INTERIM REMEDIAL MEASURE WORK PLAN

FORMER PENETREX PROCESSING FACILITY
GLENWOOD LANDING, NEW YORK
SITE # 1-30-034

Prepared for:
The New York State Department of Environmental Conservation
Division of Environmental Remediation
Albany, New York

Project No.: PEN0001

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P.W. GROSSER CONSULTING, INC.
PROJECT No. PEN0001

INTERIM REMEDIAL MEASURE WORK PLAN

1 SHORE ROAD
GLENWOOD LANDING, NEW YORK
Site # 1-30-034

Revised MAY 2008

James P. Rhodes

James P. Rhodes, P.G.
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1.0 INTRODUCTION

1.1 Project Background

This Interim Remedial Measure (IRM) Work Plan has been prepared by P.W. Grosser Consulting Inc. (PWGC), on behalf of Realty Management, Inc. of Roslyn, New York, for the property located at 1 Shore Road, Glenwood Landing, New York (a Site Location Map is included as **Figure 1**). The site is currently listed as a New York State Department of Environmental Conservation (NYSDEC) Class II inactive hazardous waste site identified as I.D. No. 130034.

One commercial structure and one residential structure are located at the site. The commercial structure is utilized by a children's party business and a church organization. Much of the building is currently vacant. The residential structure is a house which is separated into two apartments.

A former dry cleaning business, known as Penetrex Processing, Inc. (Penetrex), is reported to have operated at the site for several years prior to abandoning the facility in 1984. During its operation at the site, Penetrex is reported to have discharged dry cleaning chemicals to an on-site sanitary system and/or drywells at the property. A manufacturer of adhesive nameplates known as the Nameplate Corporation also formerly occupied the site.

In 1984, the Nassau County Department of Health (NCDH) sampled an on-site drywell associated with the former Penetrex facility and determined that constituents of dry-cleaning solvents, trichloroethene (TCE) and tetrachloroethene (PCE) were present in soils at the base of the structure. The impacted drywell was subsequently remediated in 1985 under a summary abatement order, completed by K&W Associates (property owner).

Additional testing and site characterization, which included the installation of six (6) soil borings and four (4) monitoring wells, soil and groundwater sampling, and air monitoring, were performed at the property in 1989 and 1990 by Blasland and Bouck Engineers under purview of the New York State Department of Conservation (NYSDEC) as part of a PRP (potentially responsible party) Study.

In 1993, Lawler, Matusky and Skelly Engineers (LMS) installed two additional monitoring wells at the site (at the direction of the NYSDEC) and performed additional groundwater sampling at the facility in an effort to confirm the direction of groundwater flow underlying the property and the extent of dissolved VOCs in on-site groundwater. LMS had concluded in their 1993 NYSDEC Inactive Hazardous Waste Site (IHWS) report for the Penetrex Processing site that "an ongoing discharge or continued release from residual waste in the soils . . . from several contaminant source locations on the site . . . appear to remain as a continuing source of groundwater contamination."

PWGC began a Remedial Investigation (RI) in November 2001 at the site to obtain information necessary to determine the need for a remediation. The RI included a soil boring program and sampling of the existing monitoring wells. The sanitary system located to the west of the commercial structure was successfully remediated in response to the results of the soil boring program.

A vertical profile groundwater investigation and a soil gas investigation were conducted at the site in October 2003 through January 2004 in response to the results of the initial groundwater investigation. Results of these investigations indicated elevated concentrations of volatile organic compounds (VOCs) associated with chlorinated solvents.

Based on the results of the October 2003 vertical profile groundwater investigation, shallow soil vapor sampling was required at locations near the commercial building and residential house. Results of the soil vapor sampling indicated elevated concentrations of chlorinated solvents. Based on these results, the NYSDEC required a sub-slab vapor and indoor air investigation in August 2005. A second round of indoor air sampling was conducted in May 2006. Indoor air VOC concentrations were within acceptable levels. However, elevated concentrations of VOCs were detected in sub-slab samples.

Based on the elevated sub-slab vapor concentrations, the NYSDEC in conjunction with the New York State Department of Health (NYSDOH) required the installation of sub-slab depressurization systems (SSDS) in each of the two site structures. Installation of the SSDS was completed in 2007.

The October 2003 Groundwater Investigation was expanded in December 2004 with the installation of one additional groundwater vertical profile and three additional monitoring wells. In order to further delineate the area of impact, additional soil and groundwater sampling was conducted in August 2006. As part of this investigation, a geophysical investigation was conducted at the site in June 2006 in an attempt to locate underground structures which may be acting as sources of the site's contamination. UIC structures were detected and subsequently abandoned. However, based on analytical results, these structures were not identified as sources of contamination.

The RI concluded that residual levels of volatile organic compounds (VOCs) in groundwater remain in the area of the eastern portion of the parking lot. The VOCs are likely due to former discharges of PCE to sanitary leaching pool DW-5 and to storm water leaching pool DW-1. The proposed IRM includes the installation of supplemental monitoring wells and the injection of a chemical oxidant solution into the area of impacted groundwater to accelerate the rate of attenuation.

1.2 Site Location and Description

The subject site consists of an approximately one-acre parcel located on the east side of Shore Road in the Hamlet of Glenwood Landing, Town of North Hempstead, Nassau County, New York. A site plan is included on **Figure 2**. The property is identified in Nassau County Tax maps as Section 20 - Block K - Lots 10 through 12. The property is improved with a two-story brick industrial building, a three-story wood-frame house, asphalt parking, communications tower and other ancillary improvements.

The property is bounded to the west by Shore Road and to the east by West Street. The area to the east of West Street is developed with residential houses. The site is generally located north of Scudders Lane and is situated near and adjoining several major oil storage facilities, coastal terminals, and a municipal power station near Hempstead Harbor. Glenwood Oil Terminal Corp. is located northwest, diagonally across the property.

