O	0...2.5 kPa	12.5 kPa (50 inH_2O)
0...28 inH_2O	0...7 kPa	35.0 kPa (140 inH_2O)
0...80 inH_2O	0...20 kPa	150 kPa (600 inH_2O)
0...120 inH_2O	0...30 kPa	150 kPa (600 inH_2O)
0...200 inH_2O	0...50 kPa	400 kPa (1600 inH_2O)
0...14.5 psi	0...100 kPa	400 kPa (58 psi)
0...29 psi	0...200 kPa	700 kPa (100 psi)
0...100 psi	0...700 kPa	1700 kPa (246 psi)
0...145 psi	0...1000 kPa	2700 kPa (390 psi)
0...245 psi	0...1700 kPa	2700 kPa (390 psi)
RANGE US	**RANGE METRIC**	**OVERPRESSURE**

for gauge, media compatible with 18/8 SS (DIN 1.4305)		
0...14.5 psi	0...100 kPa	200 kPa (29 psi)
0...29 psi	0...200 kPa	400 kPa (58 psi)
0...100 psi	0...700 kPa	1400 kPa (203 psi)
0...145 psi	0...1000 kPa	3400 kPa (493 psi)
0...245 psi	0...1700 kPa	3400 kPa (493 psi)
0...435 psi	0...3000 kPa	7000 kPa (1015 psi)
0...1000 psi	0...7000 kPa	14000 kPa (2030 psi)

HOW TO ORDER

Specify by part number.

Error limit 0.2% F.S. for gauge, underpressure and differential pressure

0... 10	inH$_2$0	(2.5 kPa)	HM28**D3B**10000
0... 28	inH$_2$0	(7 kPa)	HM28**D3C**10000
0... 80	inH$_2$0	(20 kPa)	HM28**D3E**10000
0... 120	inH$_2$0	(30 kPa)	HM28**D3F**10000
0... 200	inH$_2$0	(50 kPa)	HM28**D3G**10000
0... 14.5	psi	(100 kPa)	HM28**D3H**10000
0... 29	psi	(200 kPa)	HM28**D3J**10000
0... 100	psi	(700 kPa)	HM28**D3K**10000
0... 145	psi	(1000 kPa)	HM28**D3L1**1000
0... 245	psi	(1700 kPa)	HM28**D3M1**1000
For gauge, media compatible with 18/8 (DIN 1.4305)			
0... 14.5	psi	(100 kPa)	HM28**G3T1**1000
0... 29	psi	(200 kPa)	HM28**G3U1**1000
0... 100	psi	(700 kPa)	HM28**G3V1**1000
0... 145	psi	(1000 kPa)	HM28**G3P1**1000
0... 245	psi	(1700 kPa)	HM28**G3W1**1000
0... 435	psi	(3000 kPa)	HM28**G3N1**1000
0... 1000	psi	(7000 kPa)	HM28**G3R1**1000
Order Code for error limit 0.1% F.S.			HM28XXX2XXXX

(Replace eighth character '1' with '2')

Error limit 0.05% F.S. for gauge, underpressure and differential pressure

0... 28	inH$_2$0	(7 kPa)	HM28**D3C3**0000
0... 120	inH$_2$0	(30 kPa)	HM28**D3F3**0000
0... 14.5	psi	(100 kPa)	HM28**D3H3**0000
0... 29	psi	(200 kPa)	HM28**D3J3**0000
0... 100	psi	(700 kPa)	HM28**D3K3**0000
0... 245	psi	(1700 kPa)	HM28**D3M3**1000

For absolute pressure

0... 15.9	pisa	0.2% F.S. (110 kPa abs)	HM28**A3I1**0000
0... 15.9	pisa	0.1% F.S. (110 kPa abs)	HM28**A3I2**0000
0... 29	pisa	0.2% F.S. (200 kPa abs)	HM28**A3J1**0000
0... 29	pisa	0.1% F.S. (200 kPa abs)	HM28**A3J2**0000
0... 29	pisa	0.05% F.S. (200 kPa abs)	HM28**A3J3**0000
0... 100	pisa	0.2% F.S. (700 kPa abs)	HM28**A3K1**0000
0... 100	pisa	0.1% F.S. (700 kPa abs)	HM28**A3K2**0000

Options

Communication-Software and measuring places management 21.14110.14
PC-cable 21.13362.14

SCS-certificate (new instruments include a free SCS certificate)

Returned units may be recertified at extra charge.

Soft Case (See L472 for details) L402-A

SPECIFICATIONS

Pressure Connection: Hose; 4/6mm or 1/8" NPT

Scales (Selectable):
Ranges 25 mbar to 7 bar: mbar, bar, Pa, kPa, hPa, mmH$_2$0, mmHg, psi, inH$_2$0, inHg.
Ranges 10 bar to 300 bar: mbar, bar, kPa, hPa, MPa, mmH$_2$0, mmHg, psi, inH$_2$0, inHg.
Ranges 70 bar: mbar, bar, kPa, MPa, mH$_2$0, psi, inH$_2$0.

Accuracy (includes linearity, hysteresis, and repeatability): per order code.
±0.20% full scale ± 1 digit
±0.10% full scale ± 1 digit
±0.05% full scale ± 1 digit

Measuring Media: Instrument Air or Inert Gases.
For HM28G3XXXXX, Any material compatible with 18/8 stainless steel.

Operating Conditions:

Operating Temperature: -5° to +50°C (23° to 122°F)

Storage Temperature: -20° to +60°C (-4° to +140°F)

Humidity: 30 to 95% rH, non-condensing.

Display: 2 line, 16 character, dot matrix LCD, with switchable display sizes.

Battery: 9V alkaline (included). Can operate from external power supply of 7 to 14 VDC.

Current Consumption: <9mA.

Memory: 964 measured values. Recording intervals adjustable from manual, 1, 5, 10, 20, 30 seconds, 1, 2, 3, 5, 10, 30, 60 minutes.

Case Protection: IP54.

Case Dimensions: 152 x 83 x 34 mm (6 x 3.27 x 1.34 inches)

Weight: 270 g (9.5 oz).

Maximum Measurement Rates:

Stand alone: 2-1/2 readings/sec (0.1% and 0.05% ratings), 5 readings/sec (0.2% rating).

Output to RS-232: 20 measurements/sec (0.2% rating). 10 measurements/sec (0.1% and 0.05% ratings.

RS-232 Baud Rate: Adjustable, 1200, 2400, 4800, or 9600 baud.