HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

2363 Mariner Square Drive, Suite 243
Alameda, California 94501
Tel 510 521 2684
Fax 510 521 5078

1 800 347 HETI
Massachusetts
New York

March 1, 1994 **7-278**

Ms. Juliet Shin
Alameda County Department of Environmental Health
80 Swan Way, Room 200
Oakland, CA 94621

RE: **E-Z Serve Site No. 100877, 525 West A Street, Hayward**

Dear Ms. Shin,

On behalf of E-Z Serve, Inc., Hydro-Environmental Technologies, Inc. (HETI) is pleased to present the enclosed *Remedial Investigation Report* which reports on a vapor extraction test performed January 19, 1994 at the subject site. Based on the test results, we will be able to complete the design of an interim air sparging system. The proposed system would use two existing monitoring wells (MW-1A and MW-4) as vapor extraction wells and install an additional vapor extraction well and five air sparging wells. The design parameters are discussed in Section 5.0 of the report.

We are almost complete with our investigation of possible off-site sources. The results of that investigation will be forwarded to you within a week. If you have any questions, please call me at (510) 521-2684.

Sincerely,
HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

John H. Turney, P.E.
Technical Manager

cc. Mr. Brian Cobb, E-Z Serve
Mr. John Reaves

HYDRO
ENVIRONMENTAL
TECHNOLOGIES, INC.

REMEDIAL INVESTIGATION REPORT

Former E-Z Serve Site No. 100877
525 West A Street
Hayward, California

Prepared for:

E-Z Serve Management Company
2550 North Loop West, Suite 600
P.O.Box 922021
Houston, Texas 77292-2021

Prepared by:

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.
2363 Mariner Square Drive, Suite 243
Alameda, California 94501
HETI Job No. 7-278

March 1, 1994

HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

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1.0 INTRODUCTION AND PURPOSE

The purpose of this report is to present the results of Hydro-Environmental Technologies, Inc.'s (HETI's) investigative activities at former E-Z Serve Station No. 100877, 525 West A Street, Hayward, California (Figure 1). Subsurface investigative work conducted by HETI during this phase of activity included performing a pilot soil vapor extraction pilot test. The work was performed to evaluate soil vapor extraction and air sparging as remedial alternatives and obtain information to be used in the design of an interim remedial system for the site.

2.0 BACKGROUND

Several episodes of subsurface site assessment have been conducted since the discovery of a leak in the product lines in 1986. Applicable conditions at the site are as follows:

- The site is currently not in use. The only structures on site are the canopy over the former dispenser islands, some lights and a surrounding fence (Figure 2).
- Soils are predominantly silty clay. Sand has been observed in some borings at an approximate depth of 10 to 15 feet below ground surface (ft bgs) and again at approximately 25 to 30 ft bgs. The maximum depth explored was 30 ft bgs.
- Ground water is at approximately 17.8 ft bgs (June 1993). The ground water gradient is toward the west at 0.14% (June 1993). The depth to ground water has ranged from 16 to 22 ft bgs.
- The highest reported concentration of petroleum hydrocarbons in soil samples taken from borings drilled at the site is 19 parts per million (ppm) total petroleum hydrocarbons as gasoline (TPHg) in the boring for well MW-4. The highest concentration of benzene reported in soil samples (at 2.7 ppm) is also from the boring for well MW-4. All other on-site borings contained reportable concentrations of TPHg and benzene.
- Concentrations of petroleum hydrocarbons in the June 1993 on-site ground water samples ranged from 5,700 parts per billion (ppb) TPHg to 60,000 ppb TPHg. Concentrations of petroleum hydrocarbons in the June 1993 samples from off-site wells MW-7, MW-9 and MW-10 were similar. Petroleum hydrocarbons were reported in the sample from up-gradient well MW-8 at a concentration of 350 ppb TPHg.
- Eleven monitoring wells exist, eight on-site and three off-site. All wells have been completed at a total depth of approximately 30 feet. Well MW-1A, originally reported by Associated Soils Analysis as 17.8 feet deep, was measured as 29.00 feet deep.

3.0 FIELD ACTIVITIES

Field activities included the performance of a soil vapor extraction pilot test (SVE test). All field work was performed according to standard HETI protocol which was submitted with the work plan dated December 10, 1993.

On January 19, 1994, HETI conducted a SVE test using wells MW-1A, MW-2 and MW-4. This testing was conducted by extracting soil vapor from each well in turn and monitoring the vacuum influence in the surrounding wells. The vacuum was applied and extracted soil vapor was treated with an internal combustion engine which destroyed hydrocarbons in the extracted vapor stream before discharge to the atmosphere. This engine had been specially modified to treat extracted soil vapor. Sensitive air pressure gauges were used to monitor vacuum at the surrounding monitoring wells. A combined lower-explosive-limit percentage and oxygen concentration (LEL/O_2) monitoring instrument was used to monitor hydrocarbon vapor and oxygen concentrations in the extracted vapor stream. A thermal anemometer was used to measure the air flow rate.

Before beginning the test, HETI notified the Bay Area Air Quality Management District (BAAQMD) of the proposed discharge (Appendix A). The test was performed according to BAAQMD guidelines for a short term test. A Site Safety Plan was prepared and used for the testing (Appendix B).

The test began on well MW-1A as an applied vacuum of approximately 10 inches of water (in. WC) was applied to MW-1A for a period of 34 minutes. The vacuum was increased to 20, 30, 40, 50 and 60 in. WC over the length of the test. The total test length on well MW-1A was 2.13 hours. During this portion of the test, the induced vacuum was measured in wells MW-1 and MW-3 through MW-6.