1.3 Summary of Previous Investigations

Numerous environmental investigations, remedial studies, and remedial actions have been performed by PWGC at the site and are documented in the NYSDEC file including the following:

- Remedial Investigation Report, 1 Shore Road, Glenwood Landing, PWGC, August 2002
- Interim Groundwater Investigation Report, 1 Shore Road, Glenwood Landing, PWGC, March 2004 (Addendum, August 2004)
- Final Groundwater Investigation / Soil Gas Sampling Report, 1 Shore Road, Glenwood Landing, PWGC, April 2005 (Revised October 2005)
- Sub-Slab Vapor & Indoor Air Investigation Report, 1 Shore Road, Glenwood Landing, PWGC, November 2005
- Indoor Air Sampling Report, 1 Shore Road, Glenwood Landing, PWGC, June 2006
- Subsurface Investigation Report, 1 Shore Road, Glenwood Landing, PWGC, November 2006
- Sub-Slab Depressurization System Testing and As Built Drawing, 1 Shore Road, Glenwood Landing, PWGC, August 2007

1.3.1 Remedial Investigation Report

A remedial investigation (RI) was conducted at the site in November 2001 to obtain information necessary to determine the need for remediation at the site. The remedial investigation consisted of a file search (Town of North Hempstead Building Department), site reconnaissance, a soil boring program, the collection and analysis of soil samples, and the collection and analysis of groundwater samples from the four (4) existing on-site monitoring wells.

An underground injection control (UIC) investigation and remediation was performed in response to the results obtained from the soil boring program. This UIC program successfully dealt with soil issues identified during the investigation, and the site has received closure regarding those UIC issues from the Nassau County Department of Health (NCDH) and the United States Environmental Protection Agency (USEPA). Findings from the RI are presented in the Remedial Investigation Report, PWGC, August 2002 and the Storm Drain and Sanitary Leaching Pool Remediation and Closure Report, PWGC, September 2003, each previously submitted under separate cover.

Analytical results from the monitoring well sampling indicated elevated concentrations of VOCs associated with chlorinated solvents in the site's groundwater. Based on this, the NYSDEC required further groundwater investigation.

1.3.2 Interim Groundwater Investigation Report

A groundwater investigation was performed at the site from October 2003 through January 2004 at the request of the NYSDEC and as part of the Remedial Investigation to delineate the horizontal and vertical extent of the dissolved VOCs and to determine if additional investigation/remediation was warranted. Based on the results of the soil boring investigation and monitoring well sampling that was performed as part of the remedial investigation, and correspondence with the NYSDEC, eight locations were chosen for vertical profile groundwater sampling. These vertical profiles were also performed to confirm the location and the depths for additional permanent monitoring wells. The samples were collected in accordance with the protocol established in the Preliminary Remedial Investigation Report, PWGC, July 2002, submitted under separate cover. Results are detailed in the Interim Groundwater Investigation Report, PWGC, March 2004, previously submitted under separate cover.

1.3.3 Groundwater Investigation / Soil Gas Sampling Report

Based on the results of the October 2003 vertical profile groundwater investigation results, one additional temporary groundwater vertical profile well and three permanent groundwater monitoring wells were installed at the site. In addition, four soil gas points were installed as a result of a request by the NYSDEC to address concerns regarding soil vapor intrusion.

Typically, the greatest concentrations of VOCs detected in the groundwater across the site were found at the water table. To further delineate the groundwater contamination at this location, and to confirm the results from the Interim Groundwater performed in October 2003-January 2004, an additional temporary vertical profile was installed and sampled in accordance with the protocol established in the Interim Groundwater Investigation Report, PWGC, March 2004, submitted under separate cover.

Three permanent monitoring wells were constructed on December 28, 2004, to monitor the

contamination detected in the groundwater beneath the site. Following installation and development, sampling of the new and existing wells was performed. Groundwater sampling was performed on January 19, 2005. VOCs were detected above the NYSDEC Groundwater Standards in each of the samples collected, with the exception of MW-6, which is located down-gradient of the site, across Shore Road.

To address the NYSDEC's concerns regarding soil vapor intrusion into the adjacent buildings, PWGC conducted soil gas sampling at the following locations:

- SG-1 - 10 feet from the former Nameplate / former Parabit portion of the building;
- SG-2 - 10 feet from the former Penetrex portion of the building (Sunnyside Up Parties) and to the north of GW-7;
- SG-3 - conducted near the boundary, between GW-7 and the residence to the south;
- SG-4 - 10 feet from the residence.

Soil gas sampling points were installed on December 20, 2004 in accordance with procedures described in the Revised Addendum to the March 2004 Interim Groundwater Investigation Report prepared by PWGC and approved by the NYSDEC.

Analytical results were compared to the USEPA Target Shallow Soil Gas Concentrations as specified in the USEPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. Analytical Results indicated elevated concentrations of chlorinated VOC vapors in the subsurface of the site. Results are detailed in the Groundwater / Soil Gas Investigation Report, PWGC, April 2005, submitted under separate cover.

1.3.4 Sub-Slab Vapor & Indoor Air Investigation Report

In August 2005, a Sub-Slab Vapor and Indoor Air Sampling Investigation was conducted at the request of the NYSDEC to address concerns regarding soil vapor intrusion into the on-site buildings.

PWGC conducted sub-slab vapor, indoor air, and outdoor air sampling at the following locations:

- SS-1 (Sub-Slab-1) and IA-1 (Indoor Air-1) - the office of Landing Wholesale;
- SS-2 and IA-2 - the warehouse of Landing Wholesale;
- SS-3 and IA-3 - Sunnyside-Up Parties;
- SS-4 and IA-4 - Parabit Manufacturing;
- SS-5 and IA-5 - the basement of the on-site residence;
- IA-6 - the church/religious organization located upstairs from Sunnyside-Up Parties;
- OA-1 (Outdoor Air-1) - 15 feet to the southwest of the industrial building;
- OA-2 - 20 feet to the southwest of the residence.

Sub-slab vapor sampling points were installed on August 25, 2005, in accordance with procedures described in the Revised Sub-Slab Vapor and Indoor Air Sampling Plan, June 2005, prepared by PWGC and approved by the NYSDEC.

Sub-slab vapor and indoor air sampling was conducted by PWGC on August 26, 2005, the day after sub-slab sampling point installation, under the supervision of a NYSDEC representative. Samples were collected directly into six-liter, laboratory supplied Summa® canisters attached to a sampling tube. Indoor air samples were collected to characterize exposures to air within the on-site buildings.

