100% DESIGN REPORT

HWD SITE
11A PICONE BOULEVARD
FARMINGDALE, NEW YORK

Prepared For:
New York State Department of Environmental Conservation
on behalf of HWD Site Group

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ENGINEER'S CERTIFICATION

Pursuant to Section 7.2 of the "Remedial Design/Remedial Action (RD/RA) Work Plan, April 17, 2008" for the HWD Site located at 11A Picone Boulevard, Farmingdale, NY (Site), Conestoga-Rovers & Associates (CRA) submits the attached "100% Design Report" for the Site. The "100% Design Report" was prepared by CRA in accordance with the requirements of the RD/RA Work Plan.

Robert G. Adams, PE
CRA Infrastructure & Engineering, Inc.

9/23/09

Date

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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 (former R&D building) located southwest and downgradient of the Site. Results of a soil gas study are presented on Figure 2.5. 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 building, and Site controls and monitoring. The active sub-slab depressurization (ASD) system was installed at the R&D building as an Interim Remedial Measure (IRM) in September 2004 and is operational.

2.0 BACKGROUND

The following subsections present descriptions of the Site, its history of operation, and a summary of the previous environmental investigations performed.

2.1 SITE LOCATION AND DESCRIPTION

The former TSD facility 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. A trucking 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 (formerly known as the R&D Carpet and Tile Building) occupied by a specialty bath tub distributor and Ryder Truck. The east side of the building 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. 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.

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.

The 100% Design Report is organized as follows:

i) Section 1.0 presents the purpose and organization of the report;

ii) Section 2.0 presents the background information;

iii) Section 3.0 presents a summary of the pre-design activities;

iv) Section 4.0 presents the proposed Site management and sequencing of activities for the remedial action (RA);

v) Section 5.0 presents the preliminary remedial design concepts for SVE and ISCO;

vi) Section 6.0 presents Remedial Action Project Plans;

vii) Section 7.0 presents the design for contingency measures in the event unknown Site conditions may require modifications to the remedy; and

viii) Section 8.0 presents the proposed RD completion and RD implementation schedule.

1.0 INTRODUCTION

1.1 PURPOSE AND ORGANIZATION

This report presents the 100% Remedial Design (RD) for implementing the Record of Decision (ROD) remedy 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. The Site was a NYSDEC permitted TSD facility.

This 100% RD 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) and the NYSDEC approved Remedial Design/Remedial Action (RD/RA) Work Plan. The RD/RA Work Plan (January 2008, revised March 2008) was prepared to fulfill the HWD Group's requirement for a RD/RA Work Plan under the Consent Order. The RD/RA Work Plan provides for the development and implementation of final plans and specifications for the remedial alternative for the HWD Site. NYSDEC approved the RD/RA Work Plan on April 29, 2008.

A 30% Preliminary Design (September 2008) was prepared in accordance with the approved RD/RA Work Plan based on SVE treatment of soils and in situ chemical oxidation to treat the groundwater. The 30% Preliminary Design (30% RD) was submitted to NYSDEC on September 29, 2008. NYSDEC provided comments on 30% RD in a letter dated November 26, 2008. The HWD Group provided responses to the NYSDEC comments in a letter dated January 30, 2009. In the January 30, 2009 letter, the HWD Group proposed to install additional monitoring wells at the Site and conduct a round of groundwater sampling prior to completion of the 95% Remedial Design in order to finalize the extent of the groundwater treatment area prior to submittal of the 95% Remedial Design. NYSDEC concurred with this change to the RD/RA Work Plan.

Based on the previous investigation activities conducted at the Site, tetrachloroethene (PCE) had 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,

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NYSDEC issued a ROD in December 2004. In the ROD, NYSDEC selected a remedy that included soil treatment using either ISCO or 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 June 2007, the HWD Group and NYSDEC entered into a Consent Order to conduct and implement a RD/RA. A RD/RA Work Plan (January 2008, revised March 2008) was prepared to fulfill the HWD Group's requirements for a RD/RA Work Plan under the Consent Order. NYSDEC approved the RD/RA Work Plan on April 29, 2008.

A 30% Preliminary Design (September 2008) was prepared in accordance with the approved RD/RA Work Plan based on SVE treatment of soils and in situ chemical oxidation to treat the groundwater. The 30% Preliminary Design (30% RD) was submitted to NYSDEC on September 29, 2008. NYSDEC provided comments on 30% RD in a letter dated November 26, 2008. The HWD Group provided responses to the NYSDEC comments in a letter dated January 30, 2009. In the January 30, 2009 letter, the HWD Group proposed to install additional monitoring wells at the Site and conduct a round of groundwater sampling prior to completion of the 95% Remedial Design in order to finalize the extent of the groundwater treatment area prior to submittal of the 95% Remedial Design. NYSDEC concurred with this change to the RD/RA Work Plan.

2.3 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).

2.4 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;
- Continued operation, maintenance, and monitoring of the ASD system in the former R&D Carpet and Tile Building;

- Site Management Plan;
- Imposition of an environmental easement; and
- Annual certification of the institutional and engineering controls.

The ASD system was installed as an Interim Remedial Measure (IRM) in September 2004. The ASD 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 fan. The fan is used to maintain a negative pressure differential between the sub-slab air and the office air in order to prevent migration of VOC vapors from the soil into the office.

Design details for the proposed soil and groundwater treatment components are presented in Section 5.0.

3.0 PRE-DESIGN ACTIVITIES IN SUPPORT OF THE REMEDIAL DESIGN

Pre-design activities were conducted to collect additional data necessary to complete the RD. Pre-design activities included:

- Additional focused groundwater investigation to determine the optimum location for the oxidant injection points and to determine appropriate locations for the downgradient monitoring wells;
- Soil sampling to update the baseline soil concentrations prior to treatment;
- A bench-scale treatability test to estimate the oxidant demand for the Site soil and groundwater;
- Hydraulic monitoring of the existing monitoring well network to confirm water elevations and the direction of ground water flow;
- Installation of five new monitoring, one shallow upgradient well (MW-9), three shallow downgradient wells (MW-10, MW-11, and MW-12S), and one deep downgradient well (MW-12D);
- Groundwater sampling of all HWD monitoring wells including the five new wells to update baseline groundwater and VOC concentrations; and
- Groundwater sampling of off-Site well W-3 at the direction of NYSDEC to determine VOC constituents and concentrations southwest of MW-12S.

3.1 FOCUSED GROUNDWATER INVESTIGATION

3.1.1 OVERVIEW

Hydropunch groundwater sampling was completed downgradient of the Site to determine optimum locations for the oxidant injection points and monitoring wells. Hydropunch sampling was conducted from May 20, 2008 to May 23, 2008. A groundwater sample was collected from MW-7 on May 21, 2008, and additional samples were collected from existing monitoring wells MW-2 and MW-7 on May 27, 2008. Groundwater samples were collected in May 2008, February 2009, April 2009, and May 2009. A sample key is presented in Table 3.1.

Water level measurements were collected from existing monitoring wells on June 16, 2008, July 17, 2008, February 23, 2009, April 3, 2009, and on May 20, 2009.

Groundwater was also collected from existing monitor well MW-7 for the bench-scale study. A VOC sample was collected at MW-7 simultaneously with the collection of the bench-scale study sample and analyzed on a 24-hour turnaround so that it could be compared to the VOC analysis completed by CRA's treatability laboratory after shipment of the samples and compared to historical VOC concentrations. MW-7 is in the source area and was chosen for the bench-scale study because it had exhibited the highest concentrations of PCE during the RI investigations. As noted in the presentation of the data in Section 3.1.4, the PCE concentration detected at MW-7 in the initial sample collected on May 21, 2008 was less than expected based on the RI data (see Figure 2.3 for historical data). After noting this unexpected result, a second sample was collected from MW-7 on May 27, 2008 to confirm the results obtained from the May 21, 2008 sample. In addition, existing monitoring well MW-2 was sampled for comparison to the concentrations detected during the RI.

Based upon the RD/RA Work Plan, installation of five new monitoring wells and collection of baseline groundwater samples was proposed to be completed immediately prior to construction. However, based upon NYSDEC comments on the 30% Preliminary RD, the HWD group proposed to install the new monitoring wells (MW-9, MW-10, MW-11, MW-12S and MW-12D) and complete a round of groundwater monitoring prior to completion of the 95% RD. The analytical results for the new wells and existing wells would be used to finalize the groundwater treatment area. The HWD Group proposed this additional work in a letter to NYSDEC dated January 30, 2009 and NYSDEC concurred with this change to the RD/RA Work Plan.

3.1.2 HYDROPUNCH GROUNDWATER SAMPLING

A total of ten Geoprobes® were advanced and two hydropunch groundwater samples were collected at each location. 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. NYSDEC was notified in advance of the sampling activities.

Groundwater hydropunch locations are presented on Figure 3.1. At each location, a groundwater sample was collected at a depth of approximately 15 feet below ground surface (ft bgs). The groundwater table was observed to be at approximately 8 to 9 ft bgs. A second sample was collected at a depth of approximately 35 ft bgs. Samples were collected using a peristaltic pump. The samples were submitted to the laboratory for analyses for VOCs using Method 8260. NYSDEC split samples for locations HP-1 to HP-7. In order to make a determination if additional downgradient hydropunch locations would be required, samples collected from locations HP-1 to HP-7 (both shallow and deep samples) were analyzed on a 24-hour turnaround. The data for these locations were evaluated and provided to NYSDEC. Based upon the data, it was determined that the additional hydropunch samples located further downgradient were not required. The remainder of the samples (HP-8 to HP-10) were analyzed on a standard 2-week turnaround.

The hydropunch groundwater sampling results are presented in Table 3.2. Validated laboratory reports are presented in Appendix A. The results indicate that the highest VOC concentrations in the hydropunch sampling area were detected in the shallow (15 ft bgs) samples collected from HP-9 and HP-10. These locations are directly downgradient from the source area. PCE was detected in the shallow samples from HP-9 and HP-10 at concentrations of 470 milligrams per liter (µg/L) and 460 µg/L, respectively. PCE concentrations were much lower (1 to 3 µg/L) in the deeper (35 ft bgs) samples collected at HP-9 and HP-10.

Sampling locations along the perimeter of the hydropunch sampling area (HP-1 through HP-7) had much lower concentrations of VOCs in both the shallow and deep samples. The highest PCE concentration in these samples was 12 µg/L in the deep sample from HP-2. VOCs that were detected in the hydropunch samples are presented on Figure 3.1.

3.1.3 NEW MONITORING WELLS

In accordance with the letter dated January 30, 2009 submitted to the NYSDEC by the HWD Site Group, CRA installed five new monitoring wells (MW-9, -10, -11, -12S, and -12D) at the Site in February 2009. The wells were installed by Summit Drilling under the supervision of a CRA field technician on February 16, 17, and 19. The location for these wells was in accordance with the proposed locations presented in the 30% Preliminary RD. Minor adjustments were required in the final locations of MW-11 and MW-12S/12D because of overhead power lines. The surveyed locations of all the monitoring wells are presented on Figure 3.2. The logs for the new wells are presented in Appendix C. All wells except MW-12D were installed to a depth of approximately 20 ft bgs with a 10-foot of well screen. MW-12D was installed to a depth of 45 ft bgs with a 5-foot screen. The new wells were developed after completion. All drill cutting and development water was containerized in drums and staged at the Site pending off-Site disposal. The well construction details are presented in Table 3.3.

3.1.4 WATER LEVEL MEASUREMENTS

Water level measurements were collected from existing monitoring wells on June 16, 2008, July 17, 2008, February 23, 2009, April 3, 2009, and May 20, 2009. The data are summarized in Tables 3.4 and 3.5[1]. Groundwater contours for selected dates are presented on Figures 3.3 and 3.4.

Water level measurements collected on July 17, 2008 and April 3, 2009, are presented on Figures 3.3 and 3.4, respectively. The direction of groundwater flow on both dates indicate a south-southeasterly flow direction across the source area and a southwesterly flow directly downgradient, which is generally consistent with the groundwater flow direction noted in the RI/FS Reports and the 30% Preliminary RD. There is also a component of groundwater flow from the Conway Trucking property located east of the Site that flows in a southwesterly direction and merges with the groundwater from the Site in the vicinity of wells MW-12 and W-3.

The biggest difference between the contours shown on Figure 3.4 for July 17, 2008 and Figure 3.5 for April 3, 2009, is the elevation of the groundwater mound in the vicinity of well W-2 on the Conway Trucking property. On April 3, 2009, the elevation at W-2 was 57.90 feet whereas it was 55.95 feet on July 17, 2008. The groundwater elevation at well W-2 appears to fluctuate more than the other wells at the Site, potentially due to changes in recharge on the property east and southeast of the Conway Trucking property. However, even with the lower elevation at W-2 as measured on July 17, 2009, the groundwater mound is still evident.

3.1.5 GROUNDWATER SAMPLING RESULTS

Groundwater samples were collected at the site monitoring wells in May 2008, February 2009, April 2009, and May 2009. Samples were collected using low flow sampling techniques in accordance with the Field Sampling Plan and the groundwater samples were analyzed for VOCs in accordance with the Quality Assurance Project Plan (QAPP). The groundwater data are presented in Table 3.6. Validated laboratory reports are presented in Appendix C. Site-related VOCs (PCE, vinyl chloride, dichloroethene, and TCE) that were detected in the pre-design focused groundwater investigation samples are summarized on Figure 3.5. Non-Site-related VOCs that were detected in

1 Monitoring well reference elevations were resurveyed prior to the February 23, 2009 water level measurements. Groundwater elevations presented in Table 3.4 are based on reference elevations presented in the RI/FS whereas elevations presented in Table 3.5 are based on the resurveyed elevations.

the pre-design focused groundwater investigation samples are summarized on Figure 3.6.

May 2008

Two wells (MW-7 and MW-2) located within the source area were sampled on May 21 and May 27, 2008. At MW-7, PCE concentrations were 13 µg/L and 20 µg/L for May 21 and May 27, 2008, respectively. At MW-2, the PCE concentration was 51 µg/L. These data are less than the highest reported detections of PCE obtained during the RI (2,600 µg/L at MW-7 and 1,200 µg/L at MW-2).

February 2009

Groundwater samples were collected from 16 monitoring wells during the period from February 23 to February 26, 2009. VOCs that were detected in the groundwater samples are presented on Figures 3.5 and 3.6. Figure 3.5 includes pre-design data and historical data for Site-related VOCs (PCE, vinyl chloride, dichloroethene, and TCE). Figure 3.6 presents BTEX and other VOCs detections at historical locations and the pre-design hydropunch and monitoring well locations to better evaluate the source and migration of off-Site contamination that is commingling with Site contaminants of concern.

The analytical results presented in Table 3.6 indicate that PCE was detected in downgradient monitoring wells MW-11 and MW-10, consistent with expectations based on the pre-design hydropunch groundwater investigation data as presented in the Section 3.1.2.

The data in Table 3.6 also indicate that several VOCs were detected at the shallow monitoring, well MW-12S, the furthest downgradient well. As noted below, many of the VOC detections at MW-12S are unrelated to the Site. VOCs detected at MW-12S include 1,1,1-trichloroethane (120 µg/L), 1,1-dichloroethane (14 µg/L), 1,1-dichloroethene (9J µg/L), 1,2-dichlorobenzene (2J µg/L), 1,4-dichlorobenzene (2J µg/L), 4-methyl-2-pentanone (1J µg/L), acetone (21 µg/L), benzene (7J µg/L), carbon tetrachloride (21 µg/L), cis-1,2-dichloroethene (80 µg/L), cyclohexane (65 µg/L), ethylbenzene (24 µg/L), isopropylbenzene (6J µg/L), methyl cyclohexane (71 µg/L), tetrachloroethene (200 µg/L), toluene (230 µg/L), trichloroethene (230 µg/L), trifluorotrichloromethane (Freon 113) (38 µg/L), vinyl chloride (14 µg/L) and xylenes (28 µg/L). Based on a review of the RI and related monitoring data, many of these parameters were either never detected at the Site or were detected at significantly lower concentrations than the concentrations detected at MW-12S. Although the groundwater contours presented on Figures 3.3 and 3.4 indicate that MW-12S is downgradient of the

HWD site, it is also located in an area that appears to be impacted by chemical migration from the vicinity of MW-3 and other areas east of the Site. Based upon the suite of chemicals detected at MW-12S, it can be concluded that this well is in fact impacted by chemical migration from the vicinity of MW-3 and upgradient areas east of MW-3. This conclusion is supported by the investigation data as explained in the following paragraph.

1,1,1-Trichloroethane (TCA) was detected at MW-12S at a concentration of 120 μg/L. Historically, TCA was only detected in the HWD source area groundwater in 1990 at well MW-2 at a very low concentration of 6 μg/L. However, TCA was detected previously at MW-3 in 1990 at a concentration of 150 μg/L. Similarly, ethylbenzene was detected at MW-12S at 24 μg/L. Ethylbenzene has not been detected in the groundwater at the HWD source area. However, ethylbenzene was consistently detected at well MW-3 from 1990 to 2003 at concentrations ranging from 270 μg/L to 1,200 μg/L. Other compounds detected at MW-12S including 1,1-dichloroethane, cyclohexane, carbon tetrachloride, toluene, and xylenes were also detected at significant concentrations at MW-12S but appear to be unrelated to the Site based upon previous and current analytical results.

In summary, based upon these data, it is evident that the groundwater at MW-12S is significantly impacted by other source areas unrelated to the Site. Given the heavily industrialized nature of the area, it is not unexpected that wells located further downgradient from the source will in fact be impacted by other contributing sources.

CRA recommended that an additional round of groundwater levels be collected and another set of groundwater samples be collected from wells MW-9, MW-10, MW-11, MW-12S, MW-12D and MW-3 prior to completion of the 95% Design to verify the samples collected in February 2009. NYSDEC concurred with this recommendation.