The second portion of the test was conducted on well MW-4 at an initial applied vacuum of 10 in. WC. The vacuum was increased to approximately 30, 40, 50, 60 and 90 in. WC over the length of the test. The total test length on well MW-4 was 2.42 hours. During this portion of the test, the induced vacuum was measured in wells MW-1, MW-1A, MW-3, MW-5 and MW-6.

Two vapor samples were collected from MW-4 during the test: Vapor sample MW-4-1 was taken 15 minutes into the testing period, and vapor sample MW-4-2 was taken at the end of the test. The samples were collected in evacuated one-liter Tedlar® bags, labeled and placed in a dark cooler. The samples were transported under chain-of-custody to Pace Incorporated where they were analyzed for non-methane hydrocarbons, as n-octane (TPHo) by EPA Method 8015 (modified), and

benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8020 (modified).

The third portion of the test was conducted on well MW-2 at an initial applied vacuum of 10 in. WC. The vacuum was increased to approximately 20, 30, 40, 50 and 60 in. WC over the length of the test. This test was conducted only to determine vapor flow rate as a function of applied vacuum and the resulting hydrocarbon and oxygen concentration in the extracted vapor. Because of the close proximity of the former tank excavation to well MW-2 and the potential for preferential air flow through the backfill, the induced vacuum was not measured in other wells.

4.0 RESULTS OF INVESTIGATION

The data from the SVE test on wells MW-1A and MW-4 were used to estimate the radius of influence and the air permeability of the soil surrounding the three wells. The data from the SVE test were also analyzed to estimate vapor flow rate as a function of vacuum. The extracted concentrations of hydrocarbons and oxygen were used to predict long term soil vapor concentrations. Detailed calculations and graphs are included in Appendix C.

The radii of influence of both MW-1A and MW-4 were estimated as approximately 45 feet. An atypical subsurface connection seems to exist between wells MW-1A and MW-4. When vacuum was applied to one of these wells, the influence in the opposite well was higher than that in closer wells. The estimated radii of influence are shown on Figure 3.

To predict the relationship between applied vacuum and flow rate per length of screen, a graph was produced which shows the observed relationships and best-fit approximations of the relationships for each well. This graph is included in Appendix C.

The flow rates per unit screen length were used to calculate air permeability of the subsurface soil by inserting ranges of permeabilities into governing equations, until the flow rates most closely approximated the data collected during the SVE test. The flow rates observed during the SVE test indicate an air permeability range of 11 to 140 darcy for the three wells. These values are usually indicative of a medium sand while soils noted on Figure 4 of the *Site Assessment Study for Petroleum Constituents* by Associated Soils Analysis were primarily silty sand and silty clay. The lack of correlation between the soil types indicated by the calculated darcy values, and actual soil types as shown on the boring logs, is likely due to subsurface heterogeneity.

— ——→ T will VES radius contain in less permeable zones

To provide information necessary for the design of a soil vapor extraction and treatment system, hydrocarbon concentrations in extracted soil vapor were analyzed. In the final air sample of the test (MW-4-2), petroleum hydrocarbons were detected at a concentration of 2,600 milligrams per cubic meter (mg/m^3) TPHo and benzene was detected at a concentration of 120 mg/m^3. These concentrations are equivalent to 510 parts per million by volume (ppm_v) and 34 ppm_v, respectively. Copies of the laboratory reports are attached as Appendix D.

5.0 DISCUSSION OF RESULTS

The results of the field tests and data analysis during this investigation are summarized below:

- The SVE test indicated influence in subsurface pressure monitoring points as far away as 61 feet from MW-1A and MW-4. The radius of influence of vacuum during the SVE test was estimated to be approximately 45 feet.

- Petroleum hydrocarbons and benzene were detected in a vapor sample at a concentration of 2,600 mg/m^3 TPHo (510 ppm_v) and 120 mg/m^3 (34 ppm_v), respectively.

- The soil permeability to air was calculated to be 11 to 140 darcy, indicative of medium sand, while the site cross section generally indicates silty sand and silty clay.

- The SVE test results indicate that soil vapor extraction would be effective. As a result, the design of an interim air sparging system can proceed. HETI's experience with air sparging indicates a typical air sparging radius of influence of 20 to 25 feet. Based on this information, an interim remediation system is proposed with well locations shown on Figure 4 and the following design criteria:

o Number of vapor extraction wells: (Based on coverage of the site.)	Three: MW-1A, MW-4 and PVW-1 (new)
o Vapor extraction flow rate (based on 60 in. WC vacuum):	150 scfm
o Extraction vacuum at wellhead (based on typical blower limits):	60 in. WC

o Vapor extraction radius of influence (based on test data):	45 feet
o Initial extracted hydrocarbon concentration:	3,000 mg/m^3
o Initial extracted benzene concentration:	120 mg/m^3
o Initial extracted oxygen concentration (based on test data):	18 %
o Number of air sparging wells	Five (all new)
o Air injection flow rate	5 scfm per well 25 scfm total
o Air sparging well depth	30 feet
o Maximum air injection pressure (based on well casing pressure limit)	45 psig

6.0 CERTIFICATION

This report was prepared under the supervision of a registered professional engineer. All statements, conclusions and recommendations are based solely upon field observations and laboratory analyses performed by a state-certified laboratory related to the work performed by Hydro-Environmental Technologies, Inc.

It is possible that variations in the soil or ground water conditions exist beyond the points explored in this investigation. Also, site conditions are subject to change at some time in the future due to variations in rainfall, temperature, regional water usage or other factors.

The service performed by Hydro-Environmental Technologies, Inc. has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in the area of the site. No other warranty, expressed or implied, is made.

Hydro-Environmental Technologies, Inc. includes in this report chemical analytical data from a state-certified laboratory. These analyses are performed according to procedures suggested by the US EPA and the State of California. Hydro-Environmental Technologies, Inc. is not responsible for laboratory errors in procedure or result reporting.