Analytical results indicated elevated concentrations of chlorinated VOCs in the sub-slab vapor samples, but very low concentrations in the indoor air samples. Results are detailed in the Sub-Slab Vapor and Indoor Air Investigation Report, PWGC, November 2005, submitted under separate cover.

The NYSDEC required an additional round of indoor air sampling during the heating season, when vapor intrusion is most likely to occur.

1.3.5 Indoor Air Sampling Report

An additional round of indoor air sampling was conducted at the site in May 2006 to determine if indoor air VOC concentrations remained within target concentrations during the heating season, when the potential for vapor intrusion is the greatest.

Analytical results of the sampling confirmed that indoor air VOC concentrations remained within target concentrations during the heating season. Despite the absence of vapor intrusion at the site, the NYSDEC required installation of sub-slab depressurization systems (SSDS) in both on-site buildings to mitigate the existence of sub-slab VOCs.

1.3.6 Subsurface Investigation Report

A subsurface investigation was conducted in June, August, and September 2006 to locate potential sources of VOC contamination at the site and to further delineate the horizontal and vertical extent of impacted material. The investigation consisted of a geophysical survey, a soil boring program, and vertical profile groundwater sampling.

The geophysical survey detected several subsurface anomalies at the site. The anomalies were excavated. Three of the anomalies were found to be leaching pools and were subsequently sampled and abandoned following NCDH and USEPA procedures. A fourth anomaly was uncovered and found to be miscellaneous metal debris. A soil sample was collected from this test pit and submitted to the laboratory for analysis.

Soil and groundwater analytical results were used to delineate the extent of impact. Based on the results, the impacted area of contamination appears to be centered around storm drain DW-1 and sanitary leaching pool DW-5, in the eastern portion of the parking lot. A site plan indicating detected VOC concentrations is included on **Figure 3**.

1.3.7 Sub-Slab Depressurization System Testing and As Built Drawing

Communication tests were performed on the residential SSDS and the commercial SSDS in April and June 2007, respectively. The communication tests confirmed the effectiveness of the systems, that a negative pressure was created to draw out vapors from beneath the slabs of the structures. Based on the tests, the SSDS effectively mitigate the potential for vapor intrusion within the buildings.

1.4 Summary of the Remedial Investigation

The purpose of the field work portion of the RI completed by PWGC was to collect data of sufficient quality and quantity to supplement the previous investigations conducted at the site and to close gaps in the data set necessary to adequately characterize the nature and extent of contamination at the site and to evaluate contaminant migration.

1.4.1 Summary of the Nature and Extent of Contamination

The results of sampling performed during the RI, identified residual VOCs in soil above NYSDEC Recommended Soil Cleanup Objective (RSCO) predominantly in the eastern portion of the parking area in the vicinity of storm drain DW-1 and sanitary leaching pool DW-5. These concentrations were detected in soils collected at or below the water table. Soils analyzed above the water table were not impacted.

Groundwater analytical results identified VOCs above NYSDEC Groundwater Standards in the area corresponding to the impacted area of soil. VOC concentrations in the direction of groundwater flow show limited migration, as concentrations are only slightly above Groundwater Standards. Based on the groundwater flow direction (toward the west) and the VOC concentrations at adjacent down-gradient monitoring points, there does not appear to be significant plume migration from the suspect area.

VOCs in soil vapor were detected in samples from beneath both of the site's structures and in points adjacent to the building. The greatest concentrations were detected beneath the former Penetrex facility, currently utilized by Sunnyside Up Parties. Due to the presence of VOC vapors, SSDS were installed in both the commercial structure and the residential structure to mitigate the potential for exposure.

2.0 DESCRIPTION OF INTERIM REMEDIAL MEASURE

This IRM consists of the installation of permanent monitoring wells and the injection of a chemical oxidant solution in the delineated area of contamination in the eastern portion of the site's parking area. The VOCs in this area act as a source of residual contamination in groundwater. Chemical oxidant injection is intended to significantly reduce the mass of contamination through the breakdown of VOCs in the high concentration area. A site plan indicating proposed monitoring well locations and injection points is included as **Figure 4**.

2.1 Monitoring Well Installation

Five (5) monitoring wells will be installed in the area of contamination. These wells, along with the existing 7 wells at the site, will be used to monitor the effectiveness of the IRM. The monitoring wells will be constructed of two-inch diameter, schedule 40 PVC casing and screen with 0.010 inch slot.

Three (3) of the five (5) new wells (MW-8, MW-9, and MW-10) will be screened at the water table to monitor the most impacted groundwater. These wells will be constructed with 10 feet of screen and riser to grade. The top of the screen will be set 3 feet above the water table. The bottom of the screen will be set 7 feet below the water table. Water table measurements will be confirmed prior to drilling. A gravel pack of No. 2 Morie sand will be placed in the annulus around the screen, up to five feet above the top of the screen. A two-foot bentonite seal will be installed above the gravel pack. Above the bentonite layer, the annulus around the well will be backfilled with clean sand.

Two (2) of the five (5) new monitoring wells (MW-8D and MW-9D) will be screened at a 10-foot interval between 40 and 50 feet bgs to monitor IRM effectiveness at a greater depth.

The wells will be set flush to grade with a protective locking manhole cover. The riser will be fitted with a water tight cap. Drill cuttings will be monitored for VOC vapors with a photo-ionization detector (PID). Soils in which VOCs are not detected may be used to backfill the annulus of the wells. Soils in which VOCs are detected will be containerized for off-site disposal.

The new monitoring wells will be developed by a low stress (low flow) method to restore the hydraulic properties of the aquifer, while preserving soil horizons, water quality, and sample integrity. Development will be performed with dedicated instruments to prevent cross-contamination between well locations. The development of each well will continue until the turbidity is less than or equal to 50 Nephelometric Turbidity Units (NTUs), and when pH, temperature, and conductivity measurements stabilize. Stabilization will be considered achieved when three consecutive readings within five percent of each other are collected in five minutes. Portable field instruments will be used to collect measurements. If turbidity cannot be reduced to 50 NTUs, but other parameters stabilize, the well will be considered developed.