April 2009

Groundwater samples were collected from wells MW-9, MW-10, MW-11, MW-12S, MW-12D, and MW-3 during the period from April 1 to April 3, 2009. The results for the April 2009 samples were very similar to the February 2009 results except that several parameters were reported at lower concentrations at well MW-12S. For example, 1,1,1-TCA decreased from 120 μg/L to 29 μg/L, PCE decreased from 200 μg/L to 41 μg/L, toluene decreased from 230 μg/L to 96 μg/L, and TCE decreased from 230 μg/L to 34 μg/L. The only parameter that experienced a significant increase was cis-1,2-DCE that went from 80 μg/L to 210 μg/L. Following review of the April 2009 results and discussion of the results with the HWD Group, NYSDEC confirmed that the contaminants of concern at the Site are PCE, TCE, DCE, and vinyl chloride (NYSDEC letter dated May 8, 2009). NYSDEC also requested that a sample be collected from well W3 that is located downgradient of MW-12S.

May 2009

Well W3 was redeveloped on May 13, 2009 and a sample was collected for VOC analysis on May 20. The results are presented in Table 3.6 and on Figures 3.5 and 3.6. The results indicated that the Site-related-VOCs were not detected; however, several non-Site-related VOCs were detected including cyclohexane, methylcyclohexane, isopropylbenzene, and dichlorobenzenes.

Based upon a review of the groundwater monitoring results with the HWD Group and NYSDEC, it was agreed that the off-Site groundwater treatment area would be extended towards well MW-12S.

3.2 SOIL SAMPLING

3.2.1 OVERVIEW

Soil samples were collected at six locations shown on Figure 3.7. At each location, a Geoprobe® was advanced to the groundwater table and one soil sample was selected from each boring for submittal to the laboratory for VOC chemical analysis. The sample was selected from the vadose zone soil interval identified to have the highest potential for VOCs based on photoionization detector (PID) screening of the soils. At sample location GP-5, two samples were collected at depths of 0 to 2 ft bgs and 6.5 to 7.5 ft bgs. The first sample was collected at 6.5 to 7.5 ft bgs; however, because PID readings in the vadose zone at GP-5 were all low, another sample from 0 to 2 ft bgs was collected (the interval with the highest concentration during the RI). Soil samples were collected and analyzed in accordance with the QAPP and FSP. The logs for the six Geoprobe® sample locations are provided in Appendix A.

A soil sample was also collected at each Geoprobe® location for use in the treatability testing (see Section 3.3). The soil treatability testing samples were collected at or below the water table. Each treatability sample was placed in a 16-ounce jar and sent to CRA's treatability laboratory. The soil samples were composited by the treatability laboratory.

3.2.2 SOIL SAMPLE RESULTS

Laboratory results are presented in Appendix A. The soil data are summarized in Table 3.7. Detected VOCs in the soil samples are summarized on Figure 3.7.

The highest PCE concentrations were detected at locations GP-4, GP-2, and GP-6 with concentrations ranging from 1,000 to 20,000 μg/kg. The maximum PCE concentration was detected at 7 to 9 ft bgs. PCE concentrations at the other sampling locations ranged from 1 to 130 μg/kg. These concentrations are generally lower than those reported during the RI. The maximum PCE concentration detected during the RI was 440,000 μg/kg which was detected at GP-9A in the source area at a depth of 0 to 2 ft bgs.

3.3 OXIDANT DEMAND BENCH-SCALE TESTING ACTIVITIES

A bench-scale treatability study was performed to evaluate the necessary dosage of potassium permanganate ($KMnO_4$) 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.

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

- assess the effectiveness of ISCO for treatment of the VOCs in the groundwater at the Site;

- assess the NOD at the Site; and
- determine the effective concentration/dosage of oxidant required to complete treatment as expeditiously as possible.

3.3.1 INITIAL CHARACTERIZATION

A sample of soil and a sample of groundwater were collected from the Site and shipped on ice overnight to CRA's Treatability Study Laboratory in Niagara Falls, New York. The soil sample was received on May 23, 2008, and groundwater samples were received on May 23 and 28, 2008. The soil samples were collected on May 22, 2008 and the groundwater samples were collected on May 21 and 27, 2008. The groundwater samples collected for the treatability testing were obtained from MW-7 and MW-2. As previously described, a VOC analysis of the sample collected from MW-7 on May 21 reported low concentrations of PCE and further testing of the water from that well was suspended until another sample from MW-7 could be analyzed. As noted, MW-7 and MW-2 were sampled on May 27, 2008. Groundwater from each well was shipped to CRA's Treatability Study Laboratory. The results of the May 27, 2008 sampled indicated that PCE concentrations were higher at MW-2 and confirmed the MW-7 results from May 22, 2008. Sample locations and the VOC detections are shown on Figures 3.5 and 3.6.

Soil from the six Geoprobe® locations was sent into the treatability laboratory as previously described based on collection of samples from the saturated interval. The laboratory composited the samples upon receipt. The sample locations are presented on Figure 3.7. Logs for the Geoprobe® are presented in Appendix A. All samples used in the treatability testing consisted of medium and fine grained sands.

The soil and groundwater samples were analyzed for VOCs. The results of the initial analyses of soil and groundwater are shown in Appendix B, Tables B.1 and B.2. The results show that VOCs were not detected in both the soil and groundwater samples. Since VOCs were not found in the groundwater samples received, a composite of the groundwater samples from MW-7 and MW-2 was spiked with PCE to obtain a sample with a PCE concentration in the parts per million range for the microcosm testing. This is consistent with the highest concentrations of PCE detected in the groundwater at the Site during the Remedial Investigation.

3.3.2 CHEMICAL OXIDATION MICROCOSM TESTS

In order to evaluate the effectiveness of $KMnO_4$ for the treatment of VOC in the groundwater at the Site, a series of microcosm tests were conducted. Soil microcosm tests were not performed; however, the soil samples collected for treatability testing from the six Geoprobe® locations were used for the assessment of the NOD at the Site[2].

The groundwater microcosm tests consisted of placing 115 milliliters (mL) of groundwater in 125 mL serum bottles and mixing with 10 mL of $KMnO_4$ solution at varying concentrations (0.1 percent, 0.5 percent, and 2.0 percent, w/w). Control tests were prepared similarly but without the oxidizing agent solution. The bottles were 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 were sampled and analyzed for residual VOCs. The samples were analyzed immediately at the CRA Laboratory; therefore, any residual oxidant did not continue to oxidize the VOC after the microcosm had been sacrificed.

The microcosm testing showed that $KMnO_4$ was effective in destroying PCE in the groundwater. Greater than 99 percent removal of PCE was achieved at a loading rate of 0a4 grams (g) $KMnO_4$ per liter of groundwater compared with concentrations in the control microcosms. At the completion of the treatability test, final concentrations of PCE in the samples were 2.47/2.73 μg/L for a dose of 0.5 percent $KMnO_4$, 2.07/2.03 μg/L for a dose of 1.0 percent $KMnO_4$, and below detection limit (2 μg/L) for a dose of 2 percent $KMnO_4$. At a dose of 1.6 g $KMnO_4$ per liter of groundwater, PCE was removed to below its detection limit (2 μg/L). The concentration of PCE in the control sample was 1,350/1,250 μg/L. These data are shown in Appendix B, Table B.3.

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2 No VOC were detected in either the soil and groundwater samples that were received for the study. It is possible to spike groundwater to achieve conditions that are representative of Site conditions and this was performed in order to assess VOC removal from groundwater. It is not possible to spike soil to make it representative of Site conditions because VOC added in the laboratory immediately before treatment do not become sorbed to and associated with soil particles in the same way that VOC do over time in the subsurface. Therefore, soil microcosms were not run because spiking the soil in order to run soil microcosms would not have resulted in useful data. However, the dose of $KMnO_4$ that will be required at a Site is largely influenced not by the VOC present in the soil but by the natural oxidant demand (NOD) of the soil; therefore this study used spiked groundwater to confirm the effectiveness of $KMnO_4$ treatment in removing the VOC and measured the soil NOD in order to determine the required dose of $KMnO_4$.

3.3.3 NATURAL OXIDANT DEMAND

The NOD of the soil sample was assessed by placing 50 g of soil in an 8-ounce jar and adding 100 mL of 1 percent $KMnO_4$. The initial $KMnO_4$ concentration was recorded by measuring the absorbance at 525 nanometers (nm) and comparing to a standard curve which was made by plotting known concentrations of $KMnO_4$ against their measured absorbance at 525 nm. Using the standard curve, an equation was derived for the calculation of $KMnO_4$ concentration from absorbance at 525 mn. Each week the jar was sampled, and the $KMnO_4$ concentration recorded.

During the 4-week NOD test, 1.84 g of $KMnO_4$ were consumed per kg of soil. These data are shown in Appendix B, Table B.4.

3.3.4 CONCLUSIONS

A dose of 0.4 g $KMnO_4$ per liter of groundwater was effective in removing greater than 99 percent of the PCE from the groundwater sample.

The NOD of the soil was 1.84 g $KMnO_4$ per kg of soil or 5.6 pounds of $KMnO_4$ per cubic yard of saturated treatment area. The NOD of the soil is far greater than the dose required for treatment of the groundwater and therefore the dose for the NOD would be sufficient to effectively remove PCE from the groundwater.

3.4 INVESTIGATIVE WASTE MANAGEMENT

Soil and water generated during the pre-design groundwater investigation in May 2008 was stored in drums (one soil and two water). Based on characterization testing, all waste was determined to be non-hazardous. The investigative waste was disposed off Site at Veolia ES Technical Solutions located in Flanders, New Jersey in October 2008.

Soil and water generated during the supplemental pre-design groundwater investigation in February, April, and May 2009 is stored in 13 drums. This includes drill cuttings and development water generated from the installation of five new monitoring wells in February 2009 and additional sampling conducted in April and May 2009. Waste characterization has been performed and disposal is pending.

4.0 SITE MANAGEMENT AND SEQUENCING

Drawing CI-01 (Site Layout) provides a summary of the remedial action (RA) activities to be performed at the Site. The Site is located in an active industrial park and the construction work will be coordinated with the Site owner and surrounding property owners/ tenants.

4.1 REMEDIAL ACTION COMPONENTS

The RA will consist of the following major components:

i) Site preparation, including temporary fencing and temporary sediment controls;

ii) Install new monitoring wells and conduct pre-construction round of groundwater sampling;

iii) Construct and operate SVE system for soil treatment;

iv) Construct and operate ISCO injection system for groundwater treatment;

v) Performance monitoring and verification sampling;

vi) Operate, monitor, and maintain the ASD system;

vii) Implementation of environmental easement;

viii) Preparation of Site Management Plan; and

ix) Annual certification of the institutional and engineering controls.

New monitoring wells were installed in February 2009 at locations proposed in the preliminary design and samples were collected for use in the development of the 95% Design.

4.2 CONSTRUCTION SEQUENCING

Management of the Site during implementation of the construction will be required to ensure that the Site operates in an orderly, efficient, and safe manner, and to ensure that the construction is successfully implemented in accordance with the RD. The tasks to complete the construction will be sequenced to meet the following major objectives:

i) All tasks will be performed in an orderly and safe manner such that the movement and double handling of waste and materials, and the potential exposure to Site-related contaminants is minimized;

ii) All tasks will be scheduled such that sediment controls are maintained during construction activities;

iii) As portions of the different components of RA will occur concurrently, the RA activities will be scheduled to minimize work area conflicts; and

iv) The RA will be performed in a manner that will cause minimal disturbance of Site soils in order to minimize exposure to potentially contaminated soil during construction activities.

4.3 SITE MANAGEMENT

All Site activities related to the RA will be supervised by qualified personnel. Daily logs will be maintained for all activities occurring at the Site during the construction activities. In addition to the continuous daily monitoring of the construction activities, weekly and monthly progress meetings will be conducted with the contractor.

5.0 DESIGN

The following sections present descriptions of the components of the RA as listed in Section 4.1

5.1 SITE PREPARATION

Prior to commencing construction of the selected remedy, preparation activities are required to provide cleared areas, utilities, temporary construction facilities, stormwater management and sediment controls, and establishment of survey control, in support of the RA activities. A summary of the various Site preparation activities are described in the following subsections.

5.1.1 TEMPORARY CONSTRUCTION FACILITIES

Temporary construction facilities will be required during the RA activities. Existing facilities will be used where possible. Prior to commencing construction activities at the Site, temporary support facilities, including power and water will be installed as required. The Site location and existing conditions are shown on Drawing CI-01.

A temporary decontamination pad(s) will be constructed to provide for the decontamination of RC equipment that may contact contaminated soil. The temporary decontamination pad will be located along the east side of the Site, as shown on Figure CI-02. Temporary storage of drums and equipment will also be located in this area.

Temporary electrical supply will be obtained. Single-phase power will be required for temporary support facilities during the RA activities and for the RA equipment.

Potable water will be obtained from an existing water supply.

Construction fencing will be installed to protect the work area.

5.1.2 STORMWATER MANAGEMENT AND SEDIMENT PLAN

The objective of stormwater management is to minimize adverse impact, if any, to adjacent properties as a result of the RA activities at the Site. The objectives of sediment controls are to minimize the potential for sediment migration during the RA activities. Surface water runoff onto or from areas disturbed during the RA activities will be managed to minimize the potential for sediment migration, and to facilitate the containment of generated sediment. Existing storm drains in the work area will be protected to prevent potentially contaminated water and soil and sediment from entering the storm water system. Sandbags/silt curtains will be place around each inlet to temporarily isolate the drains from surface water drainage.

The stormwater sediment control design criteria are as follows:

i) Sediment control plan based on New York guidelines;

ii) Minimize release to existing storm water catch basins; and

iii) Minimize potential impact to off-Site properties.

5.1.3 SURVEY CONTROLS

Two new benchmarks have been established outside the work area for use during construction. The locations, coordinates, and elevation of the benchmarks are shown on Drawing CI-01.

5.2 NEW MONITORING WELLS

The hydropunch and water level data collected during the pre-design were evaluated to determine appropriate locations for additional groundwater monitoring wells. Four new monitoring wells were installed and sampled in the downgradient area as described in Section 3.1. The rationale for the well locations is presented in Table 5.1. At location MW-12, two nested wells (MW-12S and MW-12D) were installed to depths of 20 ft bgs and 45 ft bgs. Wells MW-12S and MW-12D are located directly downgradient of the highest PCE concentrations detected in the pre-design hydropunch samples. One new monitoring well (MW-9) was installed upgradient of the treatment area at the location. All the new wells are shown on Drawing CI-02.

The new monitoring wells are constructed in accordance with the procedures in the RD/RA Work Plan. Logs for the new monitoring wells are provided in Appendix C.

Groundwater samples were collected from the new wells as reported in Section 3.1. These data have been used in evaluating the placement of the proposed ISCO injection wells.

5.3 SVE SYSTEM

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 ft bgs. Hence, the total volume of soil requiring treatment is estimated to be approximately 84,000 cubic feet. Groundwater elevations have been variable and were determined to be only 9 to 10 ft bgs during the pre-design data collection. In May 2008 and February/April 2009 the water levels ranged from 8 to 9 feet bgs in the source area where SVE wells will be installed. This was also observed in the groundwater levels reported in the RI for April 11, 2001. The SVE wells will be set at approximately 8 feet to avoid the possibility of the wells intersecting the groundwater table. The SVE wells will effectively treat vadose zone soils below 8 feet even when the groundwater table is 10 feet or more below the ground surface. For design purposes and equipment sizing, a maximum effective depth of 12 feet has been used, as was proposed in the RD/RA Work Plan.

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.

The relationship between vapor flow, intrinsic permeability, vacuum, and radius of influence can be described by application of the Johnston equation for steady-state conditions as presented in the table summarizing SVE performance in Appendix D.

Intrinsic permeability for soils may range from 10E-6 cm^2 for sand and gravel to 10E-11 cm^2 for tight clay and silty. A conservative estimate of 5 x 10E-8 cm^2 has been used for the sandy soils present at the Site.

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 capable of removing 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 300 cubic feet per minute (cfm) will be required to meet this objective.

To complement the high design flow rate, a grid of ten SVE wells will be installed in the soil treatment area. The proposed layout of the SVE wells is presented on Figure 5.1 and Drawings CI-02, CI-03, and CI-04. 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 was not necessary. The selected design parameters are consistent with 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, which 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 is expected, with higher flow attainable at increased vacuum.

As discussed in Section 5.7.2, discharge treatment is not required to meet DAR-1 criteria. The emissions will initially be treated through two 500-pound carbon vessels piped in series to limit discharge emissions and for odor control. Once the initial screening of the SVE influent vapors is completed and the system has been balanced, the need to replace the carbon when and if it is exhausted will be evaluated. The carbon vessels will not be replaced once exhausted if it is determined that the actual emission levels are less than NYSDEC DAR-1 AGC/SGC limits.

Specific design requirements for the soil treatment system are as follows: The SVE system will include a positive displacement blower (10 hp, 230 V, 1 phase) with a capacity of 300 scfm at vacuum of 100 inches water column. The manufacturer's equipment specification sheets on the blower are included in the Draft Operations, Maintenance and Monitoring Plan (Appendix J). The blower will be skid mounted. A knock-out pot will be provided to remove water from the extracted soil vapor upstream of the blower. The knock-out pot will have a capacity of 40 gallons and will be equipped with a high level switch that will shut down the SVE blower if necessary. The knock-out pot will be heat traced. Silencers will be included in the influent and discharge piping of the SVE blower. The vapors will be treated prior to discharge in two 500-pound carbon vessels piped in series. Vapors will discharge through a 3-inch stack 3 meters in height. Water from the knockout pot will be transferred from the knockout pot to a separate holding tank for eventual disposal to an appropriate treatment facility, as determined by analysis of the water generated. The major components of the SVE system are detailed below.

5.3.1 SVE SYSTEM EQUIPMENT

SVE Skid

1. SVE Blower:

   Description: Rotary lobe blower, manufactured by Gardner Denver (Sutorbilt Legend Model 5M, P-version).
   Motor model L3712T as manufactured by Baldor.
   10 hp/230V/1 phase/1,725 rpm.

   Purpose: Creates vacuum to extract volatile contaminants from vadose zone. Forces contaminated vapors through activated carbon vessels for treatment.

2. Knockout Pot:

   Description: 40-gallon water capacity air/mist separator with manual drain valve at bottom.

   Purpose: The knockout pot removes entrained water droplets from the airstream. A high level alarm will shut down the SVE blower if the tank becomes full of water.

3. Dilution Valve

   Purpose: Allows clean air to be drawn into system to dilute contaminant concentrations.

4. Inline Filter

   Purpose: Prevent damage to the blower by capturing particulates in the airstream.