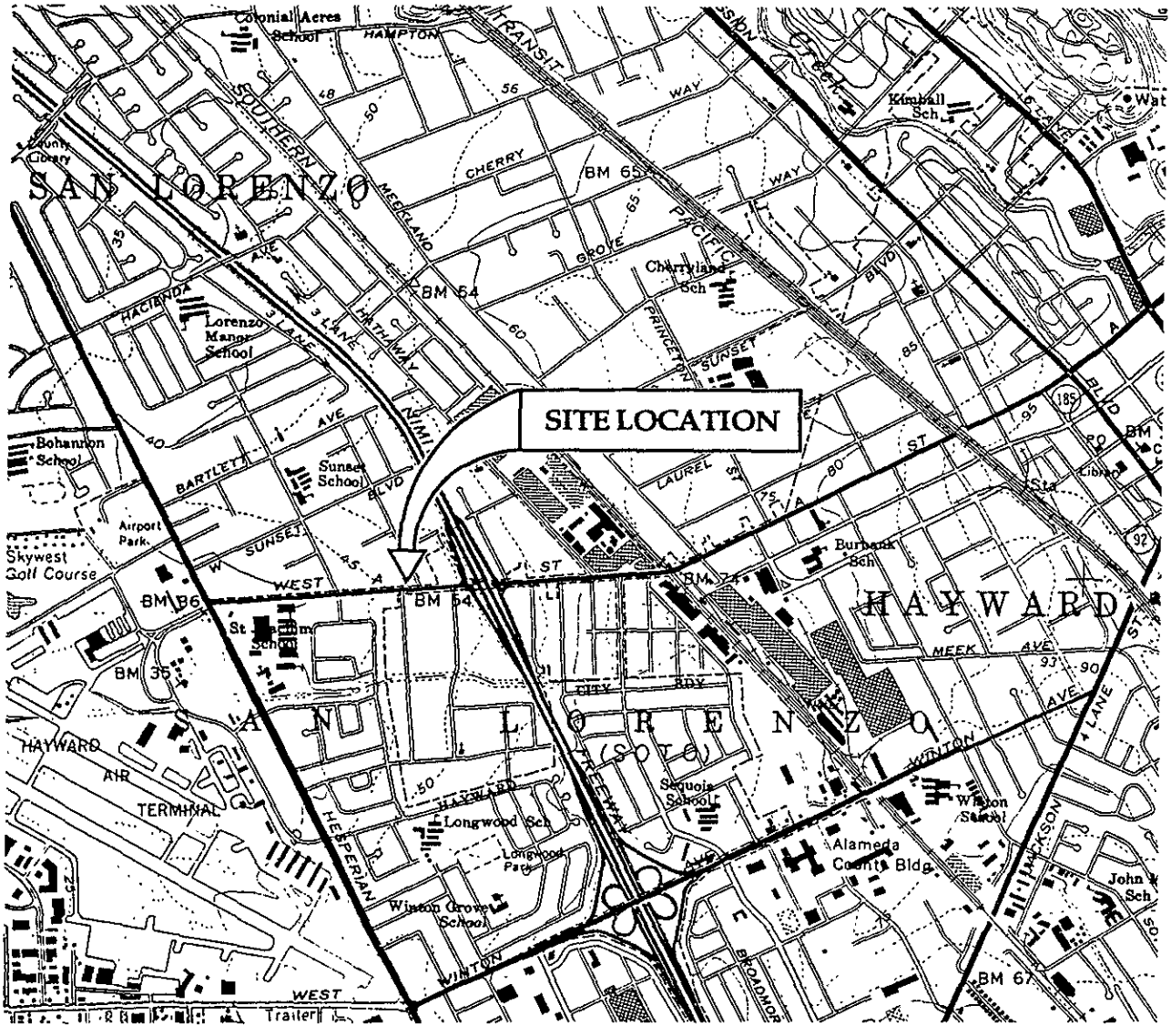
HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

Prepared by:

John H. Turney, P.E.
Project Manager

Reviewed by:

Scott Kellstedt
Western Operations Manager



SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

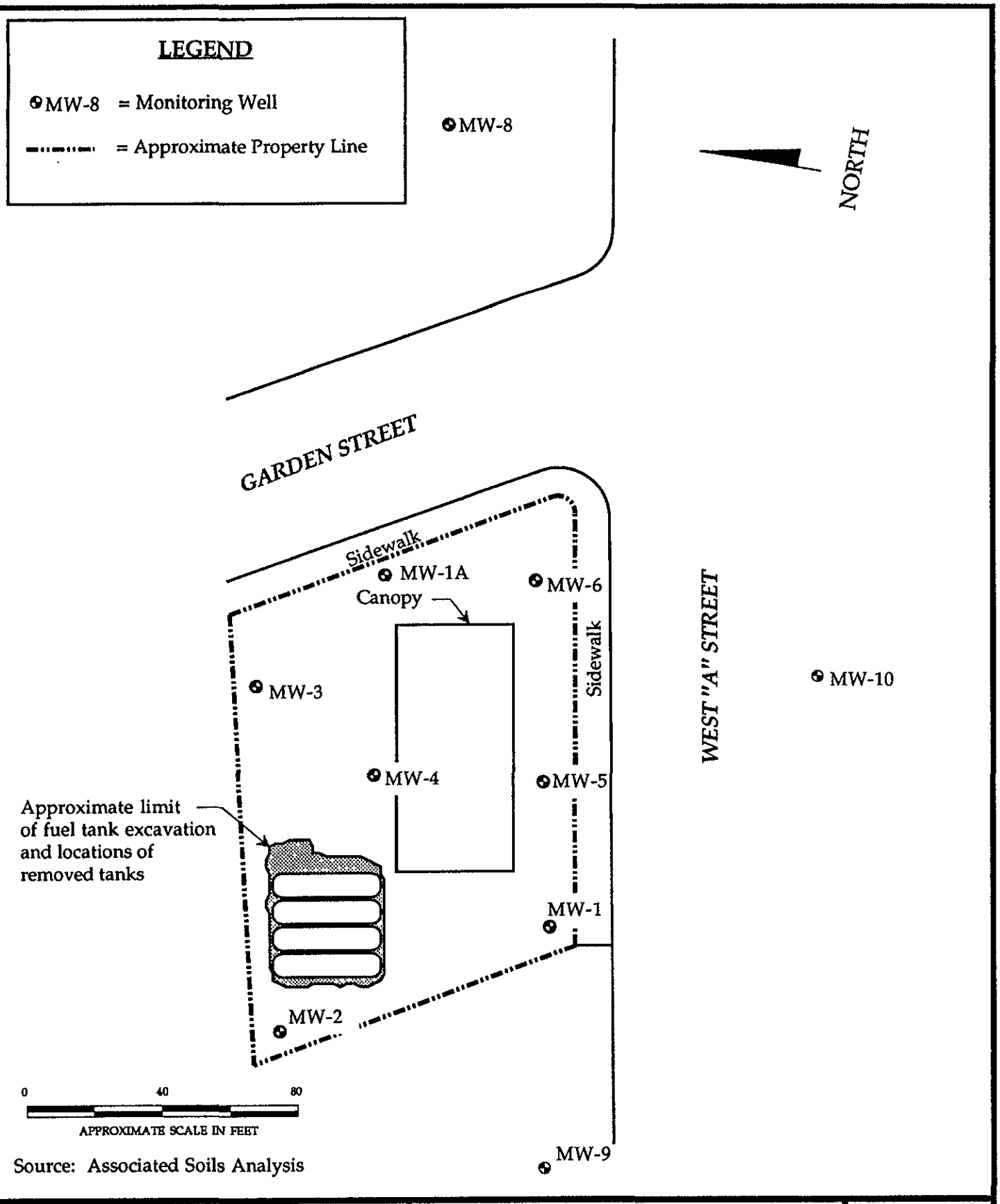
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

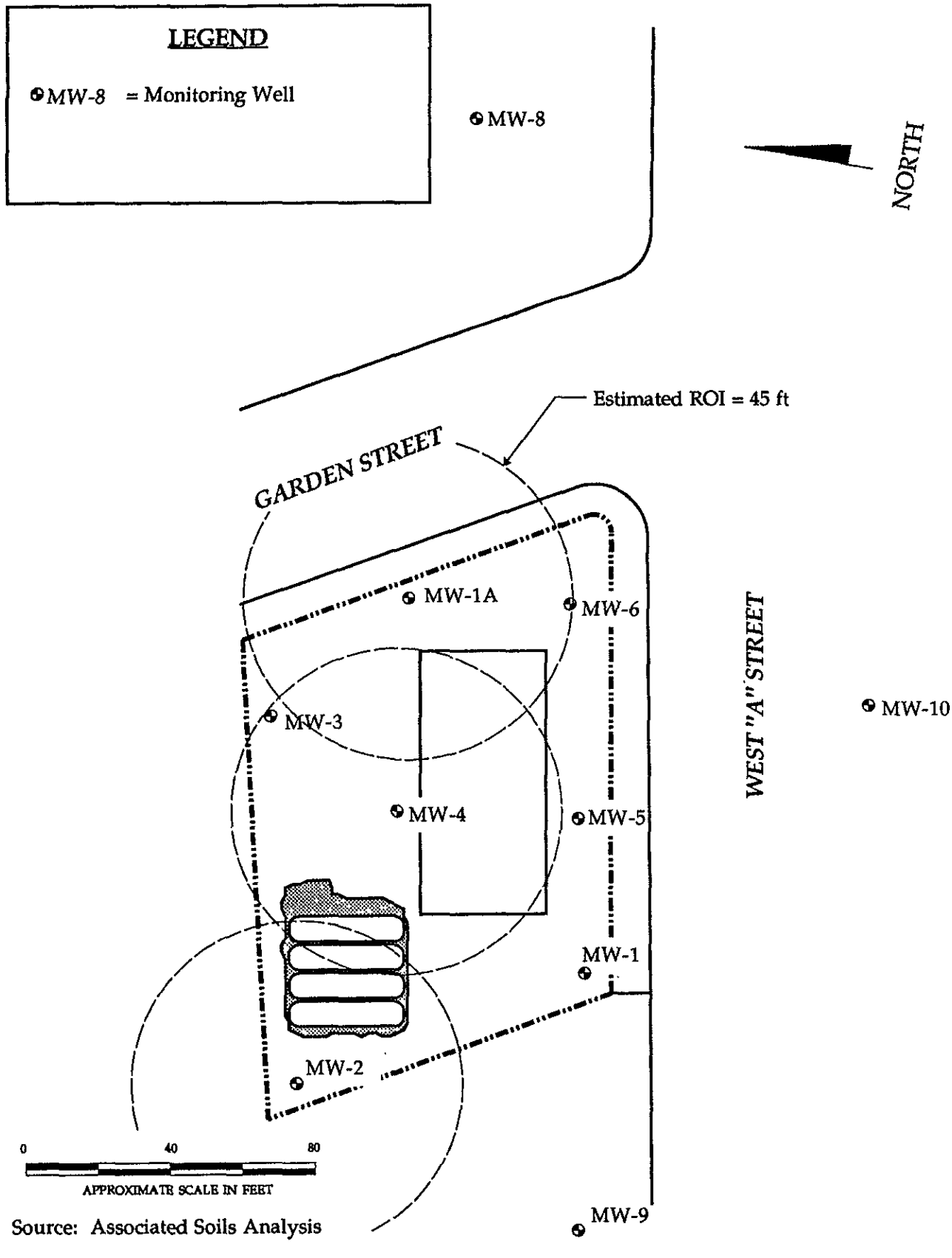
NORTH

Source: USGS 7.5' Quadrangle "Hayward"