The monitoring wells will be surveyed so that groundwater elevations can be calculated. Water level measurements will be obtained and converted into groundwater elevation data to construct groundwater contour maps and determine flow direction. The measuring point on the well casing will be marked.

2.1.1 Soil Oxidant Demand Testing

Soil samples will be collected during the monitoring well installation process for the purpose of analyzing the natural soil oxidant demand. Two (2) split-spoon soil samples will be collected from the MW-8 location from depths of 20 feet and 40 feet and submitted to Carus Chemical for analysis. Analytical results will be used to more accurately calculate the amount of chemical oxidant to treat the subject area.

2.2 Monitoring Well Sampling

An initial round of water level measurements and groundwater sampling will be performed at least two weeks after installation of the new monitoring wells. Groundwater samples will be collected from the seven existing monitoring wells and the five newly installed wells (total of 12 groundwater samples).

The monitoring wells will be sampled by a low stress (low flow) method to collect representative samples while producing a minimal amount of purge water. Sampling will be performed with

dedicated instruments to prevent cross-contamination between well locations. Purging of each well will continue until the turbidity is less than or equal to 50 Nephelometric Turbidity Units (NTUs), and when pH, temperature, and conductivity measurements stabilize. Stabilization will be considered achieved when three consecutive readings within five percent of each other are collected in five minutes. Portable field instruments will be used to collect measurements. If turbidity cannot be reduced to 50 NTUs, but other parameters stabilize, the well will be considered developed. Samples will be collected directly from the polyethylene tubing into laboratory-supplied glassware upon stabilization of field parameters.

During the sampling event, depth to bottom and depth to water measurements will be collected at each monitoring well. Water level measurements will be obtained with an electronic water level probe relative to the marked measuring point. Measurements will be recorded in a dedicated bound project field notebook along with the time collected. Measuring equipment will be decontaminated between wells using a laboratory-grade detergent and water solution and tap water rinse.

2.2.1 Laboratory Analysis

Collected groundwater samples will be placed in pre-cleaned laboratory supplied glassware, and placed in a cooler packed with ice for transport to the laboratory. Sample analysis will be provided by an ELAP-certified environmental laboratory and will consist of volatile organic compounds (VOCs) by EPA Method 8260 and metals by EPA Method 6010.

2.2.2 Quality Assurance / Quality Control

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the laboratory for all data generated.

Collected samples will be appropriately packaged, placed in coolers and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or "cold-paks" to maintain a temperature of 4°C.

If dedicated disposable materials are used to collect groundwater samples (polyethylene tubing, dedicated samplers), field equipment (rinsate) blanks will not be part of the QA/QC program. Trip blanks will accompany samples each time they are transported to the laboratory.

2.3 Chemical Oxidant Injection

In order to reduce the mass of VOCs in groundwater beneath the site, a chemical oxidant solution (potassium permanganate) will be injected through approximately 17 points into the groundwater beneath the eastern portion of the site's parking area.

Potassium permanganate has been listed on the United States Department of Homeland Security's (DHS) "Table of Chemicals of Interest" due to the potential for the chemical to be used in the production of explosives. Because of this, PWGC will prepare the CSAT Top-Screen (DHS Form 9007), January 2008 required by the USDHS for facilities that produce, use, or store such chemicals.

The potassium permanganate will be procured upon DHS acceptance of the subject site. Should the DHS find the subject site unacceptable to receive the potassium permanganate, an alternative chemical oxidant, sodium permanganate, will be used. Sodium permanganate reacts with chlorinated solvents by the same reaction as potassium permanganate. However, sodium permanganate is more expensive.

3.0 ENGINEERING SPECIFICATIONS AND CONTROLS

3.1 Engineering Specifications

3.1.1 Chemical Oxidant Injection Program

Potassium permanganate will be delivered to the site as dry crystals and mixed with water. The activated solution will be prepared by mixing each 57 lb pail of Carus® potassium permanganate solution with 125 gallons of water in a large mixing tank. The concentration of the potassium permanganate solution to be injected is based on the results of a soil oxidant demand test (section 2.1) and calculations performed by Carus®, the manufacturer of the solution. The chemical oxidant calculation sheet is included as **Attachment A**. Field personnel will set up a mixing and distribution system consisting of a mixing tank, transfer pump, and appropriate distribution hoses and fittings to connect to injection points.

Approximately 17 injection points will be installed throughout the area of contamination. Each injection boring will be advanced to a depth of 50 feet bgs. Injection locations are indicated on **Figure 4**. Potassium permanganate will be injected at multiple depths to treat groundwater throughout the water column at each injection point. Direct push rods will be driven to the target depth and then partially extracted to release the expendable drive tip. Once the target depth is achieved, an injection cap and hose is secured to the top of the tool string. The injection tool will then be raised in one-foot intervals as sodium permanganate is injected into the desired subsurface zones. Approximately 24 gallons of solution will be injected into each one foot interval. Upon reaching the water table (approximately 20 ft bgs) the hose will be disconnected and the remainder of rods and the injection tool will be removed from the borehole.

Injection activities will be conducted by a PWGC subcontractor under the supervision of a PWGC hydrogeologist.

Protective equipment during handling of sodium permanganate should include eye protection and rubber or plastic gloves. If the product comes in contact with clothing, it should be washed off immediately. Spontaneous ignition can occur with cloth or paper. The product will be stored in a

cool, dry area in closed containers. Spills will be diverted to the on-site storm water leaching pool DW-1, which is located in the impacted area, if possible, and diluted with water. Otherwise, spills will be contained and diluted with water and reduced with sodium thiosulfate, a bisulfate, or ferrous salt. The resulting sludge will be disposed in an approved landfill.

4.0 MONITORING AND MAINTENANCE

4.1 Post-Remediation Groundwater Monitoring

Approximately three months after the completion of the injection program, groundwater quality will be monitored at 12 monitoring well locations. Groundwater samples will be collected on a quarterly basis and submitted for analysis of VOCs and metals for a minimum of four quarters to monitor overall improvements to groundwater quality. Sampling will be performed in accordance with the sampling protocols specified in section 2.2 of this Work Plan.