5. Inlet and Discharge Silencers

Purpose: Reduce noise associated with the blower on the inlet and discharge sides.

6. Vacuum Relief Valve

Purpose: Prevent damage to SVE system components from excessive vacuum levels. Can be adjusted to actuate at different vacuum levels.

Granular Activated Carbon Vessels

Description: Flat bottom, carbon steel drums as manufactured by Carbonair. 500-pound standard fill capacity.

Carbon Type: Vapor Phase
Air flows through the two beds in series and the lead and lag drum can be alternated so that the cleanest carbon is always in the lag or second position.

Purpose: The carbon in the vessels adsorbs contaminants from extracted soil vapors.

Water Storage Vessel

Description: Flat bottom, carbon steel drum.
50-gallon capacity.

5.3.2 SVE SYSTEM EQUIPMENT CONTAINER

The SVE equipment will be located in a "C" Box shipping container at the northwest corner of the Conway Trucking property as shown on Drawing CI-04. The equipment container will be installed on a bed of compacted gravel. The equipment, consisting of the SVE skid, two 500-pound carbon vessels, the SVE header, and the 50-gallon knock-out tank for any generated water, will be arranged as shown in detail on Drawing CI-05. Padlocks will be placed on the "C" Box doors.

5.3.3 SVE WELLS

The SVE wells will be 2-inch diameter Schedule 40 PVC with 4 feet of #20 slot PVC well screens. Each well head will be enclosed in a 12-inch diameter by 12-inch deep flush-mounted curb box. Each SVE well will have a tight fitting threaded PVC cap that is removable to permit access to the SVE well as needed. SVE wells will be installed to an approximate maximum depth of 7.5 feet to avoid intersecting the water table. The screened interval will be 4 feet. Each well will be completed with a cover as shown on Drawing CI-07.

5.3.4 SVE PIPING AND TRENCHES

All subsurface SVE piping will be installed below grade in shallow trenches. Areas with asphalt or concrete at grade will be saw cut to allow removal of the surface material. These blocks will be brush cleaned to remove excess soil material prior to being placed into roll-offs for testing and disposal.

Excavation will be accomplished using an excavator or backhoe. All soil from within the soil treatment area that is excavated will be placed upon poly sheeting adjacent to the excavation, to be replaced back into the excavation after the piping is installed. All soil excavated outside the soil treatment area will be replaced into the excavation for backfill.

Two-inch diameter SDR 17 HDPE piping will be installed below grade from each SVE well and combined in a single utility trench which will be routed back to the equipment compound. A 2-inch perforated pipe will be also be installed beneath the SVE lines in all trenches within the soil treatment area leading from the SVE wells to the utility trench. This pipe will be used if needed to increase the vapor extraction capacity in the shallow vadose zone. The 2-inch pipe will change to solid pipe approximately 5 feet south of the 8-inch drain line that runs along the north side of the SVE treatment area. A bentonite plug will be installed across the trench in this area to seal any preferential pathway from areas outside the soil treatment area. All SVE lines will terminate approximately 1 foot above ground within the equipment compound enclosure.

Backfill for the trench around the pipes will consist of suitable excavated soil. Any large debris will be removed, tested, and disposed off Site. The soil will be compacted at optimum moisture in lifts not to exceed 12 inches, to 90 percent or greater of maximum density. The surface will be restored with concrete, asphalt, or soil to match the original ground surface. Concrete in vehicle traffic areas will be pinned to the adjoining concrete at 3-foot intervals and reinforced with 4-inch x 4-inch mesh at a minimum or as required to match the size, spacing, and location of the existing reinforcement.

Within the equipment container, each SVE influent pipe will be equipped with a pressure indicator, an inline flow meter, and a ball or gate valve to regulate the flow. The flow meter will be used for determining the flow from each SVE well. The ten SVE well influent pipes and the inlet pipe from the shallow perforated pipe will connect to a PVC header which will connect to the SVE equipment described above. A dilution valve on the 4-inch header will allow for adjustments to the vacuum pressure. Each well can be isolated from the vacuum header and, if necessary, disconnected from the header and used as a passive air inlet well.

The proposed layout of the SVE system and typical well and trenching details are included on Drawings CI-03 through CI-07. Design calculations are provided in Appendix D for the SVE system performance and air emissions.

5.3.5 CONTROLS

The SVE skid will be equipped with a control panel to enable the blower. The knockout tank high level switch will shut down the SVE system in the event that the tank is full. A cell phone will be connected to an auto dialer to notify CRA if the SVE blower is not operating. The auto dialer will be located in the SVE equipment container. An antenna will be installed on the outside of the container to facilitate the cell phone signal. If an alarm call is received, personnel will check/repair the SVE system and restart.

Startup and shutdown procedures for the SVE system are presented in the Draft OM&M Plan.

5.4 IN SITU CHEMICAL OXIDATION SYSTEM

The area requiring groundwater treatment is presented in the ROD and includes an area approximately 100 feet x 200 feet. This has been extended 40 feet south toward MW-12S resulting in a total treatment area of approximately 100 feet x 240 feet.

ISCO will 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.

The injection well layout is presented on Figure 5.1. The layout has been updated based on the groundwater data collected during the February, April, and May 2009 sampling and hydraulic monitoring events. The following paragraphs provide a description of the groundwater treatment system.

The ISCO delivery system for the groundwater will consist of a network of vertical 1-inch diameter injection wells spaced on approximately a 20-foot x 23.5-foot grid which will result in 40 injection wells. Field adjustments maybe required to avoid subsurface and/or overhead utility interferences. After discussion with the NYSDEC, the well spacing in the north south direction has been increased to expand the treatment zone southern limit to MW-12S/D. The injection wells will be constructed of Schedule 440 PVC. The wells will have a screen interval of 15 feet. The screen size is No. 20 slot. The proposed screen interval will be from 12 to 27 ft bgs. This will insure that the screen is in the saturated zone. Injection wells will be installed as drive points using direct push methods. The ISCO wells will not have a sand pack. If the ISCO wells cannot be installed in this manner, hollow stem auger drilling methods will be used. The wells will be completed with a well cover as shown on Drawing CI-07. A 3 percent $KMnO_4$ solution will be injected into the wells in order to treat the groundwater. The $KMnO_4$ solution will be mixed at the Site using an educator to initially entrain the powder into the water, which will flow into a trailer-mounted tank equipped with a mixer (either a paddle type or jet mixer). The solution will be pumped from the tank to one or more wells at a time through a manifold with multiple outlets. Each outlet will have a flow meter to determine the volume pumped to each well. All of the ISCO injection equipment will be portable. Once the injection program is complete, the tank, pump and piping will be cleaned and removed from the Site. In lieu of mixing batches of 3 percent $KMnO_4$ solution, a 3 percent $KMnO_4$ solution will be delivered to the Site by tanker ready for use. The major components of the ISCO system are detailed below.

<u>Wells</u>

Description: 40 wells penetrate up to 27 ft bgs. The wells are constructed of 1-inch Schedule 40 PVC. The bottom 15 feet of piping is PVC screen in order to distribute the chemical injection within the saturated zone.

Oxidant Tank

Description: Horizontal freestanding PVC tank manufactured by IMG inc.
Capacity: 335 gallons minimum.
Dimensions: 44 inches diameter, 56-inch length minimum.
Suitable for outdoor use.

Pump

Description: Oxidant transfer pump as manufactured by Goulds.
Model: 3196 STX.
Size: 1 x 1 1/2-6.
Capacity: 50 gpm at 20 feet TDH.
1/2 hp, 230 V, 1,750 rpm.

Mixer

Description: Mixer unit, as manufactured by IMG, or equal.
Model: MD-2, single propeller.
1/2 hp TEFC motor, 115/230 V, 350 rpm.

A treatability study was performed as a pre-design investigation task to determine the dosage required to achieve the necessary groundwater treatment. Based on the treatability test results, the estimated quantity of $KMnO_4$ required for the theoretical NOD and oxidation of the VOCs in the groundwater is approximately 56,000 pounds (5.6 pounds per cubic yard) based on a 15-foot treatment depth. The actual amount of $KMnO_4$ required to achieve treatment of the groundwater at the Site should be less than this value as VOCs including the PCE in the groundwater will be oxidized before the NOD is fully satisfied. Therefore, it is proposed initially to perform two injections for a total of approximately 144,000 gallons of 3 percent $KMnO_4$ solution (1,800 gallons per well per injection). This equates to 18,000 pounds of $KMnO_4$ for each injection or a total of 36,000 pounds of $KMnO_4$ (i.e., approximately two-thirds of the theoretical maximum based upon the treatability test results). The two injections will be spaced at least 3 months apart. The oxidant solution will be injected under pressure to ensure maximum distribution of the solution. ISCO procedures are included in the Draft OM&M Plan (Appendix J).

Following the initial two injections the groundwater will be monitored in accordance with Section 5.5.2. Additional injections will be performed if groundwater monitoring indicates that residual VOC concentrations are above the cleanup criteria and necessary to eliminate any remaining significant threat to the environment.

The HWD Site VOCs and proposed cleanup goals that will be the target of the ISCO program are presented in Section 5.7. VOCs have been identified at MW-12S that were not identified as source chemicals in the RI. As such, the success of the ISCO program will not be based on oxidation of chemicals that are from other sources.

The proposed layout of the ISCO system and a typical injection well detail are included on Drawings EF-04 and C1-07.

5.5 PLANS AND SPECIFICATIONS

The plans and specifications include required drawings, specifications, and performance standards necessary to complete construction of the system. The design drawings have been prepared to present the final design prior to comment by the applicable agencies, and are included with this report. The drawings are 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, as well as, allow a contractor to install the final system.

The design specifications are presented in Appendix E and the design drawings are presented in Appendix F.

5.6 CONSTRUCTION QUALITY ASSURANCE

The RA construction quality assurance will be performed in accordance with the Construction Quality Assurance Plan (CQAP) presented in Appendix G.

5.7 PERFORMANCE MONITORING AND VERIFICATION SAMPLING

5.7.1 SVE SYSTEM

At startup of the SVE system the influent VOC concentrations will be monitored with a FID to optimize the flow from the ten SVE wells. This will be performed daily for the first week and then weekly for the first month. An air sample will be collected once the SVE system in initially optimized during the first week of operation. After the initial month of operation, the influent VOC concentrations will be monitored monthly and the adjustments will be made to the well flow to optimize VOC recovery.

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 verification 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 approximately 8 to 10 ft bgs 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 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.

The description of the selected remedy as presented in the ROD includes:

- 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 addition, Section 6 of the ROD identifies the remediation goals at the Site to include elimination or reduction to the extent practicable:

- The release of contaminants from the soil to the groundwater that may create exceedances of groundwater quality standards.

Based upon the Site use restrictions included in the ROD selected remedy and the goal to eliminate or reduce to the extent practicable releases from the soil to the groundwater that may create exceedances of the groundwater standards, the following cleanup criteria presented in 6NYCRR Subpart 375-6 are considered potentially applicable:

Part 375 Restricted Use Soil Cleanup Levels for Protection of Public Health - Commercial

PCE	150 ppm
cis-1,2-DCE	500 ppm
trans-1,2-DCE	500 ppm
TCE	200 ppm
VC	13 ppm

Part 375 Cleanup Levels for Protection of Groundwater

PCE	1.3 ppm
cis-1,2-DCE	0.25 ppm
trans-1,2-DCE	0.19 ppm
TCE	0.47 ppm
VC	0.02 ppm

In accordance with the ROD, if and when soils are treated to unrestricted use levels, as listed in Part 375, and the groundwater is treated to either unrestricted use levels or to upgradient concentrations, the NYSDEC will consider discontinuing the need for annual certification and other Site restrictions.

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

5.7.2 EMISSIONS MODELING

Screen 3 Air Emissions modeling was performed for discharge modeling and comparison to DAR-1 AGC/SGC tables for compliance monitoring. Based on the modeling results, the expected VOC discharge will be less than 0.1 pound per day and the maximum 1-hour discharge concentration of 0.147 $\mu g/m^3$ will occur approximately 7 meters (23 feet) from the stack location. Discharge modeling results were compared to the DAR-1 AGC/SGC tables. As indicated in the Screen 3 Model Results table in Appendix D, the calculated values for tetrachloroethylene are expected to be below the compliance criteria. The Annual Guideline Concentration (AGC) limit is 1 $\mu g/m^3$ and the Short Term 1-Hour Guideline Concentration (SGC) limit is 1,000 $\mu g/m^3$. The expected maximum concentration is 0.147 $\mu g/m^3$ without any emission controls in place.

While discharge treatment is not required to meet DAR-1 criteria, the emissions will initially be treated through two 500-pound carbon vessels piped in series to limit discharge emissions and for odor control. Once the initial screening of the SVE influent vapors is completed and the system has been balanced, the need for replacement of the carbon when and if it is exhausted will be evaluated.

5.7.3 ISCO SYSTEM

Groundwater monitoring will be conducted to assess the overall groundwater quality during the remedial action and also to specifically evaluate the progress of the ISCO 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, MW-12S, and MW-12D 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 determine whether the groundwater concentrations remain below the remediation goals. The Groundwater Monitoring Wells will be sampled semi-annually for a 3-year period. The groundwater sampling schedule is presented in Table 5.2.

Samples will be collected and analyzed in accordance with the QAPP and FSP.

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 important to characterize and monitor the upgradient groundwater as this will form the basis for determining when the Site remediation is complete. Monitoring wells MW-4, MW-9, MW-5, MW-1, MW-1D, W-2, MW-3 and MW-3D will be used to monitor groundwater quality upgradient of the treatment area. VOCs that have been detected at MW-3 historically and are not related to the Site are now evident at MW-12S. NYSDEC has acknowledged that the contaminants of concern at the Site are PCE, TCE, DCE, and vinyl chloride and that the HWD Group is not responsible for remediation of non-Site-related compounds.

Cleanup goals for the groundwater will be developed based upon the concentrations of PCE, TCE, DCE, and vinyl chloride in the upgradient wells and the Class GA groundwater standards, whichever are greater. It is possible that the limitations of the treatment technology may prevent achieving groundwater standards for the Site-related VOCs at all monitoring well locations. If this is the case, the HWD Group may petition NYSDEC for approval to terminate the treatment with justification. Since monitoring well MW-12S is located in an area that is impacted by contaminant migration from other off-Site sources, it is also possible that the VOCs detected at MW-12S will initially be reduced in concentration as a result of oxidation by $KMnO_4$; however, these VOCs may again be detected during long-term monitoring due to migration from off-Site sources.

5.7.4 ASD SYSTEM

Following completion of the Site remediation, a soil gas sample will be collected next to the R&D Carpet Building to assess if the ASD system is no longer required.

The soil gas sample will be collected at the location shown on Figure 5.2. The sample will be collected and analyzed in accordance with the QAPP and FSP, and analyzed for PCE, cis-1,2-DCE, trans-1,2-DCE, TCE, and VC.

5.8 FINAL REPORT

Upon completion of the remedial construction activities, a final report and as-built drawings will be prepared to summarize the work performed, identify any modifications to this design, and provide all supporting documentation for the work. The Final Report will include a certification by a professional engineer licensed in the State of New York that all requirements of this design have been complied with and all activities have been performed in full accordance with the final design.

5.9 IMPLEMENTATION OF ENVIRONMENTAL EASEMENT

An institutional control in the form of an environmental easement will be implemented 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.

5.10 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.

The need for continued operation of the ASD will be addressed in the Site Management Plan based on the evaluation of the potential for vapor intrusion into the former R&D Carpet and Tile Building.

5.11 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 NYSDEC registry of inactive hazardous waste disposal sites has been eliminated.

5.12 OPERATION, MAINTENANCE, AND MONITORING

A preliminary inspection and operation schedule for the remedial components is presented in Table 5.3.

A Draft Operations, Maintenance and Monitoring Plan (OM&M) Plan is presented in Appendix J. The OM&M Plan will be finalized when construction of the remedial systems is completed and submitted to the NYSDEC with the Final Engineering Report.

5.13 PERMITS

The following permits will be required for the RA:

- Building Permit - Town of Farmingdale; and
- Underground Injection Control (UIC) Permit - USEPA/NYSDEC.

With regard to the latter, USEPA will be notified in accordance with 40 CRA 144 prior to conducting the subsurface chemical injections. A letter will be submitted explaining the scope of work (type of oxidant, number of injection wells, amount of material to be injected, number of injection rounds, byproducts, and presence of nearby drinking wells).

6.0 REMEDIAL ACTION PROJECT PLANS

This section provides an overview of the following Project Plans that are presented as appendices to this 100% Remedial Design Report.

- Appendix G - Construction Quality Assurance Plan;
- Appendix H - Quality Assurance Project Plan;
- Appendix I - Field Sampling Plan;
- Appendix J - Draft Operations, Maintenance and Monitoring Plan;
- Appendix K- Health and Safety Plan; and
- Appendix L - Waste Management 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 CONSTRUCTION QUALITY ASSURANCE PLAN

The field and testing quality assurance objectives, protocols, and procedures supporting the construction activities are provided in the Construction Quality Assurance Plan (CQAP). The CQAP presented in Appendix G includes:

- Project description;
- Project organization;
- Project responsibilities;
- Quality assurance objectives;
- Project meeting procedures;
- Inspection and testing requirements;
- Quality assurance reports; and
- Record keeping.

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). The QAPP presented in Appendix H includes:

- Project description;
- Project organization;
- Project responsibilities;
- Sampling and custody procedures;
- Calibration procedures;
- Quality assurance objectives;
- Analytical procedures;
- Data analysis and reporting;
- Internal quality control checks;
- Performance and system audits;
- Preventative maintenance;
- Method-specific procedures for assessing data precision, accuracy, and completeness;
- Laboratory corrective actions; and
- Quality assurance 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. The FSP presented in Appendix I 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 OPERATIONS, MAINTENANCE AND MONITORING PLAN

A Site-specific Operations, Maintenance, and Monitoring Plan (OM&M Plan) is required to ensure that operations, maintenance and monitoring will be conducted as required to support the remedial program. The draft OM&M Plan presented in Appendix J includes:

- Background;
- Operating philosophy;
- Annual remedial requirements for the ASD, SVE and ISCO systems;
- Operations of the ASD and SVE systems;
- ISCO procedures;
- Monitoring and verification sampling;
- Inspections and maintenance;
- Contingency Plan;
- Determination that remedial objectives are achieved; and
- Operations management.