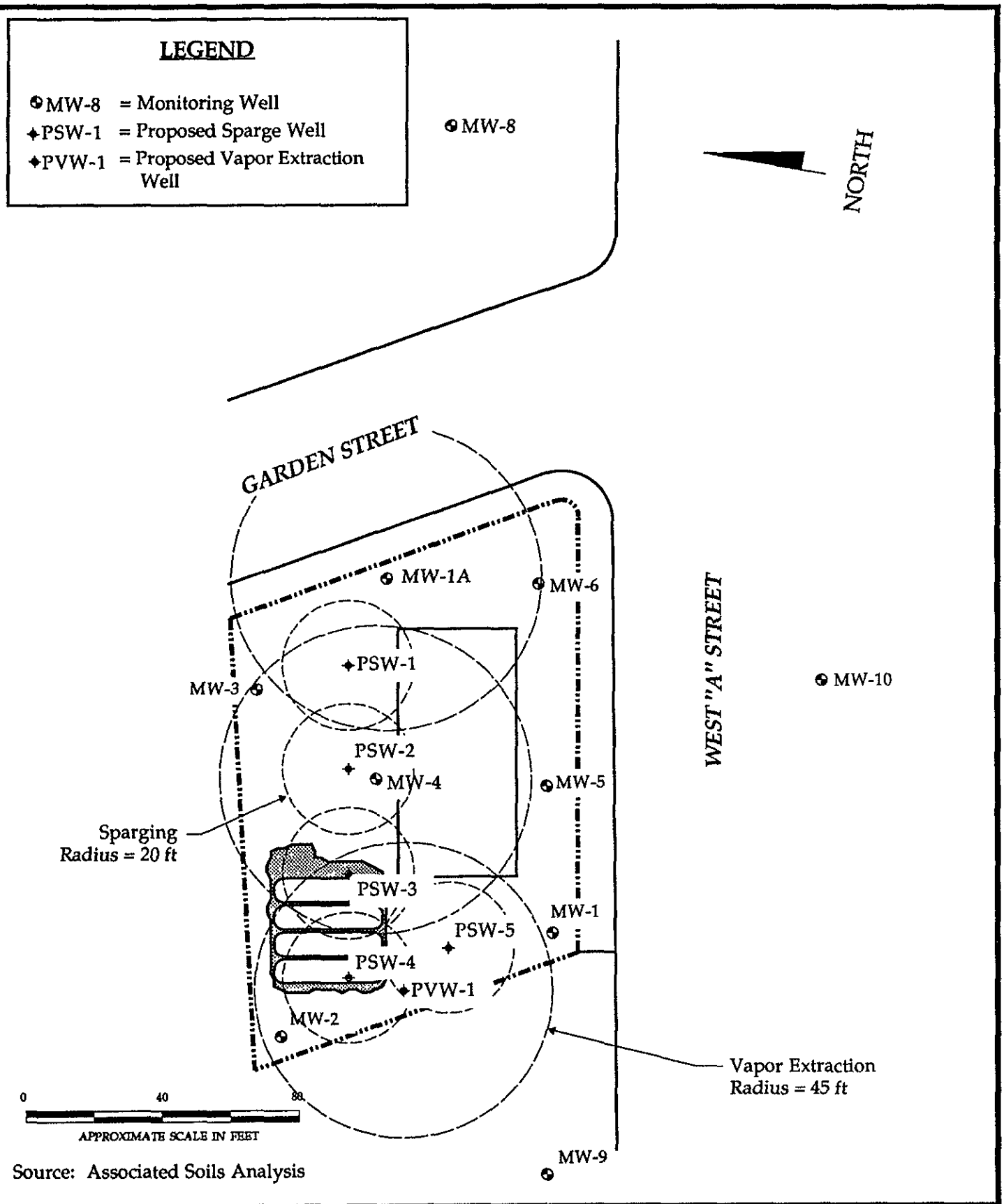
HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.	**SITE LOCATION MAP** E-Z Serve Station No. 100877 525 West A Street Hayward, California	**Job No. 7-278** **Figure 1** 12/7/93



HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.	**SITE PLAN** E-Z Serve Station No. 100877 525 West A Street Hayward, California	Figure **2** 7-278 2/10/94



HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.	**RADII OF INFLUENCE** E-Z Serve Station No. 100877 525 West A Street Hayward, California	Figure **3** 7-278 2/10/94



Source: Associated Soils Analysis

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.	**PROPOSED WELL LOCATIONS** E-Z Serve Station No. 100877 525 West A Street Hayward, California	Figure 4 7-278 2/10/94

HYDRO ENVIRONMENTAL TECHNOLOGIES, INC.

2363 Mariner Square Drive, Suite 243
Alameda, CA 94501
Tel. 510-521-2684
Fax 510-521-5078

1-800-347-HETI
Massachusetts
New York

January 11, 1994 **7-278**

Mr. Barry Young
Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

Subject: Soil Vapor Extraction Pilot Test, E-Z Serve Site No. 100877
525 West A Street, Hayward

Dear Mr. Young,

On behalf of E-Z Serve, Inc., Hydro-Environmental Technologies, Inc. (HETI) is officially notifying the Bay Area Air Quality Management District (BAAQMD) of a soil vapor extraction (SVE) pilot test to be performed at the site referenced above. The proposed SVE pilot test date is scheduled for january 19, 1994. This test will be conducted at the site to evaluate the feasibility of using in-situ soil vapor extraction technology for the removal of petroleum hydrocarbons (gasoline) from impacted soil.