Collected groundwater samples will be placed in pre-cleaned laboratory supplied glassware, and placed in a cooler packed with ice for transport to the laboratory. Sample analysis will be provided by an ELAP-certified environmental laboratory and will consist of volatile organic compounds (VOCs) by EPA Method 8260 and metals by EPA Method 6010.

Sampling rounds following the baseline and initial post-injection sampling rounds may require fewer samples, based on analytical results. A minimum of one down-gradient well (MW-2 through MW-5) will be sampled throughout the duration post-remediation groundwater monitoring, to confirm that contaminant migration has not occurred. VOC concentrations have been consistently low in the down-gradient wells relative to groundwater data obtained from the eastern portion of the parking area. The same is true for off-site well MW-6, where impacted groundwater has not been detected.

5.0 HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP) takes into account the specific hazards inherent to the site and presents the minimum requirements which are to be met by the remediation contractor and its subcontractors, PWGC and its subcontractors, and other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. The HASP is provided as **Attachment B**.

Contractors and subcontractors will have the option of adopting this HASP or developing their own site-specific document. If a contractor or subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in the site HASP prepared by PWGC and must be made available to PWGC and the NYSDEC.

Activities performed under the HASP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926, and the PWGC Corporate Environmental Health and Safety policy. Modifications to the HASP may be made with the approval of the PWGC Health and Safety Manager (HSM) and/or Project Manager (PM).

6.0 SCHEDULE

Monitoring well installation will commence a minimum of two weeks following approval of this Work Plan by the NYSDEC. The estimated duration of the monitoring well installation and development is one week. Baseline sampling will occur approximately two weeks following monitoring well installation. The chemical oxidation program will begin following baseline sampling, and will take approximately one week to complete. The post-remediation monitoring well sampling will be performed quarterly for a minimum of one year. Monitoring beyond one year will be based upon quarterly groundwater results. A timeline is included as **Table 1**.

7.0 REFERENCES

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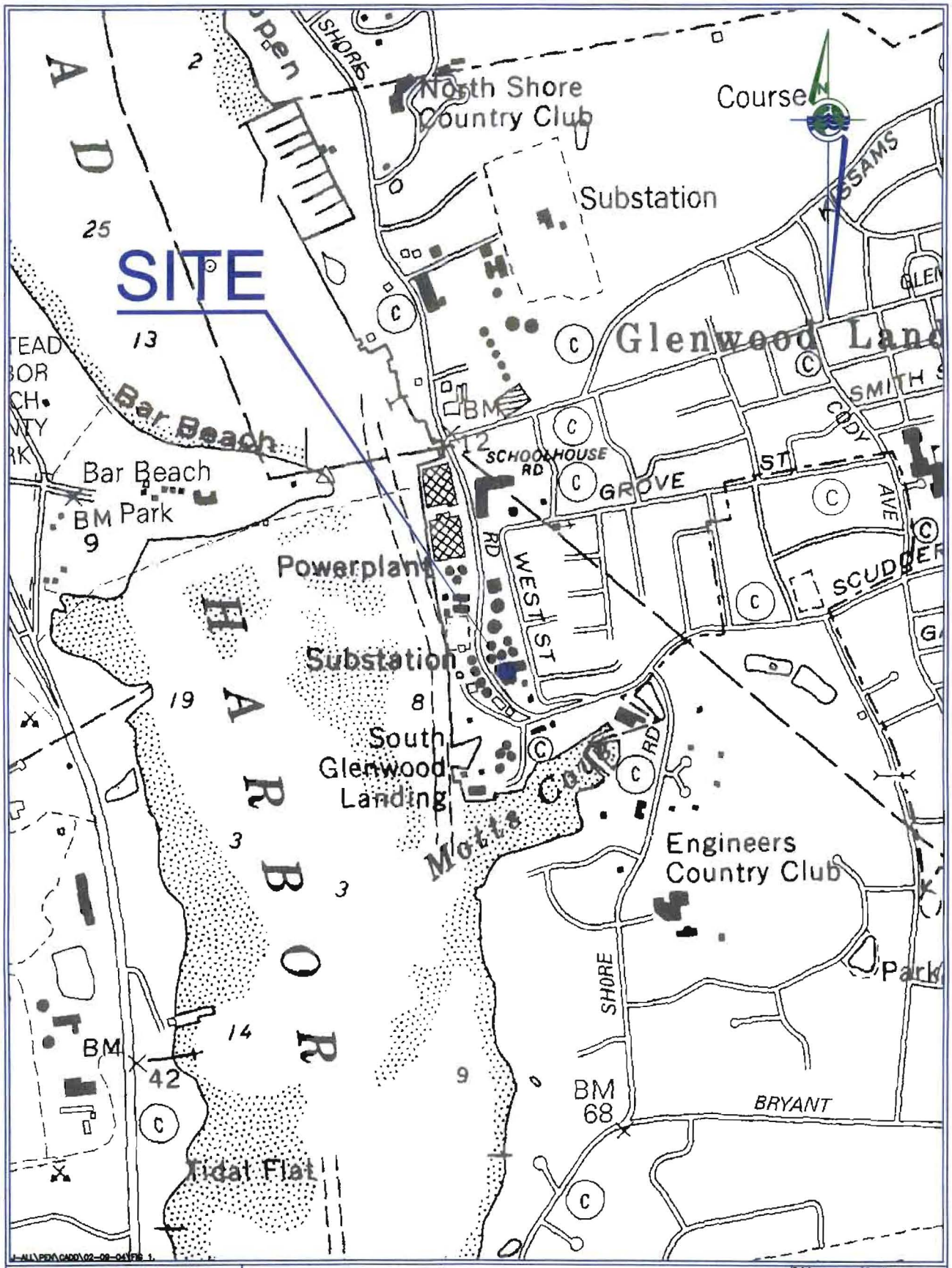
USEPA, Environmental Response Team, August 11, 1994. SOP # 2006, *Sampling Equipment Decontamination.*

FIGURES



P.W. GROSSER CONSULTING
ENGINEER & HYDROGEOLOGIST, P.C.