6.5 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. The HASP presented in Appendix K 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.

6.6 WASTE MANAGEMENT PLAN

A Site-specific Waste Management Plan (WMP) is required to ensure that waste generated during remedial activities is handled in accordance with the Remedial Action Work Plan and applicable regulatory requirements. The WMP is presented in Appendix L.

7.0 CONTINGENCY PLAN

This section presents the remedial design for contingency measures in the event that unknown Site conditions require modifications to the remedy design.

The contingency plan for the soil treatment system includes 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.

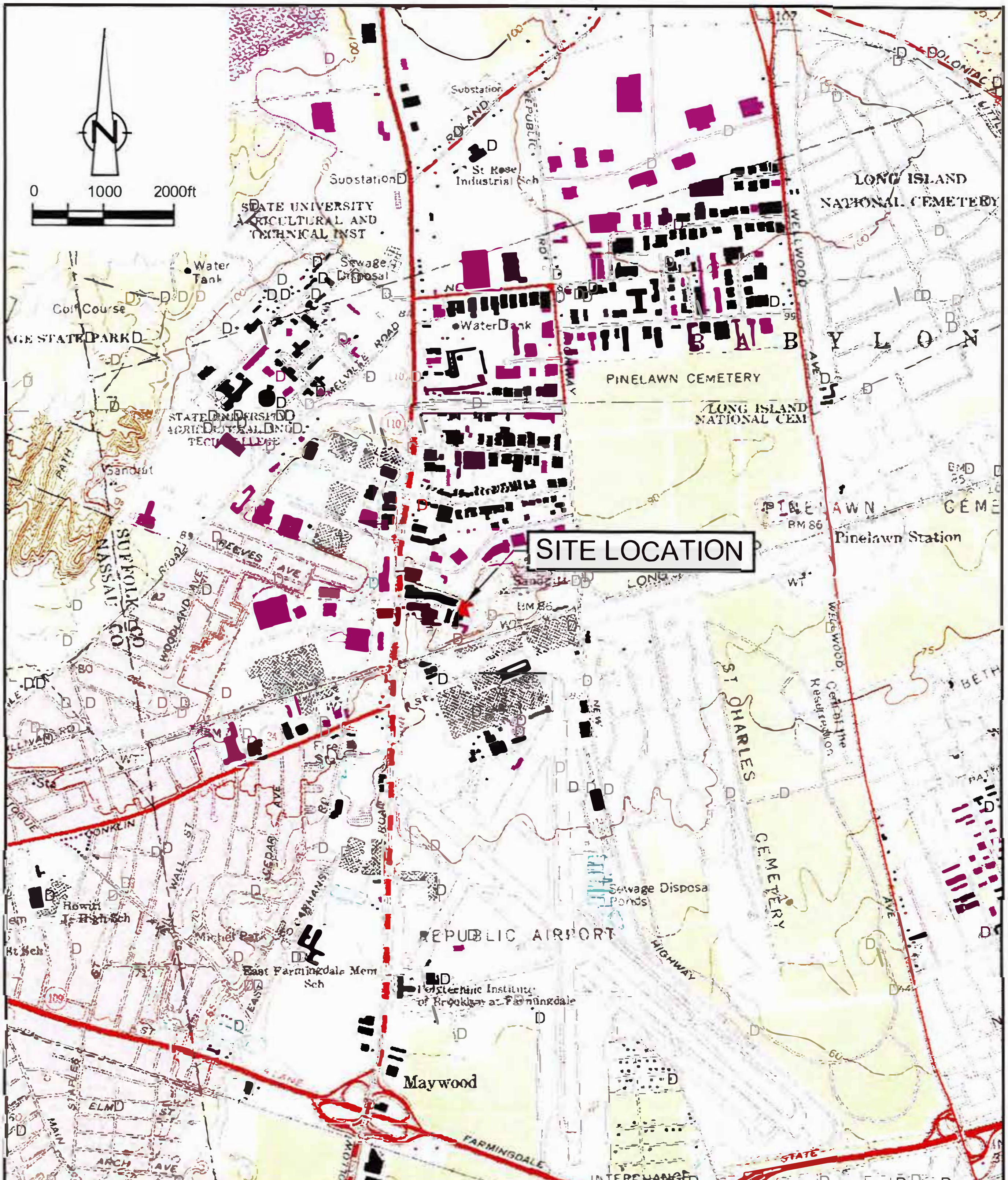
The contingency plan for the groundwater treatment system includes one or more of the following:

- Additional ISCO injections in areas requiring additional treatment;
- Installation of additional injection wells in areas requiring additional treatment or use of SVE wells for injection if the capillary fringe area above the ISCO well screen levels require treatment; and
- Modifications to the $KMnO_4$ solution (i.e., higher strength) to achieve additional treatment.

Details of any contingency measure will be developed as necessary and submitted to NYSDEC prior to implementation.

8.0 RD COMPLETION AND RA IMPLEMENTATION SCHEDULE

A RD Completion and RA Implementation schedule is presented on Figure 8.1.



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

figure 1.1

SITE LOCATION
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA001 SEP 23/2009

SOURCE: BLASLAND, BOUCK & LEE INC. SITE PLAN

LEGEND:

SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)

FENCE LINE

EXISIING GROUNDWAIER 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 MW4 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 6/13/94 (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 DAIE 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).
8. WELLS MW-9, MW-10, MW-11, MW-12S AND MW-12D INSTALLED BY CONESTOGA-ROVERS & ASSOCIATES (CRA) IN FEBRUARY 2009

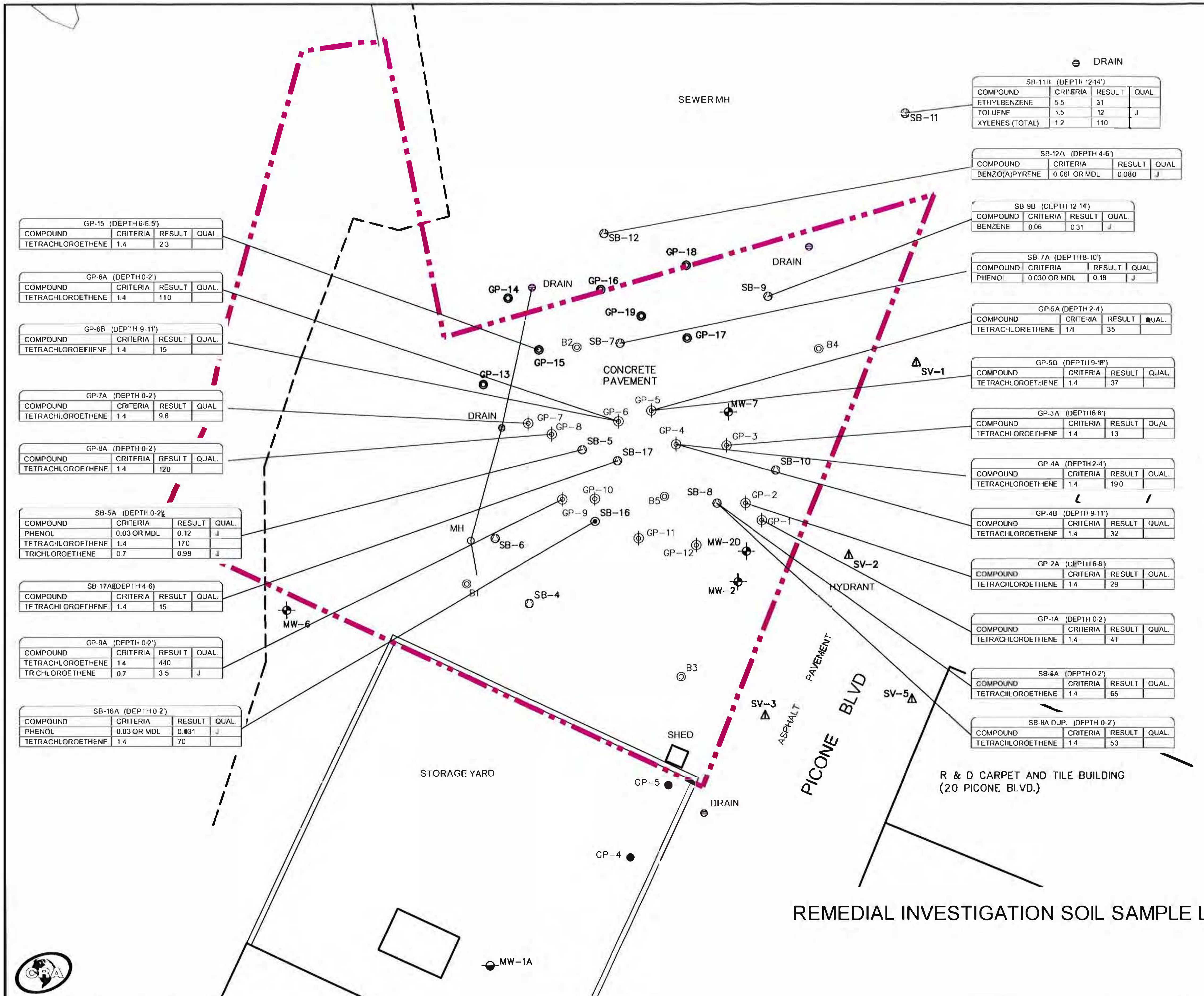
SOURCE:

1. 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.
2. MONITORING WELL, DRAIN AND MANHOLE LOCATIONS SURVEYED FEBRUARY 24, 2009 BY BORBAS SURVEYING
3. AERIAL PHOTOGRAPH FROM GOOGLE EARTH

figure 2.1

SITE PLAN
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA020 SEP 23/2009



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	

LEGEND:

- SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)
- FENCE LINE
- SOIL VOC DELINEATION BORING (AUGUST 2002)
- SOIL VAPOR SAMPLE LOCATION (AUGUST 2002)
- EXISTING GROUNDWATER MONITORING WELL LOCATION (INSTALLED FOR INVESTIGATION OF THE HWD SITE)
- SOIL BORING/HYDROPUNCH LOCATION
- HYDROPUNCH LOCATION ONLY
- SOIL BORING LOCATION ONLY
- GEOPROBE SOIL BORING LOCATION
- GEOPROBE GROUNDWATER SAMPLING LOCATION (APPROXIMATE)
- PHASE II SOIL BORING LOCATION (APPROXIMATE)

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
5. RESULTS & CRITERIA IN PPM. VALUES LISTED ONLY WHERE LOCATION EXCEEDED CRITERIA.

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 5/18/2003

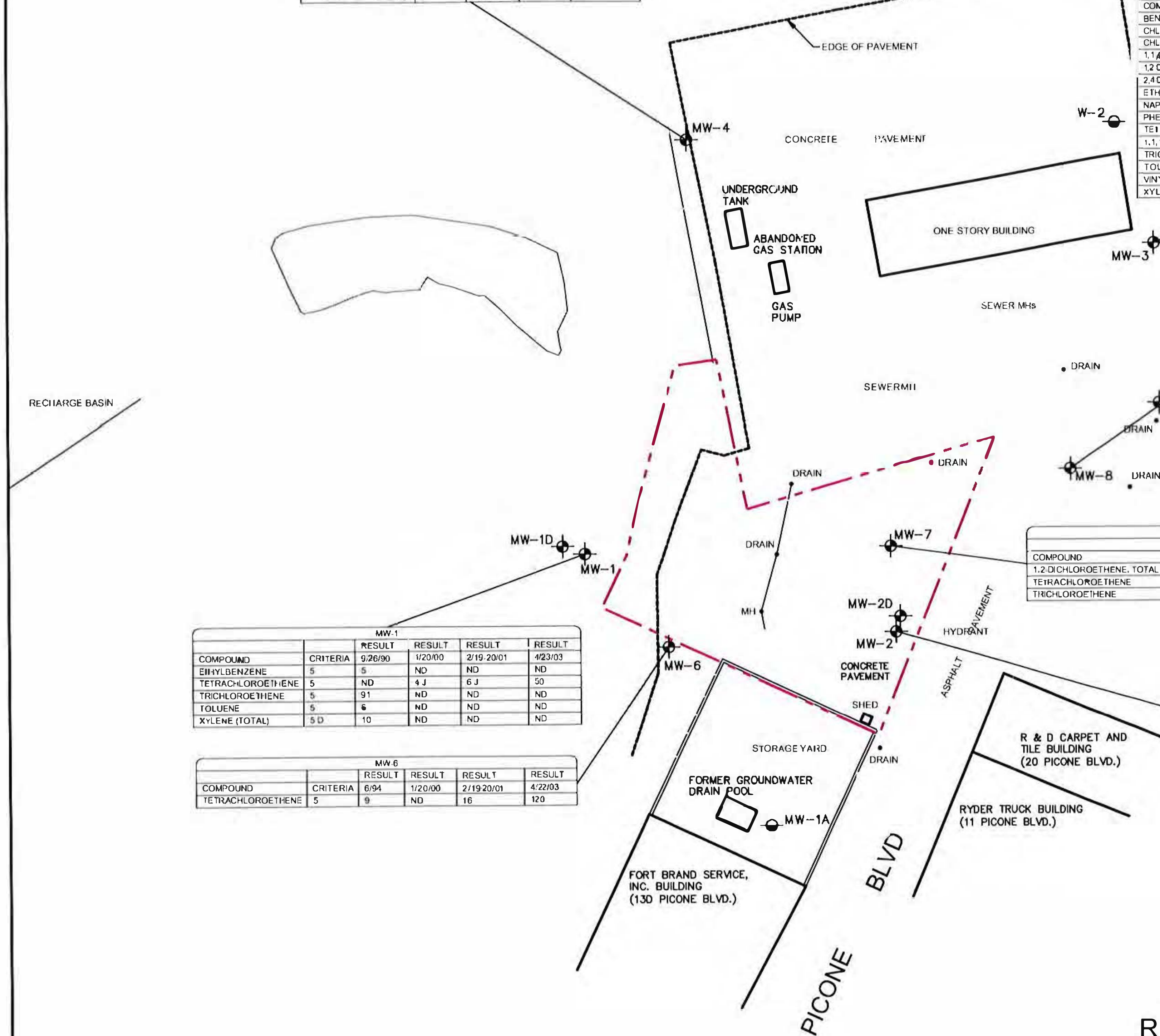
SAMPLE INFORMATION SOURCE:

BLASLAND, BOUCK & LEE INC.
FEASIBILITY STUDY REPORT, FIGURE 6

figure 2.2

REMEDIAL INVESTIGATION SOIL SAMPLE LOCATIONS AND VOC RESULTS
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA003 SEP 23/2009



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-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

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	790BD	68	360	1,200
TRICHLOROETHENE	5	130	ND	14 J	34

NOTES:

1. ALL CONCENT
(ug/L) EQUIVAL
2. G = GUIDANCE
3. * = CRITERIA V
APPLIES TO
4. D = VALUE LIS
5. A = VALUE LIS
6. J= THE RESUI
BUT GREAT
AN APPROX
7. BD= CONTAM
DILUTED S
8. ND= NOTDET
9. NA = NOT ANA
10. CRITERIAREF
ENVIRONMEN
TECHNICAL AI
TITLED AMBIE
AND GROUND
UPDATEDAPF

SOURCE:

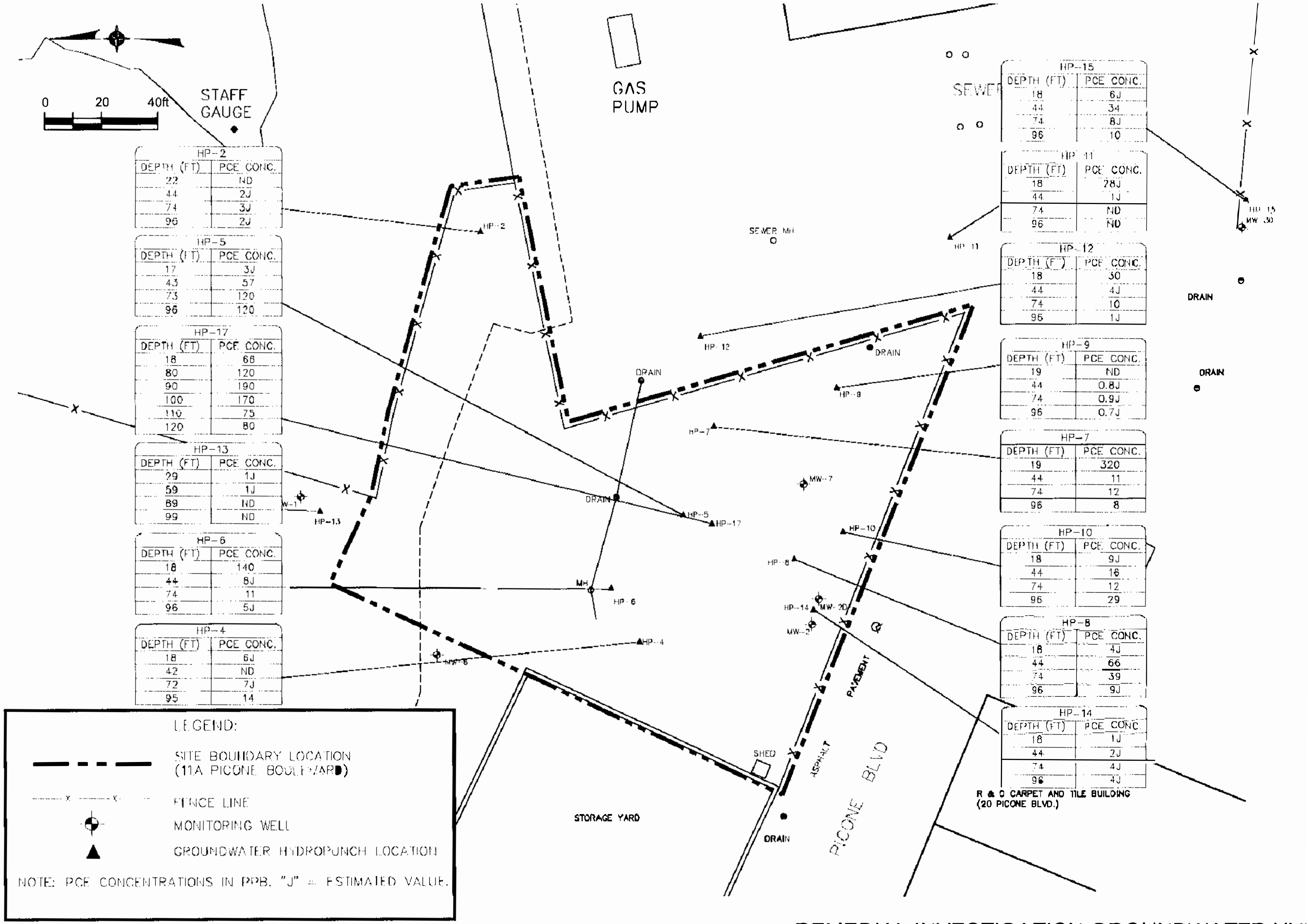
ALL BASE MAP INF
MAP ENTITLED "M
SITE-PICONE BOU
PREPARED BY ALE
THROUGH 11/29/9