The test will be conducted by connecting a CEECON internal combustion engine (ICE) to a test well. One test well will be utilized. The ICE will extract subsurface soil vapors from the well and, through internal combustion, use the vapors to power the engine. Hydrocarbon destruction efficiencies should be greater than 92 percent. The test will be conducted at a maximum flow rate of 100 standard cubic feet per minute for 4 to 8 hours.

If you have any questions or require additional information, please feel free to call me at (510) 521-2684.

Sincerely,
HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

John H. Turney, P.E.
Project Manager

cc: Mr. Brian Cobb, E-Z Serve
Mr. Michael Hodges, CEECON

SITE SAFETY PLAN

FOR

CLIENT: E-Z SERVE

SITE: 100877 Job No: 7-278

ADDRESS: 525 WEST A STREET
HAYWARD, CA

SCOPE OF WORK (Check all that apply):

Soil Excavation.....	☐	Soil Stockpile Sampling.....	☐
Drilling.....	☐	Monitoring Well Sampling.....	☐
Testing		System Installation	
Aquifer.....	☐	Ground Water.....	☐
Vapor Extraction.....	☑	Vapor Extraction.....	☐
Air Sparging.....	☐	Air Sparging.....	☐
System Operation and Maintenance...	☐		

PURPOSE AND SCOPE

This Site Safety Plan (SSP) establishes the basic safety guidelines and requirements for the above scope(s) of work at the above site (see Site Location Map - Figure 1). This SSP addresses the expected potential hazards that may be encountered during this project.

The provisions set-forth in this SSP will apply to Hydro-Environmental Technologies, Inc. (HETI) employees and any subcontractors working for HETI at the job site. All personnel working for HETI, including subcontractors, at the job site must read this SSP, and sign the attached Compliance Agreement (Appendix A) before entering the work area.

I. FACILITY BACKGROUND / WORKPLAN

SITE BACKGROUND AND HISTORY:

Several episodes of subsurface site assessment have been conducted since the discovery of a leak in the product lines in 1986. Applicable conditions at the site are as follows:

- The site is currently not in use. The only structures on site are the canopy over the former dispenser islands, some lights and a surrounding fence.
- Soils are predominantly silty clay. Sand has been observed in some borings at an approximate depth of 10 to 15 feet below ground surface (ft bgs) and again at approximately 25 to 30 ft bgs. The maximum depth explored was 30 ft bgs.

- Ground water is at approximately 17.8 ft bgs (June 1993). The ground water gradient is toward the west at 0.14% (June 1993). The depth to ground water has ranged from 16 to 22 ft bgs.
- The highest reported concentration of petroleum hydrocarbons in soil samples taken from borings drilled at the site is 19 parts per million (ppm) total petroleum hydrocarbons as gasoline (TPHg) in the boring for well MW-4. The highest concentration of benzene reported in soil samples (at 2.7 ppm) is also from the boring for well MW-4. All other on-site borings contained reportable concentrations of TPHg and benzene.
- Concentrations of petroleum hydrocarbons in the June 1993 on-site ground water samples ranged from 5,700 parts per billion (ppb) TPHg to 60,000 ppb TPHg. Concentrations of petroleum hydrocarbons in the June 1993 samples from off-site wells MW-7, MW-9 and MW-10 were similar. Petroleum hydrocarbons were reported in the sample from up-gradient well MW-8 at a concentration of 350 ppb TPHg.
- Eleven monitoring wells exist, eight on site and three off site. All wells have a total depth of 30 feet except well MW-1A, which is 17.8 feet deep.

WORK ACTIVITIES:

The tasks proposed to be performed under this SSP include the following:

- Perform a SVE test.
- Analyze data/results and prepare design criteria based on the findings of the field test.
- Prepare an Interim Remediation Work Plan.
- Prepare system construction and installation specifications.

II. KEY SAFETY PERSONNEL AND RESPONSIBILITIES

All personnel working for HETI at the job site are responsible for project safety. Specific individual responsibilities are listed below:

Project Manager: JOHN TURNEY

The Project Manager is responsible for preparation of this SSP. He/she has the authority to provide for the auditing of compliance with the provisions of this SSP, suspend or modify work practices, and to report to the Regional Manager any individuals whose conduct does not meet the provisions presented in this SSP. The Project Manager can be reached at (510) 521-2684.

Site Safety Officer: JOHN TURNEY

The Site Safety Officer (SSO) is responsible for the dissemination of the information contained in this SSP to all HETI personnel working at the job site, and to the responsible representative(s) of each subcontractor firm working for HETI at the job site.

The SSO is responsible for ensuring the following items are adequately addressed:

- Inspection of tools, drilling equipment and safety equipment
- Safety supplies & equipment inventory
- Site-specific training/hazard communication
- Accident/incident reporting
- Decontamination/contamination reduction procedures

The Site Safety Officer shall be responsible to take necessary steps to ensure that employees are protected from physical hazards, which could include;

- Falling objects such as tools or equipment
- Falls from elevations
- Tripping over hoses, pipes, tools, or equipment
- Slipping on wet or oily surfaces
- Insufficient or faulty protective equipment
- Insufficient or faulty operations, equipment, or tools
- Noise

The SSO has the authority to suspend work anytime he/she determines the safety provisions set-forth in this SSP are inadequate to ensure worker safety. The SSO or Project Manager must be present during all phases of the site work.

SSO Pager Number: (510) 308-7641

III. JOB HAZARD ANALYSIS / SITE CHARACTERIZATION

CHEMICAL HAZARDS:

The hazardous chemicals which may be encountered at the site are petroleum hydrocarbons, including benzene, toluene, ethylbenzene, and xylene. A summary of relevant chemical, physical and toxicological properties for each chemical hazard is discussed below:

Benzene:

Colorless liquid with an aromatic odor.