Site Location Map

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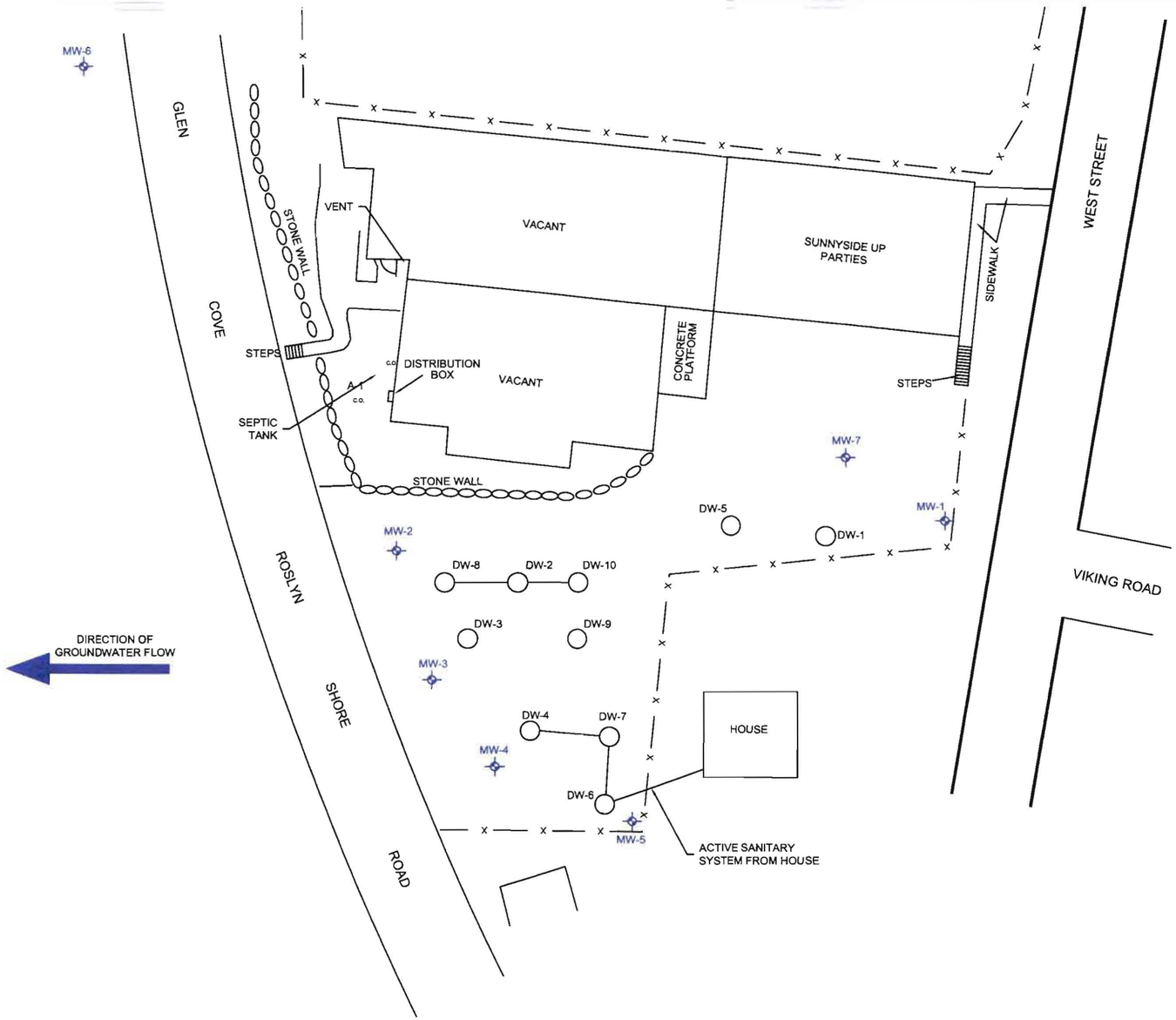

SOURCE: YEC, INC., SURVEY MAP 10, JULY 1992

SITE PLAN
FORMER PENETREX PROCESSING
NYSDEC I.D. No. 130034

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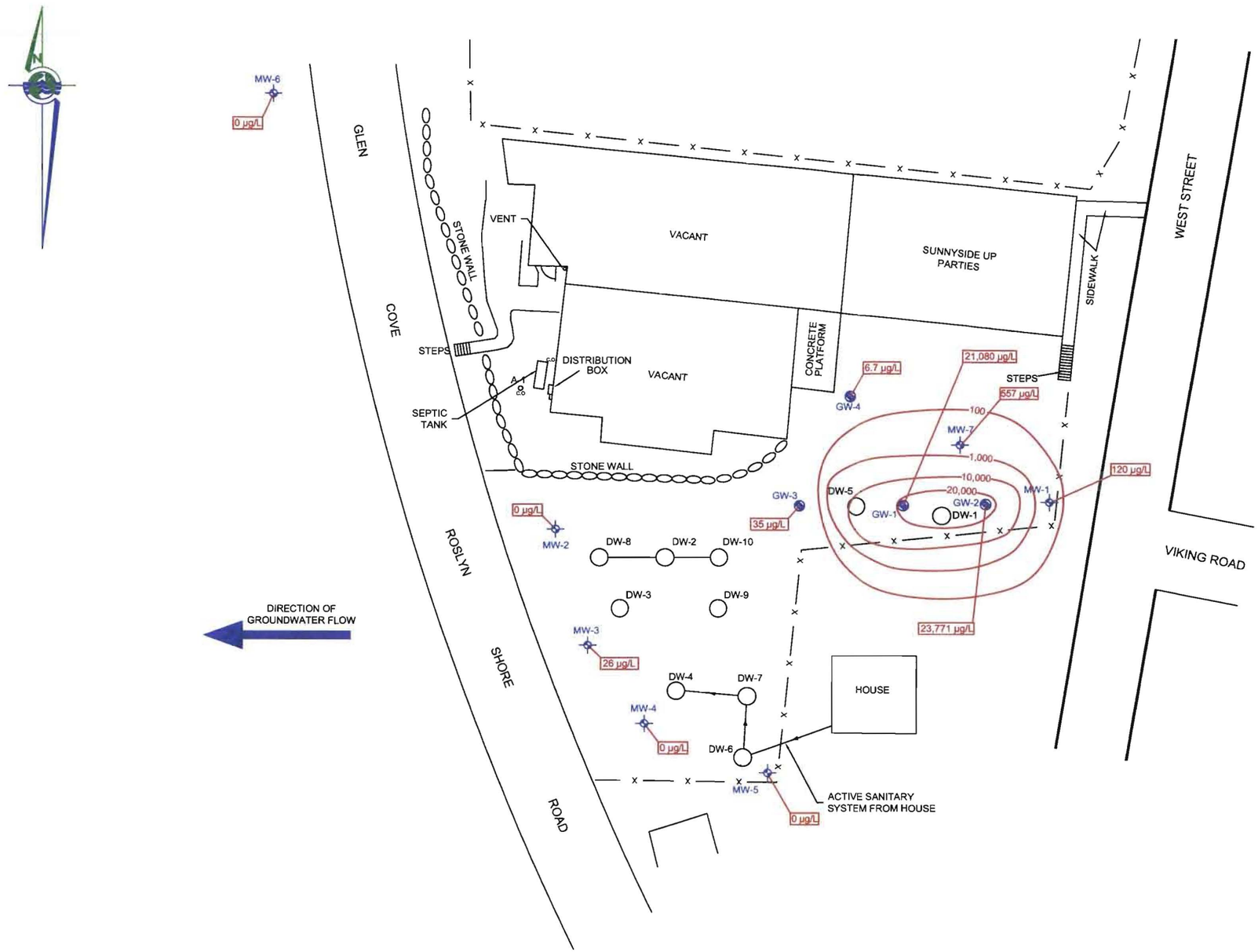
Project:	Designed By:	Figure No:
PEN0001	JPR	2
CADD Operator:	Approved By:	Date:
LLG	JPR	12/10/07