SAMPLE INFORMA

BLASLAND, BOUC
FEASIBILITY STUD

REMEDIAL INVESTIGATION MONITORING WELL

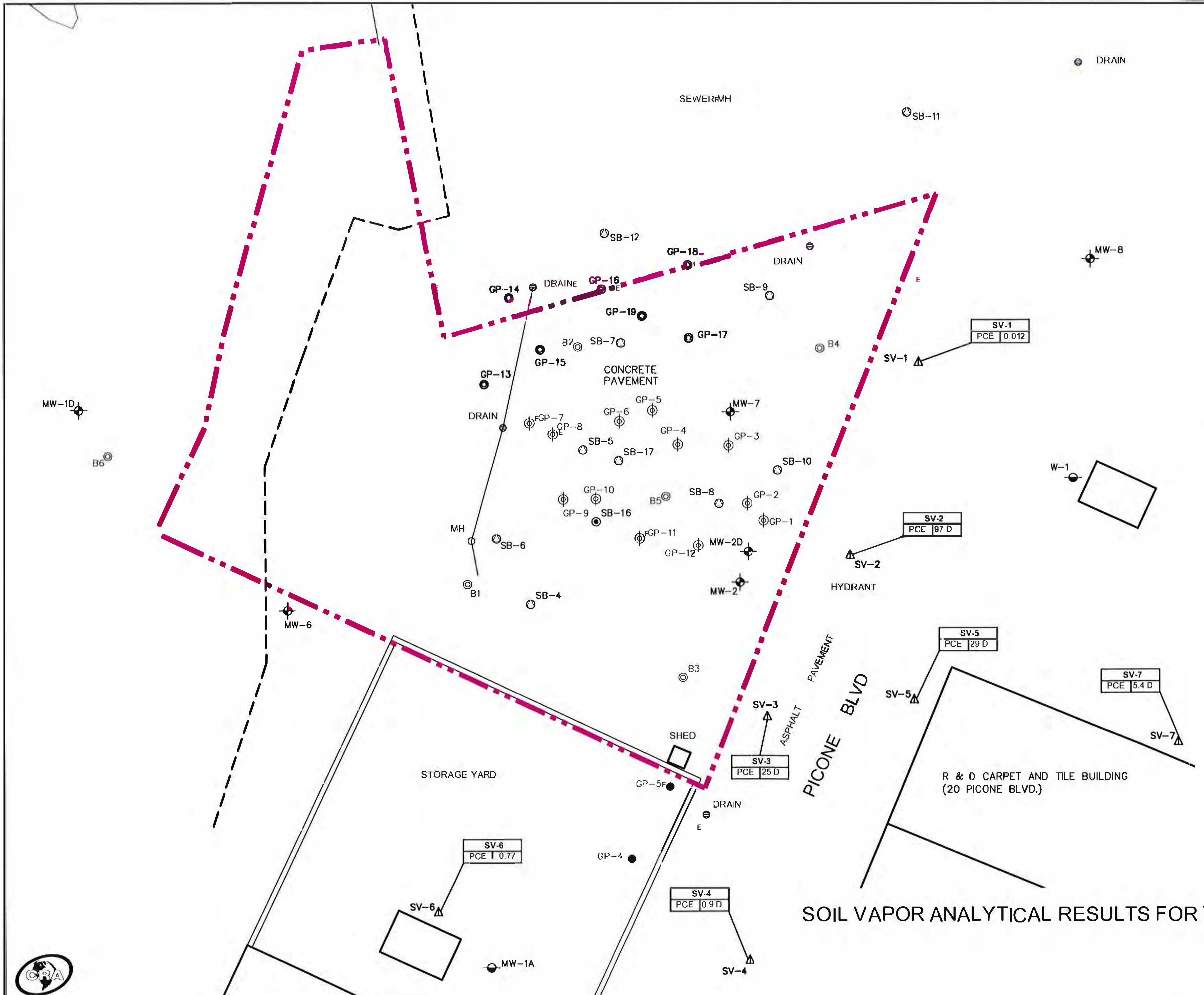
1



REMEDIAL INVESTIGATION GROUNDWATER HY

1

SAMPLE INFORMATION SOURCE:
BLASLAND, BOUCK & LEE INC.



0 10 30ft

LEGEND:

- SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)
- FENCE LINE
- SOIL VOC DELINEATION BORING (AUGUST 2002)
- SOIL VAPOR SAMPLE LOCATION (AUGUST 2002)
- EXISTING GROUNDWATER MONITORING WELL LOCATION (INSTALLED FOR INVESTIGATION OF THE HWD SITE)
- SOIL BORING/HYDROPUNCH LOCATION
- HYDROPUNCH LOCATION ONLY
- SOIL BORING LOCATION ONLY
- GEOPROBE SOIL BORING LOCATION
- GEOPROBE GROUNDWATER SAMPLING LOCATION (APPROXIMATE)
- PHASE II SOIL BORING LOCATION (APPROXIMATE)

SV-1		SAMPLE IDENTIFICATION
PCE	0.012	SAMPLE CONCENTRATION (PPMV)

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 YORKE 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
5. RESULTS & CRITERIA IN PPM. VALUES LISTED ONLY WHERE LOCATION EXCEEDED CRITERIA
5. D = COMPOUNDS AT SECONDARY DILUTION FACTOR

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. 993903.DWG, SURVEYED 11/22/99 THROUGH 11/29/99. SURVEY REVISED 2/9/2000 AND 5/13/2003

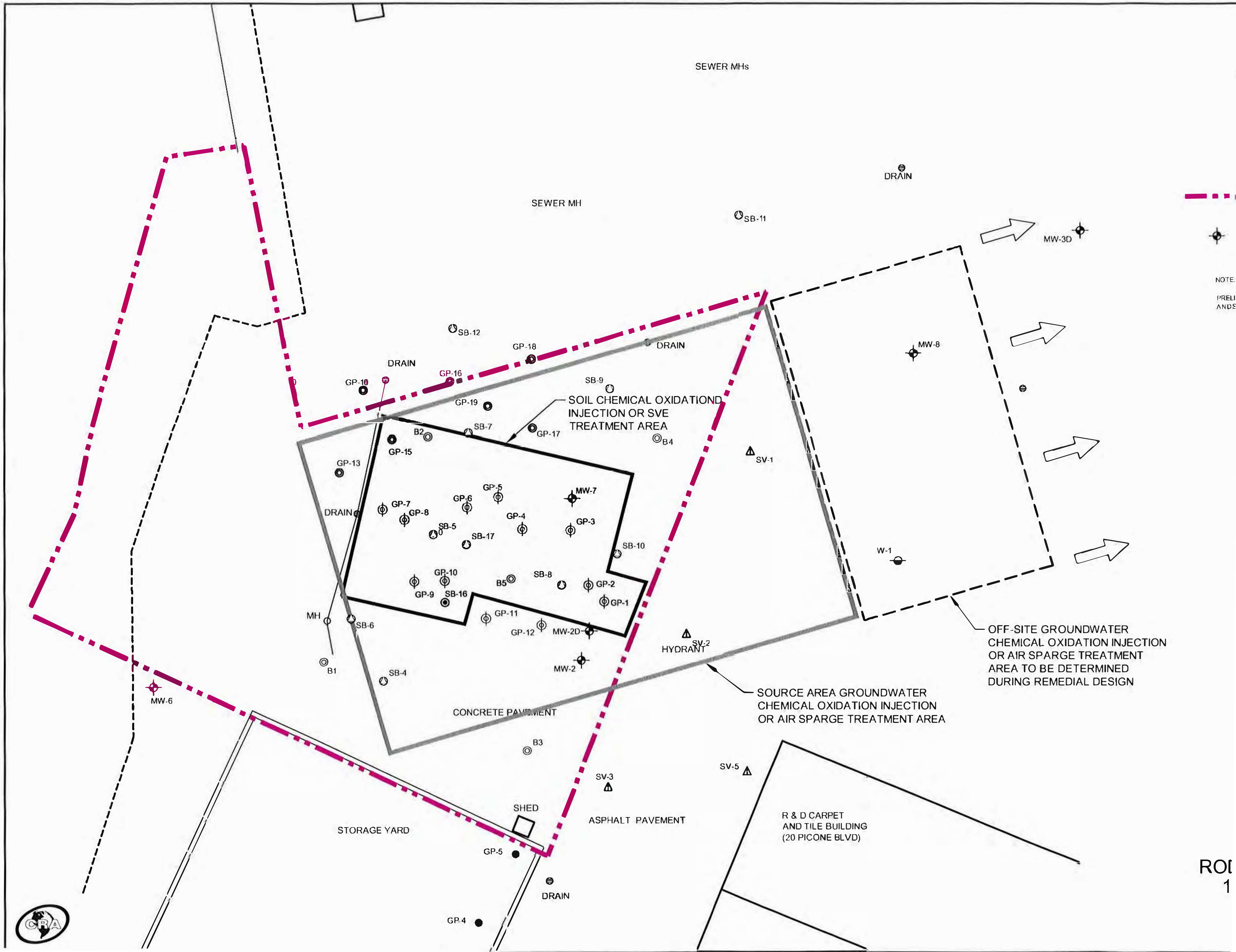
SAMPLE INFORMATION SOURCE:

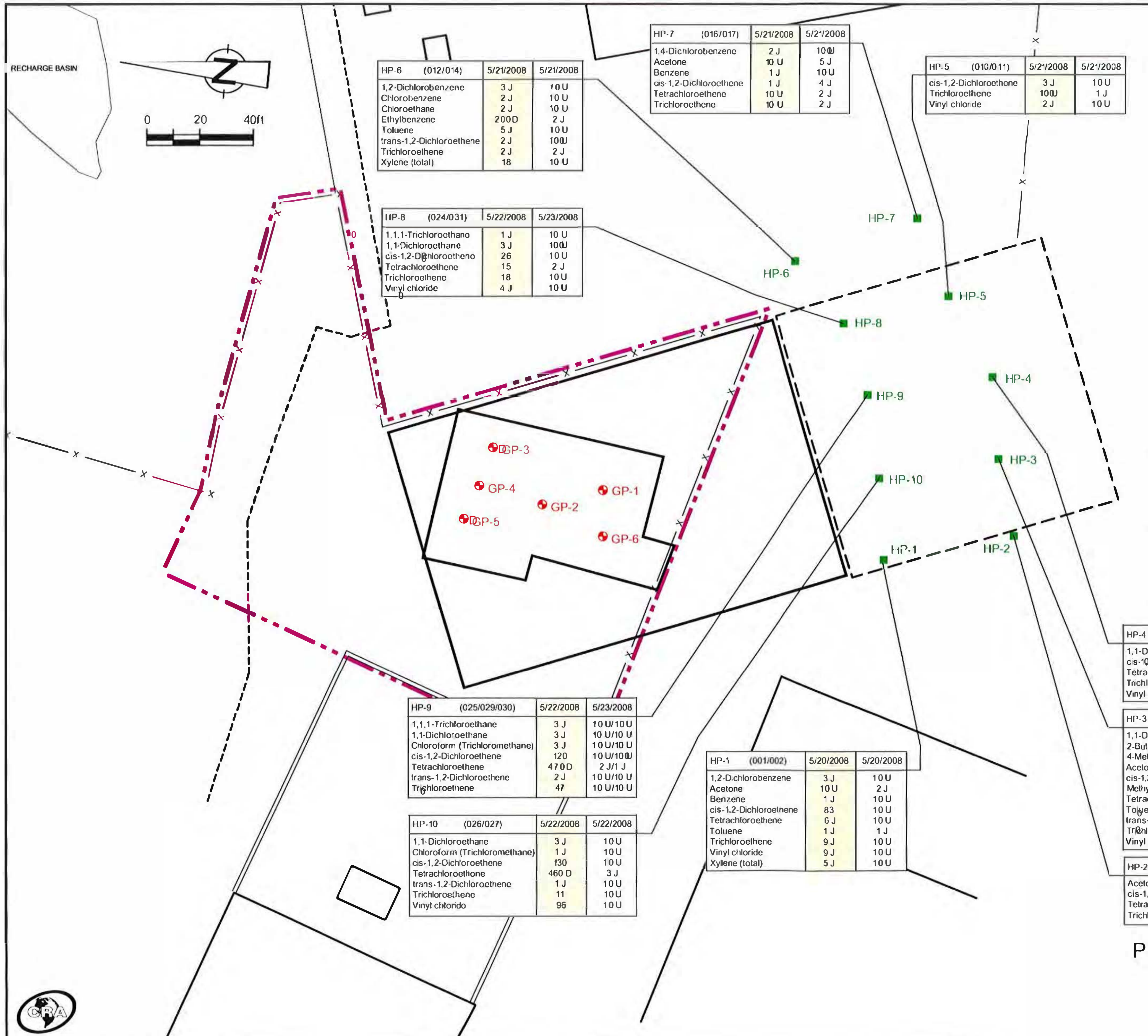
BLASLAND, BOUCK & LEE INC.
FEASIBILITY STUDY REPORT, FIGURE 2

figure 2.5

SOIL VAPOR ANALYTICAL RESULTS FOR TETRACHLOROETHENE (PPMV)
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA023 SEP 23/2009


SEWER MHs
SEWER MH
DRAIN
SB-11
MW-3D
SB-12
GP-18
DRAIN
DRAIN
GP-16
GP-19
SB-9
SOIL CHEMICAL OXIDATION INJECTION OR SVE TREATMENT AREA
SB-7
GP-17
B2
B4
GP-15
SV-1
GP-13
MW-8
GP-5
GP-6
MW-7
GP-7
GP-8
DRAIN
GP-4
GP-3
SB-5
SB-17
SB-10
W-1
GP-10
B5
SB-8
GP-2
GP-9
SB-16
GP-1
GP-11
MH
SB-6
GP-12
MW-2D
HYDRANT
SV-2
B1
MW-2
SB-4
MW-6
OFF-SITE GROUNDWATER CHEMICAL OXIDATION INJECTION OR AIR SPARGE TREATMENT AREA TO BE DETERMINED DURING REMEDIAL DESIGN
SOURCE AREA GROUNDWATER CHEMICAL OXIDATION INJECTION OR AIR SPARGE TREATMENT AREA
CONCRETE PAVEMENT
B3
SV-3
SV-5
SHED
STORAGE YARD
ASPHALT PAVEMENT
R & D CARPET AND TILE BUILDING (20 PICONE BLVD)
GP-5
DRAIN
GP-4
NOTE:
ROD
1



HP-6 (012/014)	5/21/2008	5/21/2008
1,2-Dichlorobenzene	3 J	10 U
Chlorobenzene	2 J	10 U
Chloroethane	2 J	10 U
Ethylbenzene	200D	2 J
Toluene	5 J	10 U
trans-1,2-Dichloroethene	2 J	10U
Trichloroethene	2 J	2 J
Xylene (total)	18	10 U

HP-7 (016/017)	5/21/2008	5/21/2008
1,4-Dichlorobenzene	2 J	10U
Acetone	10 U	5 J
Benzene	1 J	10 U
cis-1,2-Dichloroethene	1 J	4 J
Tetrachloroethene	10 U	2 J
Trichloroethene	10 U	2 J

HP-5 (010/011)	5/21/2008	5/21/2008
cis-1,2-Dichloroethene	3 J	10 U
Trichloroethene	10U	1 J
Vinyl chloride	2 J	10 U

HP-8 (024/031)	5/22/2008	5/23/2008
1,1,1-Trichloroethane	1 J	10 U
1,1-Dichloroethane	3 J	10U
cis-1,2-Dichloroethene	26	10 U
Tetrachloroethene	15	2 J
Trichloroethene	18	10 U
Vinyl chloride	4 J	10 U

HP-4 (008/009)	5/21/2008	5/21/2008
1,1-Dichloroethane	4 J	10 U
cis-1,2-Dichloroethene	10	10 U
Tetrachloroethene	5 J	10 U
Trichloroethene	6 J	10 U
Vinyl chloride	2 J	10 U

HP-3 (005/007)	5/20/2008	5/21/2008
1,1-Dichloroethane	5 J	10 U
2-Butanone (Methyl Ethyl Ketone)	5 J	10 U
4-Methyl-2-Pentanone (Methyl isobutyl Ketone)	1 J	10 U
Acetone	5 J	10 U
cis-1,2-Dichloroethene	41	10 U
Methyl cyclohexane	4 J	10 U
Tetrachloroethene	4 J	1 J
Toluene	2 J	10 U
trans-1,2-Dichloroethene	3 J	10 U
Trichloroethene	8 J	10 U
Vinyl chloride	38	10 U

HP-2 (003/004)	5/20/2008	5/20/2008
Acetone	3 J	2 J
cis-1,2-Dichloroethene	3 J	2 J
Tetrachloroethene	8 J	12
Trichloroethene	5 J	5 J

HP-9 (025/029/030)	5/22/2008	5/23/2008
1,1,1-Trichloroethane	3 J	10 U/10 U
1,1-Dichloroethane	3 J	10 U/10 U
Chloroform (Trichloromethane)	3 J	10 U/10 U
cis-1,2-Dichloroethene	120	10 U/10U
Tetrachloroethene	470 D	2 J/1 J
trans-1,2-Dichloroethene	2 J	10 U/10 U
Trichloroethene	47	10 U/10 U

HP-10 (026/027)	5/22/2008	5/22/2008
1,1-Dichloroethane	3 J	10 U
Chloroform (Trichloromethane)	1 J	10 U
cis-1,2-Dichloroethene	130	10 U
Tetrachloroethene	460 D	3 J
trans-1,2-Dichloroethene	1 J	10 U
Trichloroethene	11	10 U
Vinyl chloride	96	10 U