Vapor pressure	75 mm Hg @ 68 °F
Flash point	12 °F
Hazard classification	flammable liquid
Permissible exposure limit (PEL)	none

Benzene is recognized by the National Institute of Occupational Safety and Health (NIOSH) as a potential human carcinogen.

Benzene can enter the body through all four routes of exposure: (1) inhalation; (2) adsorption; (3) ingestion; and (4) injection. Target organs are the blood, central nervous system, skin, bone marrow, eyes, and respiratory system. Acute exposure effects include irritation of the eyes, nose, and respiratory system as well as headache, nausea, staggered gait, depression, and abdominal pain. The chronic effect of over-exposure is the potential for cancer.

Toluene:

Colorless liquid with an aromatic odor.

Vapor pressure	22 mm Hg @ 68 °F
Flash point	40 °F
Hazard classification	flammable liquid
Permissible exposure limit (PEL)	100 ppm

Toluene can enter the body through all four routes of exposure: (1) inhalation; (2) adsorption; (3) ingestion; and (4) injection. Target organs are the central nervous system, liver, kidneys, and skin. Acute exposure effects include fatigue, dizziness, headache, euphoria, dilated pupils, paralysis.

Ethylbenzene:

Colorless liquid with an aromatic odor.

Vapor pressure	7.1 mm Hg @ 68 °F
Flash point	55 °F
Hazard classification	flammable liquid
Permissible exposure limit (PEL)	100 ppm

Ethylbenzene can enter the body through all four routes of exposure: (1) inhalation; (2) adsorption; (3) ingestion; and (4) injection. Target organs are the eyes, upper respiratory system, skin and central nervous system. Acute exposure effects include

irritation of the eyes and mucous membranes, nose, and respiratory system as well as headache, nausea, staggered gait, headache, dermatitis, narcosis and coma.

Xylenes: Colorless liquid with an aromatic odor.

Vapor pressure	8 mm Hg @ 68 °F
Flash point	63° F to 81 °F
Hazard classification	flammable liquid
Permissible exposure limit (PEL)	100 ppm

Xylenes can enter the body through all four routes of exposure: (1) inhalation; (2) adsorption; (3) ingestion; and (4) injection. Target organs are the central nervous system, eyes, gastrointestinal tract, blood, liver, kidneys and skin. Acute exposure effects include dizziness, excitement, drowsiness, incoordination, abdominal pain, vomiting, and irritation of the eyes, nose and throat.

Other Potentially Hazardous Chemicals:

Propane: Colorless gas with mercaptan added as an odorant (rotten egg).

Vapor pressure	>760 mm Hg @ 68 °F
Flash point	Gas
Hazard classification	flammable gas
Permissible exposure limit (PEL)	1000 ppm

Xylenes can enter the body through inhalation. Exposure effects include freezing of skin from vaporization of liquid and cold gas, dizziness, disorientation and asphyxiation.

The controls to limit potential for exposure to the above chemical hazards is addressed below:

- Inhalation of contaminants will be controlled by MONITORING VAPORS PER SECTION V. PROPANE TANK FILLING WILL BE PERFORMED BY TRAINED FILLING STATION PERSONNEL ONLY.

- Ingestion of contaminants will be controlled by prohibiting eating, drinking, smoking, and chewing in the work area. In addition, workers shall wash their hands and face before engaging in any of the above activities.

- Absorption of contaminants will be controlled by KEEPING THEM WITHIN CLOSED SYSTEM, LONG SLEEVE SHIRTS & TROUSERS, GLOVES

- o Injection of contaminants will be controlled by wearing work gloves in the work area.

FIRE HAZARDS:

The potential for fire or explosion exists whenever flammable liquids or vapors are present above lower explosions limit (LEL) concentrations and sufficient oxygen is present to support combustion. These potential fire hazards are addressed below:

- o The potential exists for petroleum hydrocarbon vapors to exceed LEL concentrations within the wells. However, well-gas generally does not contain sufficient oxygen to support combustion.

- o Other potential fire hazards associated with the scope of work have been mitigated by: FIRE SAFETY CONTROLS ON IC ENGINE.

- o In addition to the above, the HETI truck shall have an operative fire extinguisher on board. All personnel shall be familiar with its location and use.

ELECTRICAL HAZARDS:

The potential electrical hazards expected on the job site are addressed below:

- o Expected voltages: N/A
- o No electrical enclosures will be opened unless power is disconnected. Power will be verified disconnected with a meter prior to working on any circuits.

PHYSICAL HAZARDS:

The potential physical hazards expected at the job site are addressed below:

- The potential for physical injury exists from the operation of moving equipment such as drill rigs, forklifts and trucks. Use of steel toe boots, hard hats, and safety glasses will be required when in the work area. Backup alarms are required on all trucks and forklifts.
- The potential for physical injury exists from public traffic on the site. The site is ☐ is not ☑ open to public vehicles. Work will ☐ will not ☑ be performed in the public right-of-way. If work is performed in the public right-of-way, orange vests shall be worn, a traffic control plan is attached and an encroachment permit from the appropriate government agency shall be obtained.
- The potential for burns from hot surfaces exist from the operation of an internal combustion engine ☑, an air compressor ☐. Compressed air piping is hot. All hot surfaces shall be allowed to cool and/or be handled with thick cloth work gloves.
- The potential for noise hazards exist at the site from the operation of IC ENGINE. It is not expected that noise levels will exceed the acceptable CAL-OSHA permissible exposure level of 90 dB. However, workers should be aware of the presence of these hazards and take steps to avoid them. Ear / noise protection, though not required, shall be available to all personnel within the job site in the event noise levels exceed worker comfort or protection levels.
- Personnel should be cognizant of the fact that when protective equipment such as respirators, gloves, and/or protective clothing are worn, visibility, hearing, and manual dexterity are impaired.