J:\Projects M-R\Pen - Penetrex\CADD\6-23-08\Fig 2 Site Plan.dwg



SOURCE: YEC, INC., SURVEY MAP 10, JULY 1992

TOTAL VOC CONTOURS AT WATER TABLE
FORMER PENETREX PROCESSING
NYSDEC I.D. No. 130034

P.W. GROSSER CONSULTING
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Project:	Designed By:	Figure No:
PEN0001	JPR	3
CADD Operator: LLG	Approved By: JPR	Date: 12/10/07

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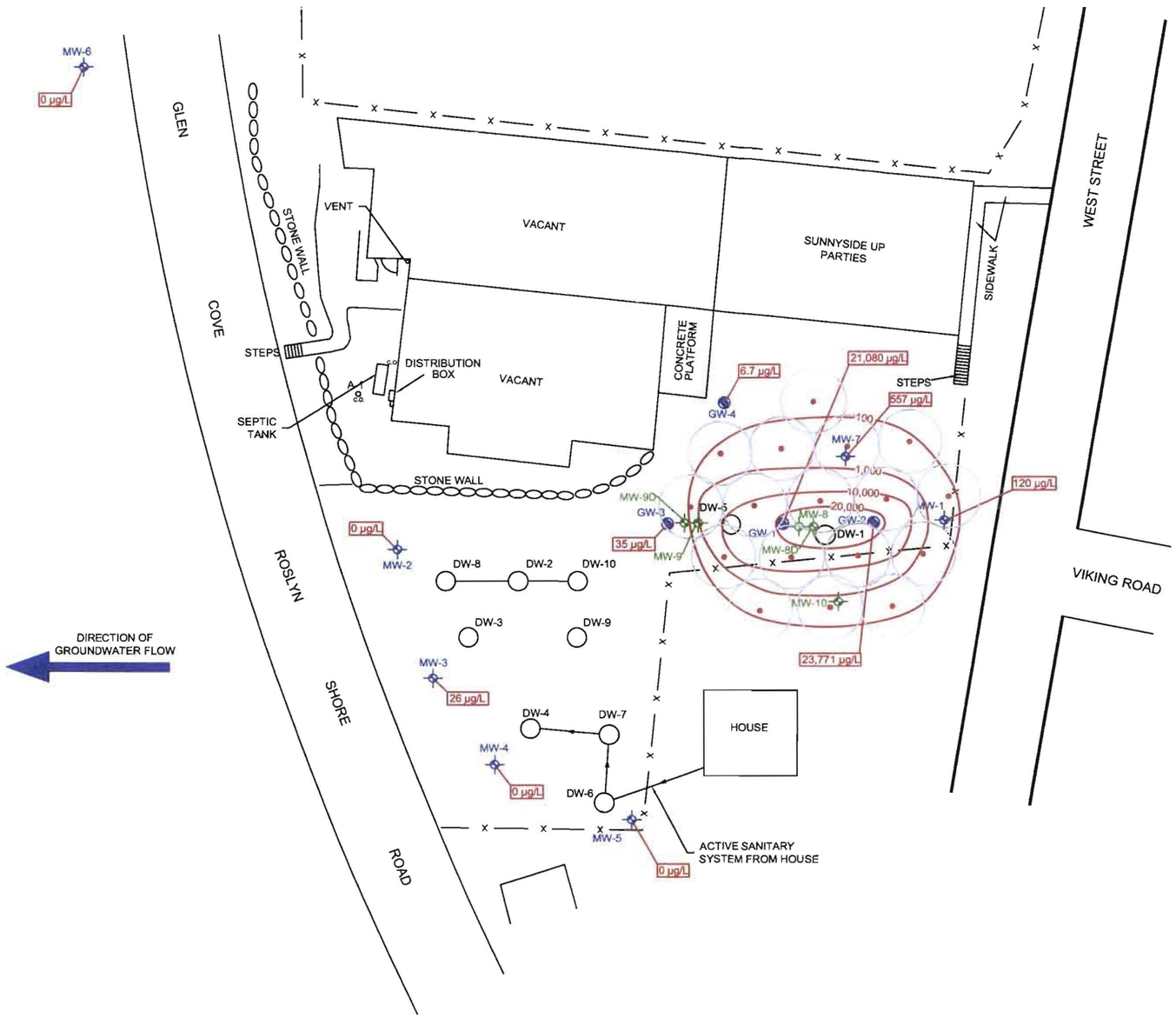