HP-1 (001/002)	5/20/2008	5/20/2008
1,2-Dichlorobenzene	3 J	10 U
Acetone	10 U	2 J
Benzene	1 J	10 U
cis-1,2-Dichloroethene	83	10 U
Tetrachloroethene	6 J	10 U
Toluene	1 J	1 J
Trichloroethene	9 J	10 U
Vinyl chloride	9 J	10 U
Xylene (total)	5 J	10 U

LEGEND

SITE BOUNDARY LOCATION (10A PICONE BOULEVARD)

FENCE LINE

ANTICIPATED AREA OF SATURATED SOIL/ GROUNDWATER TO BE TREATED BY CHEMICAL OXIDATION

EXISTING MONITORING WELL (NOT SAMPLED)

HP-2 PRE-DESIGN HYDROPUNCH LOCATION

GP-6 PRE-DESIGN SOIL SAMPLE LOCATION

MONITORING WELL ID — SAMPLE ID — SAMPLE DATE

HP-5 (010/011)	5/21/2008	5/21/2008
cis-1,2-Dichloroethene	3 J	10 U
Trichloroethene	10 U	1 J
Vinyl chloride	2 J	10 U

PARAMETER — SAMPLE DEPTH 15' — SAMPLE DEPTH 35' — CONCENTRATION (µg/L)

HORIZONTAL DATUM:
LONG ISLAND STATE PLANE COORDINATE SYSTEM NAD 83

NOTES:

1) J = ESTIMATED
2) U = NON-DETECT AT ASSOCIATED VALUE
3) D = COMPOUNDS AT SECONDARY DILUTION FACTOR

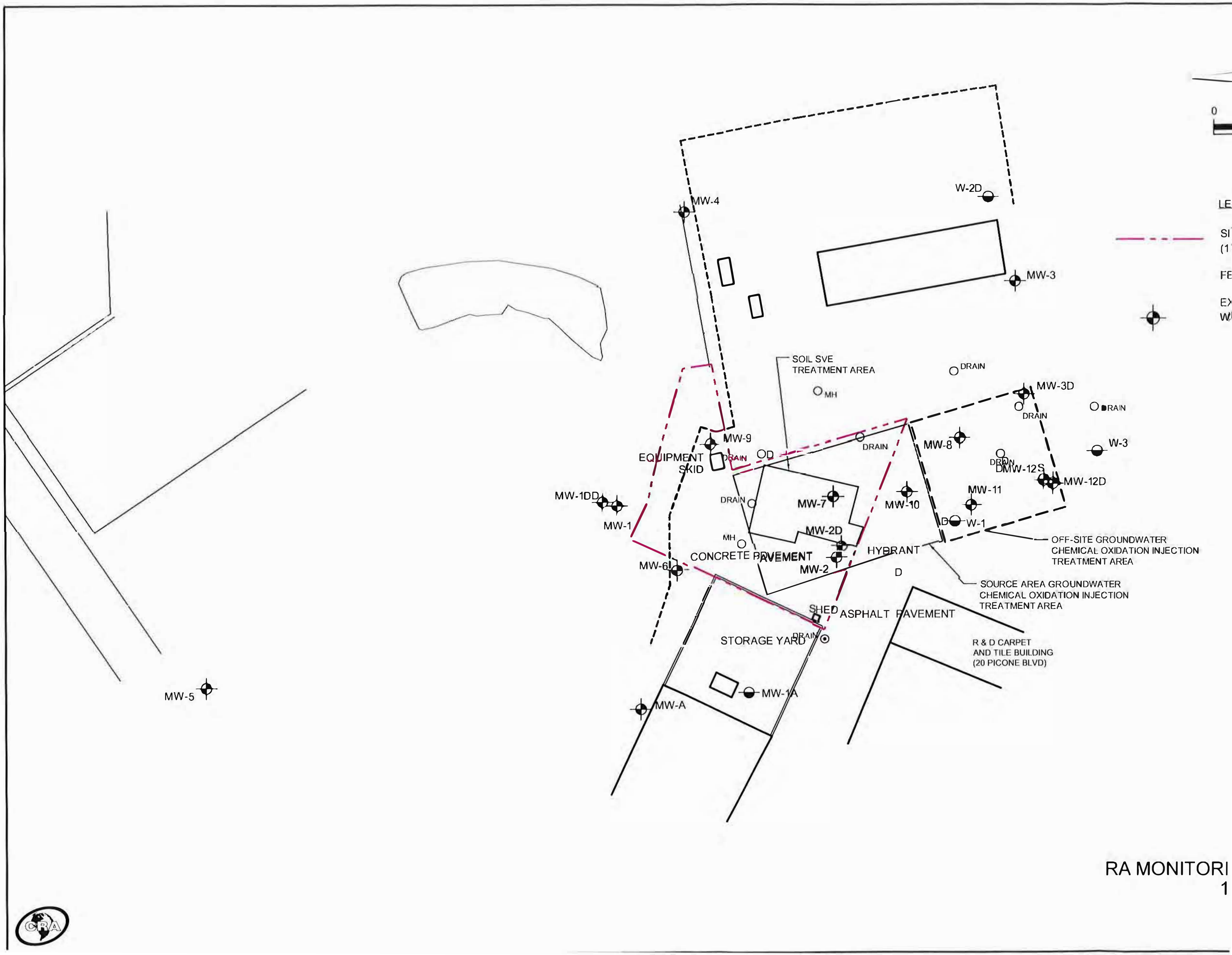
SOURCE:

1) 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.
2) CRA HYDROPUNCH AND GEOPROBE LOCATIONS SURVEYED MAY 22, 2008 BY BORBAS SURVEYING

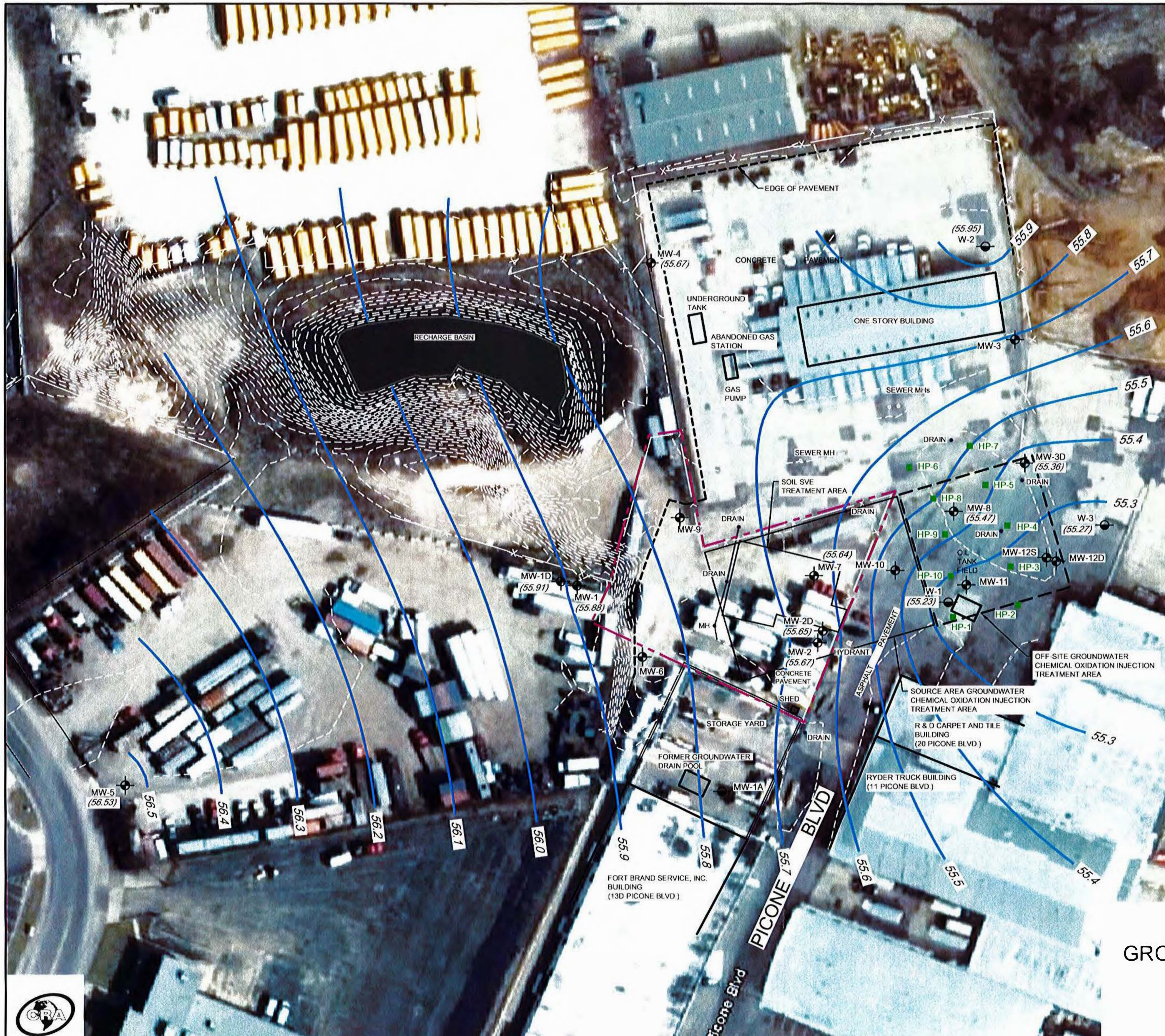
figure 3.1

PRE-DESIGN HYDROPUNCH VOC RESULTS
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA026 SEP 23/2009



MW-4
W-2D
MW-3
SOIL SVE
TREATMENT AREA
MH
DRAIN
MW-3D
MW-9
EQUIPMENT
SKID
MW-8
W-3
MW-1DD
MW-1
MW-7
MW-10
MW-11
MW-12S
MW-12D
W-1
MW-2D
HYDRANT
CONCRETE PAVEMENT
MW-2
MW-6
OFF-SITE GROUNDWATER
CHEMICAL OXIDATION INJECTION
TREATMENT AREA
SOURCE AREA GROUNDWATER
CHEMICAL OXIDATION INJECTION
TREATMENT AREA
SHED
ASPHALT PAVEMENT
STORAGE YARD
R & D CARPET
AND TILE BUILDING
(20 PICONE BLVD)
MW-1A
MW-A
MW-5
0
RA MONITORI
1



N

0 40 80ft

LEGEND:

SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)

FENCE LINE

ANTICIPATED AREA OF SATURATED SOIL/ GROUNDWATER TO BE TREATED BY CHEMICAL OXIDATION

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

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

HP-2 PRE-DESIGN HYDROPUNCH LOCATION

56.5 GROUNDWATER CONTOUR

(55.27) GROUNDWATER ELEVATION

SOURCE:

1) 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.

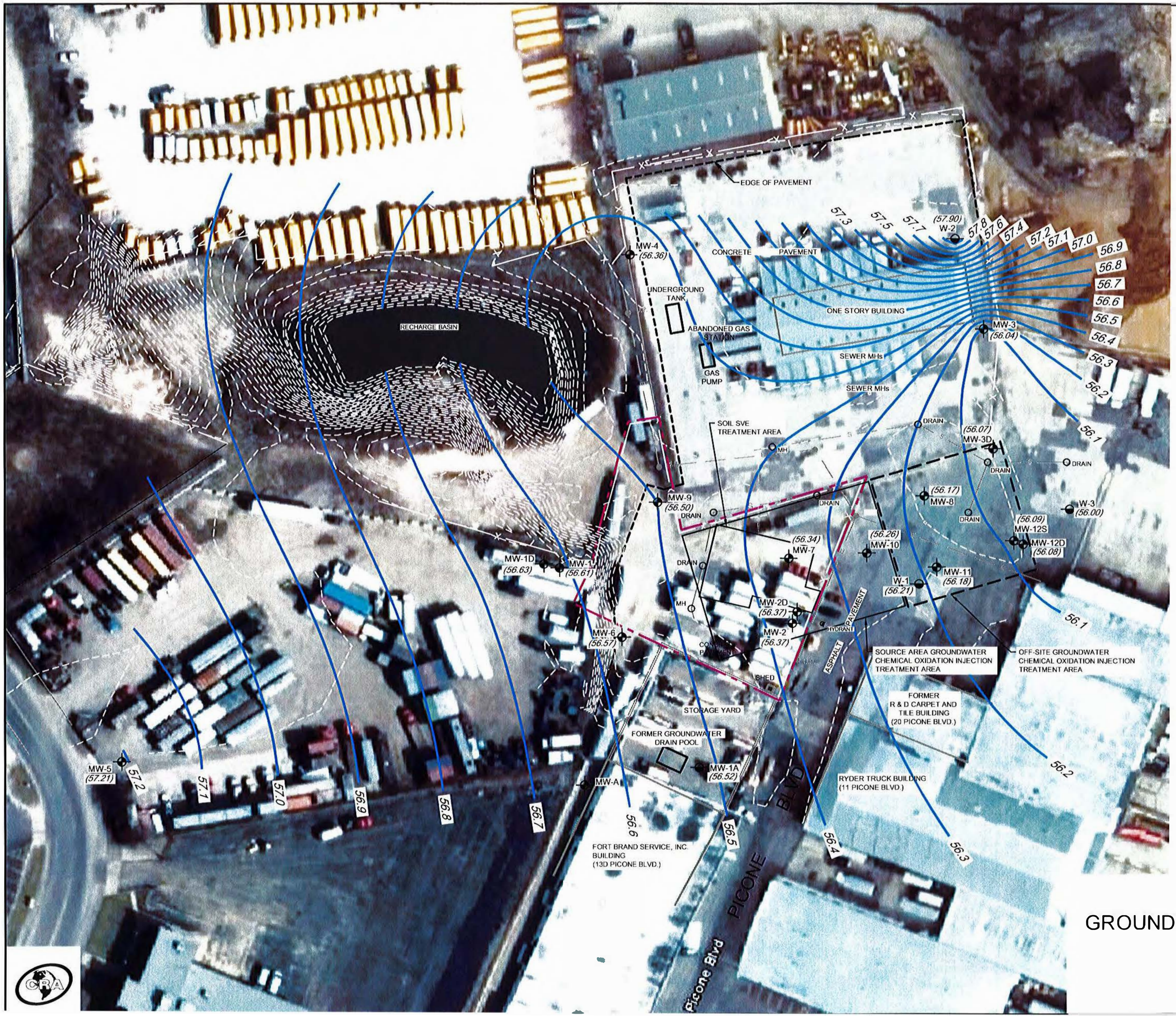
2) CRA HYDROPUNCH AND GEOPROBE LOCATIONS SURVEYED MAY 22, 2008 BY BORBAS SURVEYING

3) AERIAL PHOTOGRAPH FROM GOOGLE EARTH

figure 3.3

GROUNDWATER CONTOURS - JULY 17, 2008
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA010 SEP 23/2009



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56.5 GROUN
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(5662) GROUN

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HORIZONTAL DATUM:
LONG ISLAND STATE P

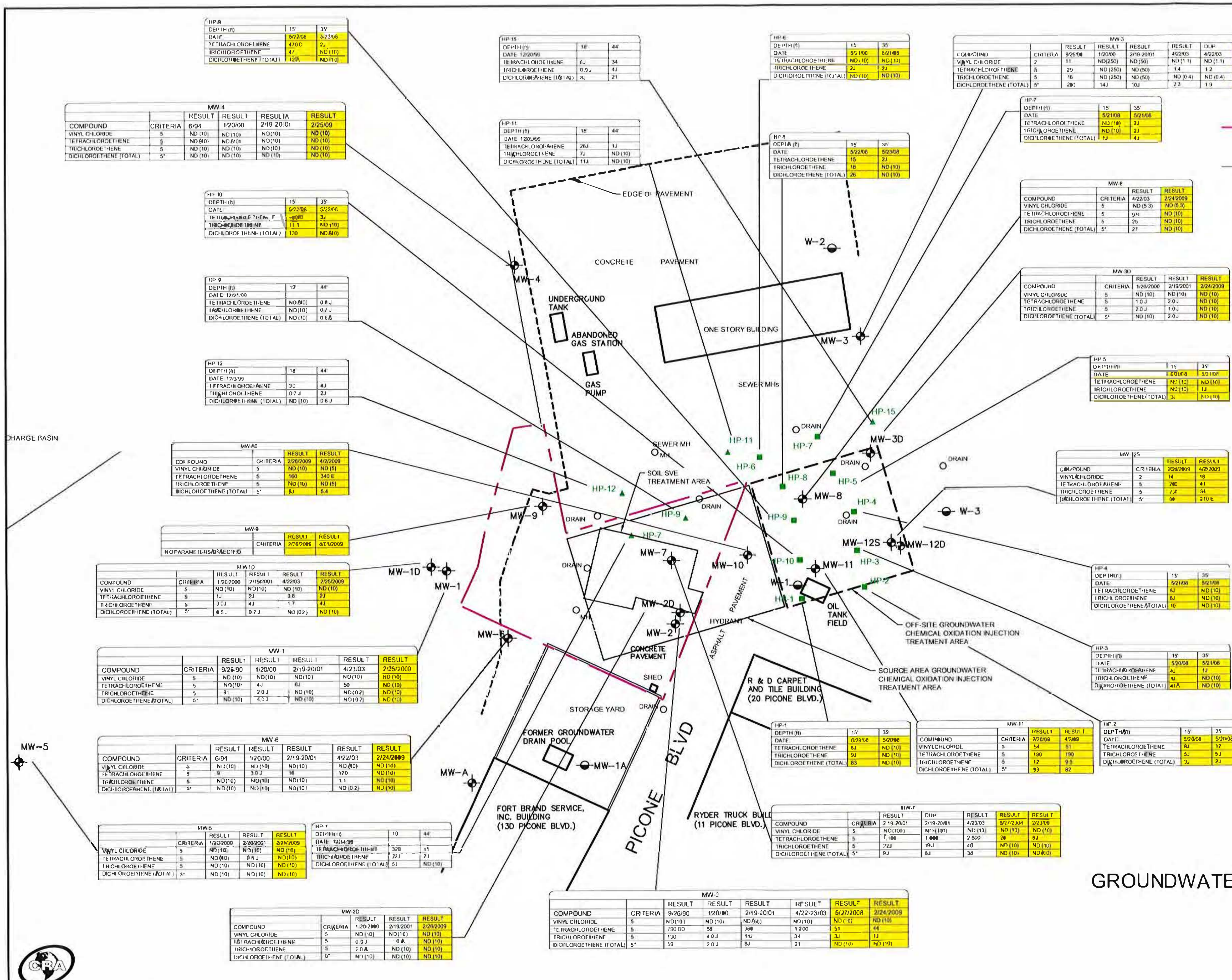
SOURCE:

1) ALL BASE MAP INFORMATI
MAP ENTITLED "MONITORI
SITE-PICONE BOULEVARD,
PREPARED BY ALBERT W.
THROUGH 11/29/99. SURVE

2) MONITORING WELL, DRAIN
FEBRUARY 24, 2009 BY BOI

3) AERIAL PHOTOGRAPH FRO

GROUNDWATER CONT
1



LEGEND:

SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)

FENCE LINE

ANTICIPATED AREA OF SATURATED SOIL/ GROUNDWATER TO BE TREATED BY CHEMICAL OXIDATION

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

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

HP-2 PRE-DESIGN HYDROPUNCH LOCATION (CRA)

HP-11 HYDROPUNCH LOCATION (BLASLAND, BOUCK & LEE INC.)

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. AA 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 QUALITED SAMPLE ANALYSIS
8. ND = NOT DETECTED
9. NA = NOT ANALYZED
10. NR = NOT REPORTED
11. NJ = TENTATIVELY IDENTIFIED COMPOUND
12. 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
13. E = VALUE ABOVE QUANTIFICATION RANGE

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.

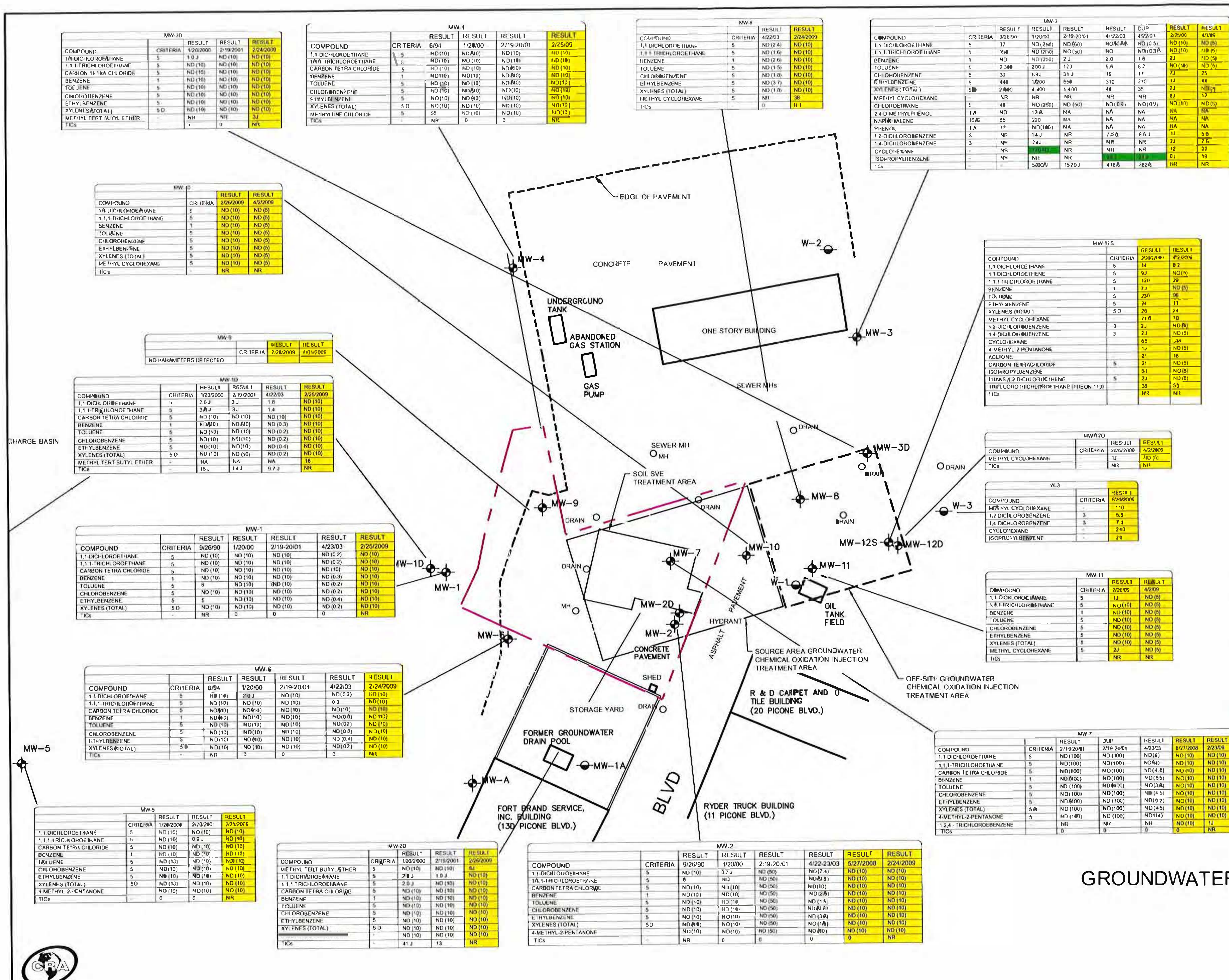
SAMPLE INFORMATION SOURCE:

BLASLAND, BOUCK & LEE INC
FEASIBILITY STUDY REPORT, FIGURE 7
CRA PREDESIGN INVESTIGATION (2008-2009)

figure 3.5

GROUNDWATER MONITORING WELL DATA
PCE, TCE, DCE, AND VC
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA019 SEP 23/2009



LEGEND:

SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)

FENCE LINE

ANTICIPATED AREA OF SATURATED SOIL/ GROUNDWATER TO BE TREATED BY CHEMICAL OXIDATION

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 NR = NOT REPORTED

11. NJ = TENTATIVELY IDENTIFIED COMPOUND

12 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

13 E = VALUE ABOVE QUANTIFICATION RANGE

PARAMETER REPORTED AS A TENTATIVELY IDENTIFIED COMPOUND

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.

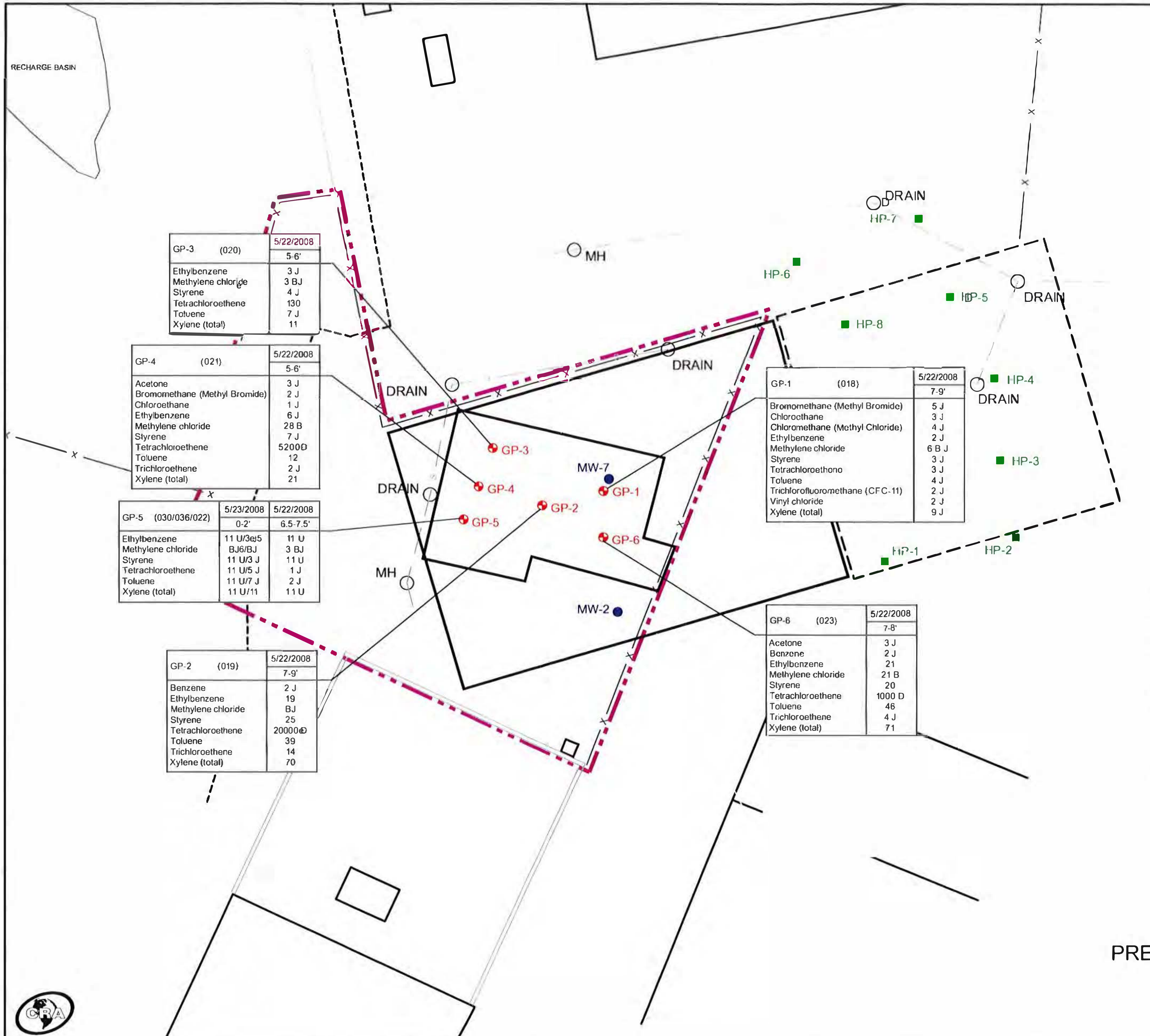
SAMPLE INFORMATION SOURCE:

BLASLAND, BOUCK & LEE INC
FEASIBILITY STUDY REPORT, FIGURE 7
CRA - PREDESIGN INVESTIGATION (2008-2009)

figure 3.6

GROUNDWATER MONITORING WELL DATA
NON SITE RELATED VOCs
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA014 SEP 23/2009



GP-3 (020)	5/22/2008
	5-6'
Ethylbenzene	3 J
Methylene chloride	3 BJ
Styrene	4 J
Tetrachloroethene	130
Toluene	7 J
Xylene (total)	11

GP-4 (021)	5/22/2008
	5-6'
Acetone	3 J
Bromomethane (Methyl Bromide)	2 J
Chloroethane	1 J
Ethylbenzene	6 J
Methylene chloride	28 B
Styrene	7 J
Tetrachloroethene	5200D
Toluene	12
Trichloroethene	2 J
Xylene (total)	21

GP-5 (030/036/022)	5/23/2008	5/22/2008
	0-2'	6.5-7.5'
Ethylbenzene	11 U/3e/5	11 U
Methylene chloride	BJ6/BJ	3 BJ
Styrene	11 U/3 J	11 U
Tetrachloroethene	11 U/5 J	1 J
Toluene	11 U/7 J	2 J
Xylene (total)	11 U/11	11 U

GP-2 (019)	5/22/2008
	7-9'
Benzene	2 J
Ethylbenzene	19
Methylene chloride	BJ
Styrene	25
Tetrachloroethene	20000D
Toluene	39
Trichloroethene	14
Xylene (total)	70

GP-1 (018)	5/22/2008
	7-9'
Bromomethane (Methyl Bromide)	5 J
Chloroethane	3 J
Chloromethane (Methyl Chloride)	4 J
Ethylbenzene	2 J
Methylene chloride	6 B J
Styrene	3 J
Tetrachloroethono	3 J
Toluene	4 J
Trichlorofluoromethane (CFC-11)	2 J
Vinyl chloride	2 J
Xylene (total)	9 J

GP-6 (023)	5/22/2008
	7-8'
Acetone	3 J
Benzene	2 J
Ethylbenzene	21
Methylene chloride	21 B
Styrene	20
Tetrachloroethene	1000 D
Toluene	46
Trichloroethene	4 J
Xylene (total)	71

0 20 40ft

LEGEND

- SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)
- FENCE LINE
- ANTICIPATED AREA OF SATURATED SOIL/ GROUNDWATER TO BE TREATED BY CHEMICAL OXIDATION
- MW-7 EXISTING GROUNDWATER MONITORING WELL LOCATION (SAMPLED FOR PRE-DESIGN INVESTIGATION)
- EXISTING MONITORING WELL (NOT SAMPLED)
- HP-2 PRE-DESIGN HYDROPUNCH LOCATION
- GP-6 PRE-DESIGN SOIL SAMPLE LOCATION

MONITORING WELL ID — SAMPLE ID — SAMPLE DATE — SAMPLE DEPTH — PARAMETER — CONCENTRATION (µg/kg)

GP-3 (020)	5/22/2008
	5-6'
Ethylbenzene	3 J
Methylene chloride	3 BJ
Styrene	4 J
Tetrachloroethene	130
Toluene	7 J
Xylene (total)	11

HORIZONTAL DATUM:
LONG ISLAND STATE PLANE COORDINATE SYSTEM NAD 83

NOTES:

1) J = ESTIMATED
2) U = NON-DETECT AT ASSOCIATED VALUE
3) D = COMPOUNDS AT SECONDARY DILUTION FACTOR
4) B = METHOD BLANK CONTAMINATION

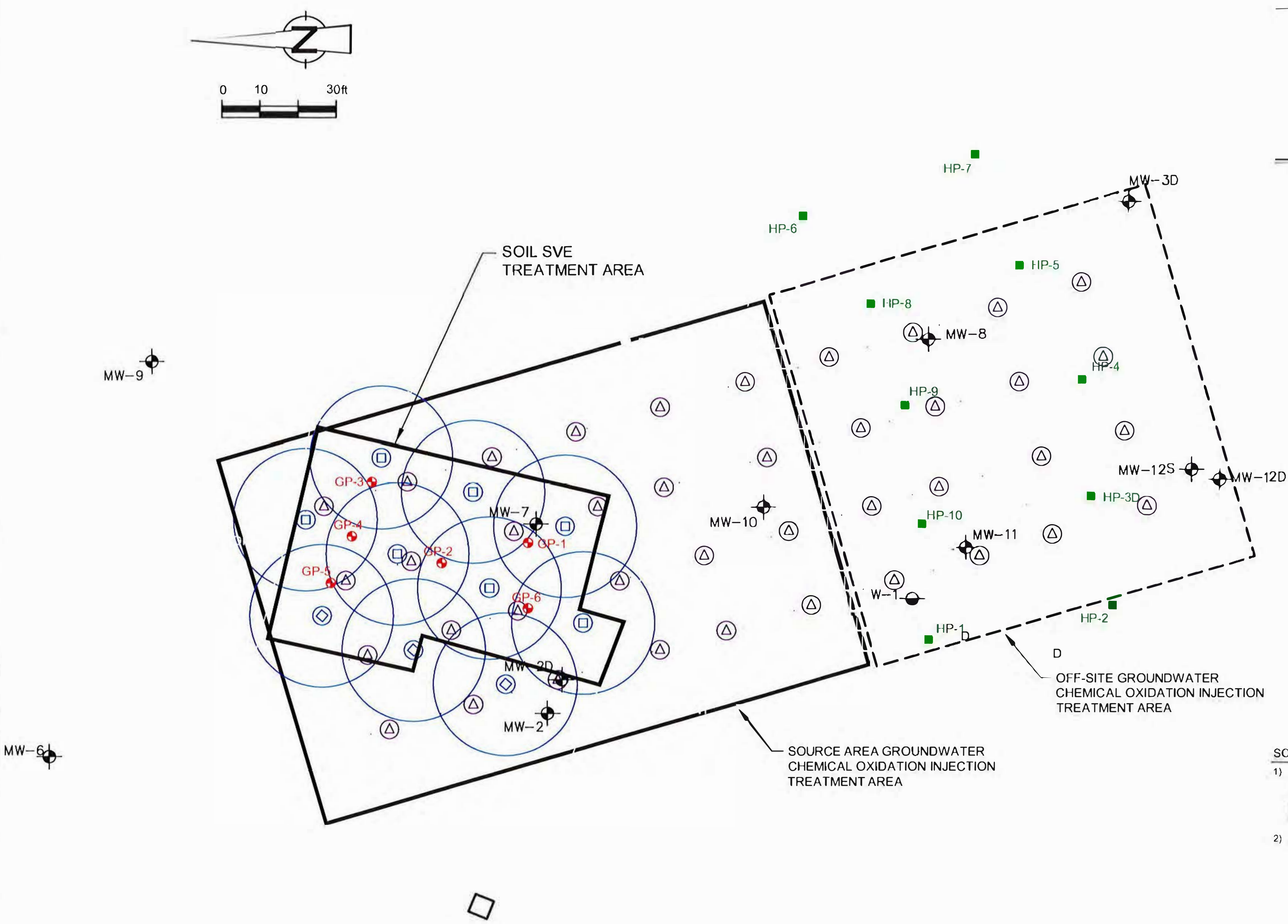
SOURCE:

1) 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.
2) CRA HYDROPUNCH AND GEOPROBE LOCATIONS SURVEYED MAY 22, 2008 BY BORBAS SURVEYING

figure 3.7

PRE-DESIGN GEOPROBE SOIL VOC RESULTS
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(004)GN-WA008 SEP 23/2009



LEGEND:

FENCE L

EXISTING LOCATIO THE HWD

EXISTING LOCATIO OTHERS

ANTICIPA GROUND OXIDATIO

PROPOS

PROPOS

HP-2 PRE-DES

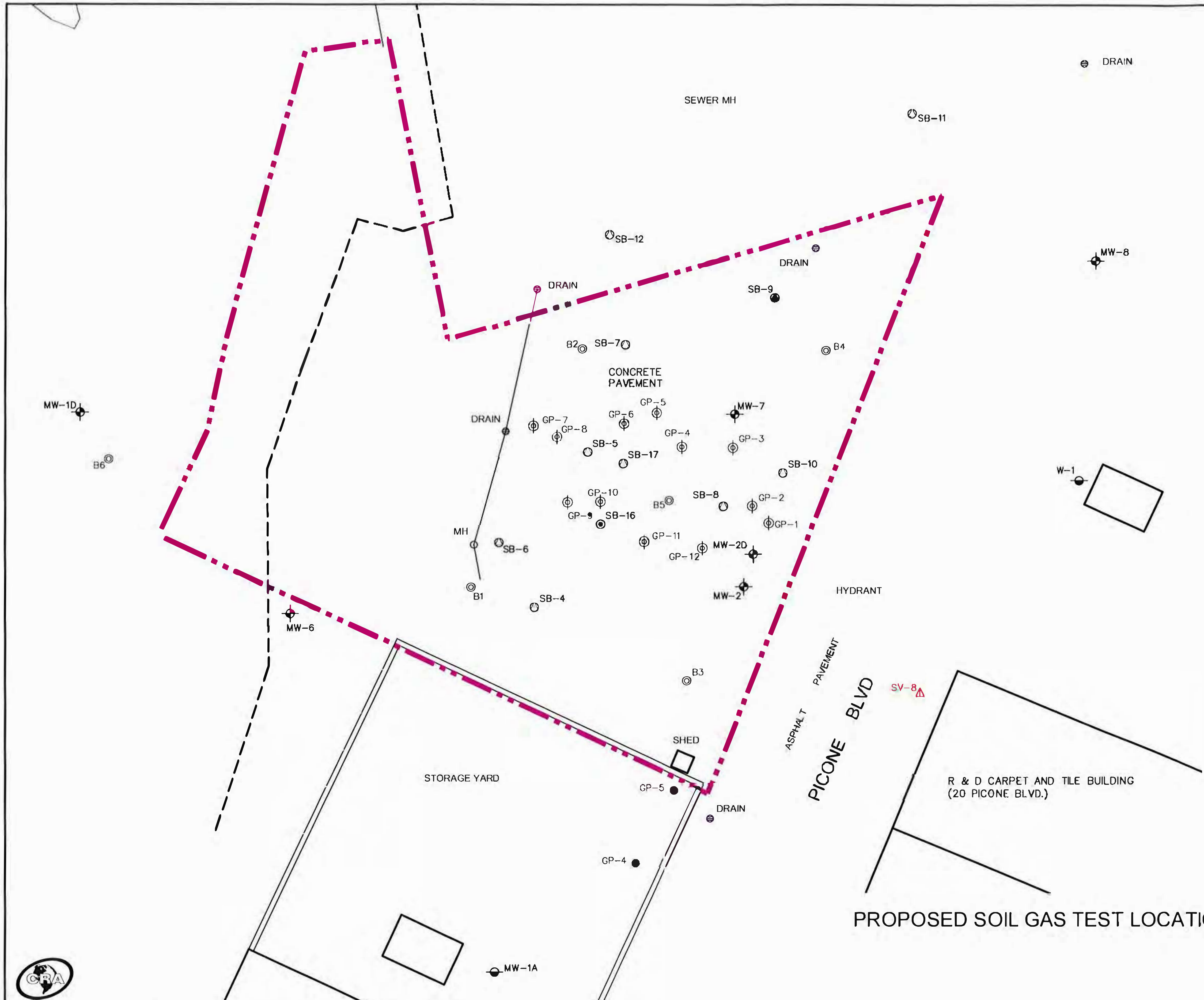
GP-6 PRE-DES

SOURCE:

1) ALL BASE MAP INFORMATION MAP ENTITLED "MONITORING SITE, PICONE BOULEVARD, FA PREPARED BY ALBERT W. TA THROUGH 11/29/99. SURVEY I

2) CRA HYDROPUNCH AND GEO BY BORBAS SURVEYING

SVE AND IS
1



0 10 30ft

LEGEND

- SITE BOUNDARY LOCATION (11A PICONE BOULEVARD)
- FENCE LINE
- SOIL VOC DELINEATION BORING (AUGUST 2002)
- SOIL VAPOR SAMPLE LOCATION (AUGUST 2002)
- PROPOSED SOIL VAPOR SAMPLE LOCATION
- EXISTING GROUNDWATER MONITORING WELL LOCATION (INSTALLED FOR INVESTIGATION OF THE HWD SITE)
- SOIL BORING/HYDROPUNCH LOCATION
- HYDROPUNCH LOCATION ONLY
- SOIL BORING LOCATION ONLY
- GEOPROBE SOIL BORING LOCATION
- GEOPROBE GROUNDWATER SAMPLING LOCATION (APPROXIMATE)
- PHASE II SOIL BORING LOCATION (APPROXIMATE)
- SAMPLE IDENTIFICATION
- SAMPLE CONCENTRATION (PPMV)

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 YORKS PHASE II INVESTIGATION, DECEMBER 1991".
4. THE LOCATIONS OF GEOPROBE GROUNDWATER SAMPLING LOCATIONS (GP-4 AND GP-5) AT 130 PICONE BOULEVARD ARE APPROXIMATE. THE SOURCE IS FIGURE 2 - GROUNDWATER SAMPLING LOCATIONS PREPARED BY FANNING, PHILLIPS & MOLNAR (FPM) DATED 8/23/96
5. RESULTS & CRITERIA IN PPM. VALUES LISTED ONLY WHERE LOCATION EXCEEDED CRITERIA

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

SAMPLE INFORMATION SOURCE:

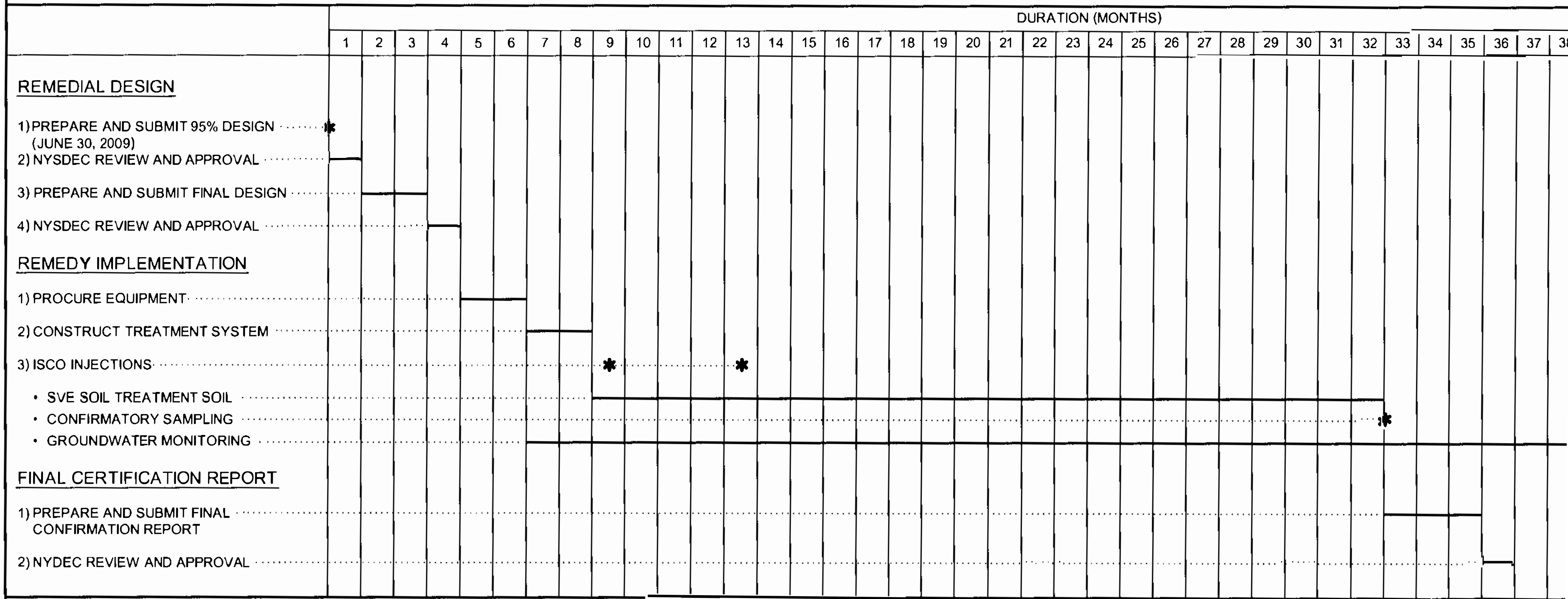
BLASLAND, BOUCK & LEE INC
FEASIBILITY STUDY REPORT, FIGURE 2

figure 5.2

PROPOSED SOIL GAS TEST LOCATION FOR TETRACHLOROETHENE
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

CRA

50138-00(004)GN-WA027 SEP 23/2009



DURATION (MONTHS)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
REMEDIAL DESIGN
1) PREPARE AND SUBMIT 95% DESIGN (JUNE 30, 2009)
2) NYSDEC REVIEW AND APPROVAL
3) PREPARE AND SUBMIT FINAL DESIGN
4) NYSDEC REVIEW AND APPROVAL
REMEDY IMPLEMENTATION
1) PROCURE EQUIPMENT
2) CONSTRUCT TREATMENT SYSTEM
3) ISCO INJECTIONS
• SVE SOIL TREATMENT SOIL
• CONFIRMATORY SAMPLING
• GROUNDWATER MONITORING
FINAL CERTIFICATION REPORT
1) PREPARE AND SUBMIT FINAL CONFIRMATION REPORT
2) NYDEC REVIEW AND APPROVAL

DRAWING INDEX

DWG. No	TITLE
CIVIL DRAWINGS	
CI-01	EXISTING CONDITIONS
CI-02	SITE MAP / WELL LOCATIONS
CI-03	SVE TRENCH LOCATION
CI-04	SVE PIPING LAYOUT
CI-05	EQUIPMENT LAYOUT / MISC NOTES
CI-06	WELL AND TRENCH DETAILS
FLOW SHEETS	
PF-01	PROCESS FLOW DIAGRAM
EF-00	ENGINEERING FLOW SHEET LEGEND
EF-01	ENGINEERING FLOW SHEET SVE WELLS
EF-02	ENGINEERING FLOW SHEET SVE WELLS
EF-03	ENGINEERING FLOW SHEET SVE SYSTEM
EF-04	ENGINEERING FLOW SHEET ISCOSYSTEM
MECHANICAL	
ME-01	SVE HEADER LAYOUT
ELECTRICAL	
EL-01	GROUNDING / POWER PLAN AND DETAILS

HWD SITE
FARMINGDALE, NEW YORK

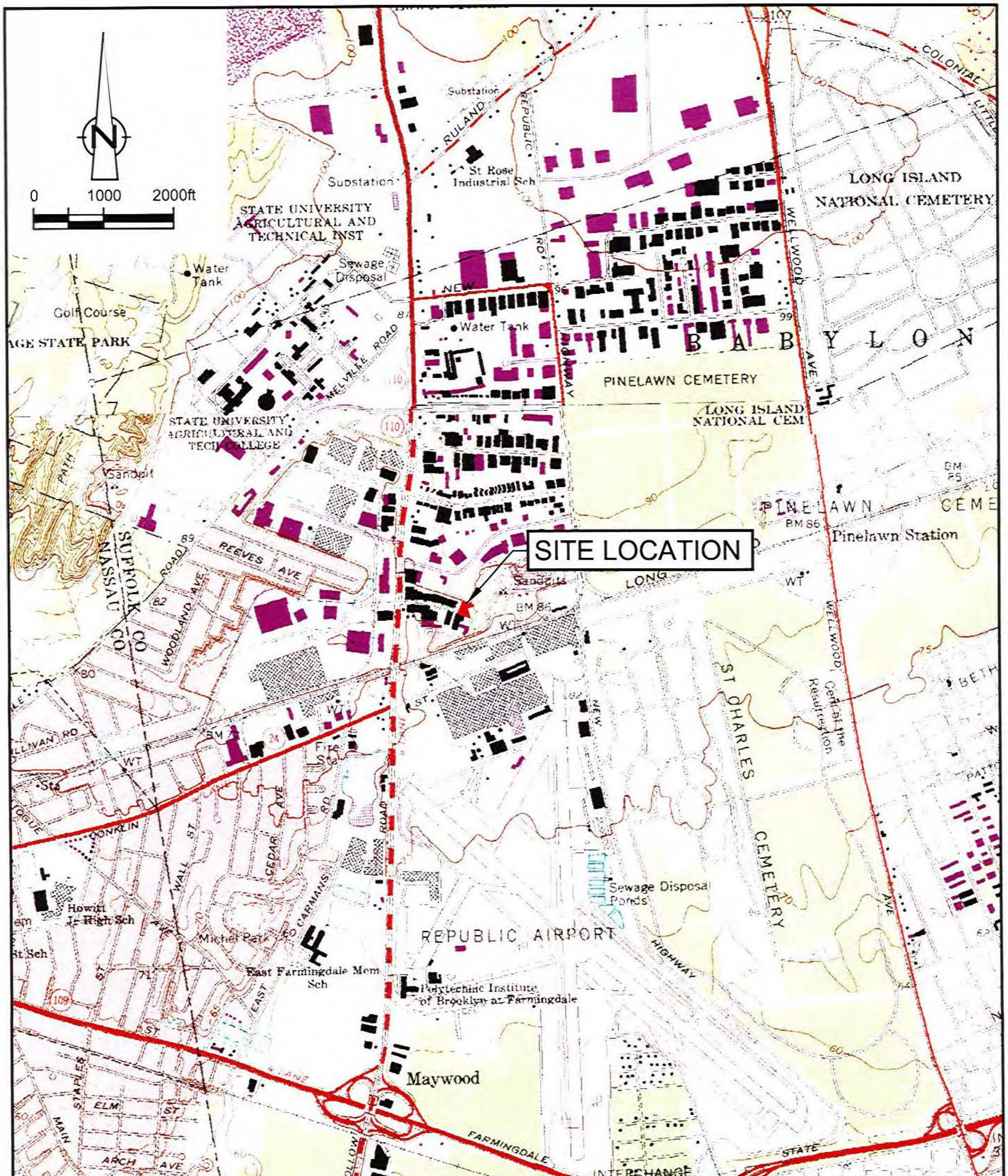
ISCO / SVE TREATMENT

SEPTEMBER 2009

100% DESIGN REPORT

50138-00(004)

CRA Infrastructure
& Engineering, Inc.



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

figure 2.1

SITE LOCATION
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(006)GN-WA001 SEP 23/2009

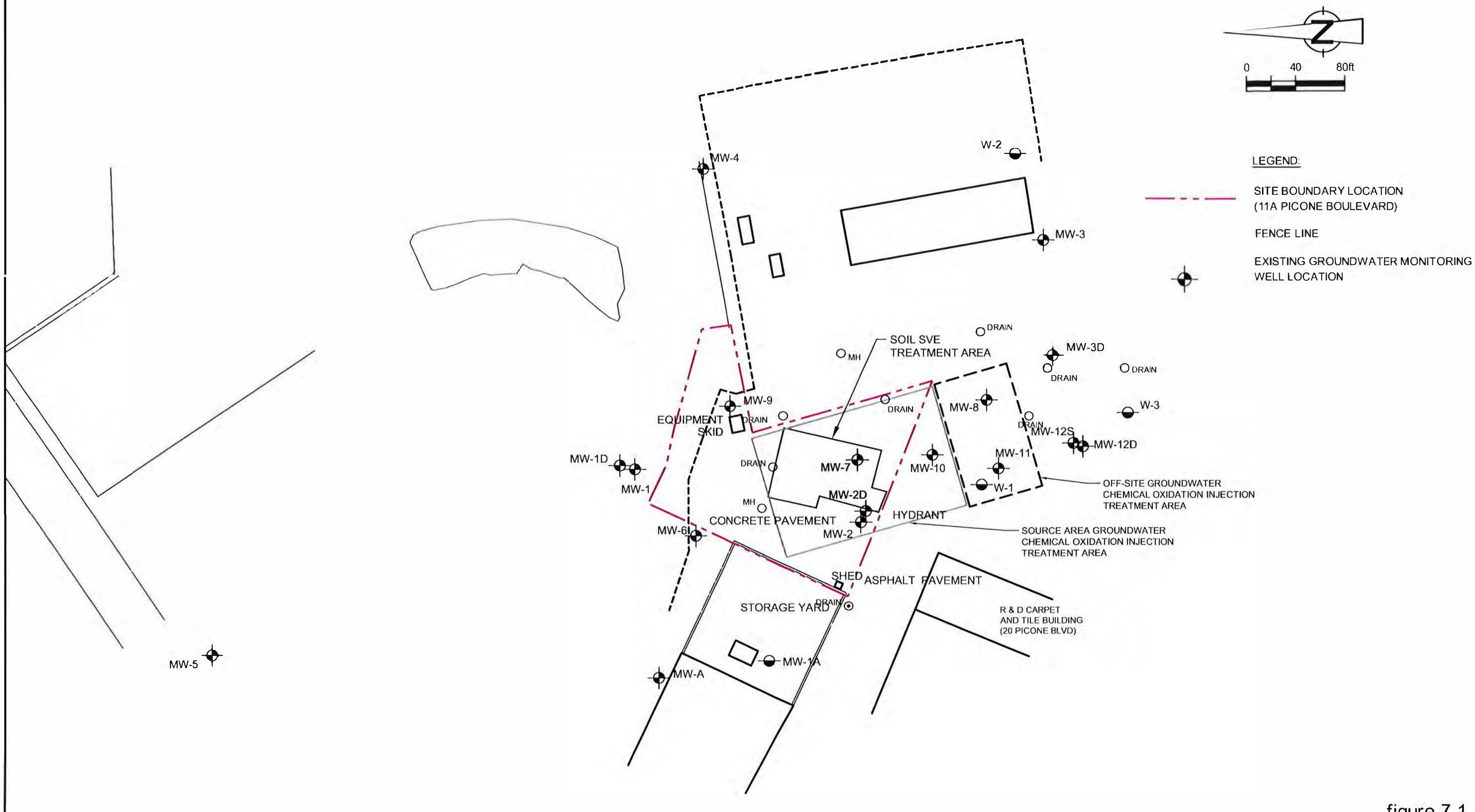


figure 7.1

RA MONITORING WELL LOCATIONS
100% DESIGN REPORT
HWD SITE
Farmingdale, New York

50138-00(006)GN-WA002 SEP 23/2009