LEGEND

- PROPOSED INJECTION POINT
- PROPOSED MONITORING WELL
- EXISTING MONITORING WELL
- DRY WELL / LEACHING STRUCTURE
- GW-3 GROUNDWATER PROFILE LOCATION (SEPT. 2006)
- 6.7 µg/L TOTAL VOCs (SEPT. 2006)
- 100 TOTAL VOC CONTOUR (SEPT. 2006)

40 0 40 80

SCALE: 1"=40'

SOURCE: YEC, INC., SURVEY MAP 10, JULY 1992

PROPOSED CHEMICAL INJECTION POINTS AND MONITORING WELLS FORMER PENETREX PROCESSING

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TABLE

IRM Schedule
Former Penetrex Facility
Glenwood Landing, New York
Site No. 130034

WEEK	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
TASK																															
NYSDEC Approval of Work Plan																															
Preparation of DHS Top-Screen																															
Ten day notice to NYSDEC																															
Monitoring Well Installation																															
DHS Review and Approval of Top-Screen (estimated duration)																															
Monitoring Well Development																															
Baseline Monitoring Well Sampling																															
Laboratory Analysis																															
Analytical Data Analysis																															
Chemical Oxidant Injection																															
Initial Post-Injection Remediation Monitoring Well Sampling																															
Laboratory Analysis																															
IRM Report Preparation																															

Monitoring Well Sampling will continue quarterly for a minimum of one year following chemical oxidant injection.

ATTACHMENT – A
Chemical Oxidant Calculation Sheet

1 Shore Road, Glenwood Landing, New York

Version 3.0 0104

Parameters	Units	Estimates		Assumption Basis
*** Site Description ***				
Length	Ft.	84.00		provided
Width	Ft.	64.00		provided
Area	Sq. Ft.	5,376.00		
Thickness	Ft.	30.00		provided
Total Volume	Cu. Yd.	5,973.33		
Porosity	%	30.00		provided
Plume Total Pore Volume	Gal.	361,984.00		
Avg. Contaminant Conc.	ppm	23.00	*difficult to est	provided
Mass of Contaminant	lb.	69.48		
NOD	g/kg	1.50	BNL value	Determined by Laboratory Test--CARUS I ABs
Effective NOD %	10	0.15	BNL value	Empirical "rule of thumb" because the subsurface is not a well mixed system cf. NOD test
NOD	lb/yd3	0.45		
NOD Oxidant Demand	lb	2,661.12		
Avg. Stoichiometric Demand	lb/lb	2.40		Primary Contaminant PCE
Contaminant Oxidant Demand	lb.	166.75		
Theoretical Oxidant Demand	lb.	2,827.87		
SWAG Factor	???	2.00	^	Some uncertainty of subsurface characterization and ability to get 100% contact in the silt layer.
Calculated Oxidant Demand		5,655.75		
*** Injection Design ***		KMnO4	NaMnO4	
Radius of Influence	Ft.	10.00	10	Based on lithogeology (i.e silt) and empirical experience
Number of Injection Points		17.11	17.11	
Injection Concentration	% wt/wt	5.00%	2.00%	A compromise between enough volume and not too much injection time
Flow Rate - Per Injection Point	GPM	10.00	1	SWAG
Number of Wells per Phase		8	8	Practical limitation with one geoprobe rig.
Total Injection Flow Rate	GPM	80.00	80	
Estimated Injection Pressure	PSIG	40.00	40	Necessary to achieve laminar flow away from the injection point
Injection Volume/Hole	Gal	752.95	1,739.83	
*** Injection Schedule ***				
Hours per Day	Hrs	8.00	8	provided
Days Per Week	Days	5.00	5	provided
Number of Inj. Days	Days	0.34	0.78	
Number of Inj. Weeks	Weeks	0.07	0.16	

40% NaMnO4 Injection Options

Pounds of 40% NaMnO4 Solution	Gallons of 40% Solution	Number of Pails	Number of Drums	Number of Totes	Price per Lb of Solution	Total Cost of Chemical
12,584	1,103.86	220.77	23.00	5.02	$ 2.60	$ 32,718.49

Total Gallons of Dilution Water Required	Dilution Water Flow Rate - GPM	NaMnO4 40% Solution Flow Rate - GPM	OR	Dilution Water Gals per Pail	Dilution Water Gals per Drum	Dilution Water Gals per Tote
28,668.67	77.03	2.97		129.86	1,246.62	5,713.67

Dry KMnO4 Injection Options

Pounds of KMnO4 (Dry Crystals)	Number of Pails	Number of Drums	Number of Totes	Price per Lb (Dry)	Total Cost of Chemical
5,656	102.83	17.14	1.71	$ 2.10	$11,877.07

Total Gallons of Dilution Water Required	Dilution Water Flow Rate - GPM	OR	Dilution Water Gals per Pail	Dilution Water Gals per Drum	Dilution Water Gals per Tote
12,884.79	80.00		125.30	751.80	7,517.99

Instructions: Fill in all white colored blanks. Leave all shaded cells - these calculate themselves.
Please call Carus at 800/435-6856 for current chemical pricing.

g KMnO4 / kg soil	lb KMnO4 / 454 g KMnO4	kg soil / 1000 g soil	454 g soil / lb soil	assumed density: 110 lb soil / ft^3	27 ft^3 soil / yd^3 soil	Result
						2.97

CARUS®

This calculation is a reasonable approximation of the amount of permanganate that would be needed to fully oxidize the contaminant in the treatment area. The assumptions made for this calculation are the same that have been made for other successful permanganate projects. This calculation assumes relatively even distribution in the injection zone and even advection and diffusion from the injection zones.

^ Use a 2 swag factor because we aleady assumed elevated average contaminant concentration.

Chemical pricing based upon April 7, 2008 conversation with Kelly Frasco (Carus).

ATTACHMENT – B
Health & Safety Plan