HEAT STRESS:

The anticipated weather conditions will be: COOL / COLD.

The potential for heat stress is present if the temperature exceeds 80°F. Some signs and symptoms of heat stress are presented below:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include: muscle spasms, heavy sweating, dizziness, nausea and fainting.
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include: pale, cool, moist skin; heavy sweating; dizziness; nausea and fainting.

- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occurs. Competent medical help must be obtained. Signs and symptoms are: red, hot, unusually dry skin; lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse and coma.

Preventing heat stress is particularly important because once someone suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat injuries. To avoid heat stress the following steps shall be taken whenever the ambient temperature is over 80 °F:

1) Field personnel shall have a work/rest cycle of 2 hours work, 15 minutes rest.

2) The Site Safety Officer shall mandate work slowdowns as needed.

IV. JOB HAZARD SUMMARY

In summary, the expected potential hazards to personnel working in the work area are (Check all that apply):

(1) Over exposure to chemical contaminants	☑
(2) Physical injury from equipment being operated at job site	☑
(3) Public traffic	☐
(4) Hot surfaces	☑
(5) Heat stress	☐
(6) Fire	☑
(7) Electrical shock	☐
(8) Other	☐

As described in Section III - Job Hazard Analysis, these potential hazards have been mitigated for the protection of both the worker health and safety. The proposed work does not appear to present any potential health risk to workers, the surrounding community, or the environment.

V. EXPOSURE MONITORING PLAN

Periodic monitoring for organic vapors is ☐ is not ☑ required. The Site Safety Officer shall monitor the ambient air in the work area with an organic vapor photoionization meter (Thermo Environmental Model 580B OVM, or equivalent) should their presence be detected by odor. If the meter indicates petroleum

hydrocarbon concentrations in the area exceed 300 ppm, the Site Safety Officer shall require personnel in the work area to wear respirators with organic vapor cartridges (MSA 464046, or equivalent).

The manufacturer's calibration procedures for the Model 580B OVM are located within the instrument case. Field calibration shall be performed daily during use.

All personnel working for HETI at the job site shall be monitored for heat stress. Because workers at the job site are expected to be wearing permeable clothing (e.g. standard cotton or synthetic work clothes), monitoring for heat stress will consist of personnel constantly observing each other for any of the heat stress symptoms discussed in Section III.

Field personnel shall be cautioned to inform each other of non-visual effects of the presence of toxins, such as: headaches, dizziness, nausea, blurred vision, cramps, irritation of eyes, skin, or respiratory tract, changes in complexion or skin discoloration, changes in apparent motor coordination, changes in personality or demeanor, excessive salivation or changes in pupillary response or changes in speech ability or pattern.

VI. PERSONAL PROTECTIVE EQUIPMENT

Level D personal protection equipment is expected to be the highest protective level required to complete the field activities for this project. Modified Level C protection may also be required at the discretion of the Site Safety Officer. The following lists summarize the personal protective equipment that shall be available to all field personnel working in the work area:

Level D Protection (shall be worn at all times)

- Boots, steel toe
- Safety glasses, chemical splash goggles, or face shield
- Hard hat
- Work gloves required ☑ optional ☑ (☑ — WHILE CONNECTING / DISCONNECTING SYSTEM; ☑ — DURING SYSTEM OPERATION)
- Long leg trousers
- Long sleeves required ☑ optional ☐

Modified Level C Protection (available at all times.)

- Half-face air purifying respirator with organic vapor cartridges to be used should organic vapor concentrations exceed 300 ppm as discussed in Section V of this SSP.
- Hearing protection

VII. SITE CONTROL

The exclusion, contamination reduction, and support zones are shown in Figure 2. these zones shall be marked with natural barriers, cones or tape as appropriate. Personnel without the proper training, personal protective equipment or who have not agreed to follow this SSP shall not be allowed into the exclusion or contamination reduction zones.

VIII. DECONTAMINATION MEASURES

Field personnel shall wash hands and face before entering a clean area. Additional decontamination measures are discussed under General Safe Work Practices (section IX).

IX. GENERAL SAFE WORK PRACTICES

The project operations shall be conducted with the following minimum safety requirements employed:

- Eating, drinking, and smoking shall be restricted to a designated support zone.
- All personnel shall wash hands and face before eating, drinking, or smoking.

X. SANITATION

The location of the nearest running water source and toilet is LIBERTY PIZZA ACROSS GARDEN AVE.

A portable potable water cooler or other source of drinking water shall be maintained on site.

XI. STANDARD OPERATING PROCEDURES

The following HETI protocols apply to this scope of work:

Drilling, Well Construction and Sampling Protocols	☐
Soil Vapor Extraction Protocol	☑
Air sparging Protocol	☐

XII EMERGENCY RESPONSE PLAN

In the event of an accident resulting in physical injury, first aid will be administered and the injured worker will be transported to
MEDICAL EXPRESS

In the event of a fire or explosion, local fire or response agencies will be called by dialling 9-1-1. The Project Manager shall also be notified.

Emergency Telephone Numbers:

Fire and Police **911**
Hospital ..... (510) 782-7111

Directions to Hospital: See Figure 1
WEST ON A ST TO HAYWARD AIRPORT
LEFT ON HESPERIAN BLVD
22429 HESPERIAN BLVD

A fire extinguisher, located in the HETI vehicle will be located on-site during all installation, testing and servicing activities.

Additional Contingency Telephone Numbers:

HETI ..... **(510) 521-268**
All cases where an accident has occurred will require filling out an incident / accident report and submitting it within 48 hours of the accident.

XIII. TRAINING REQUIREMENTS

All site personnel will be required to have completed the 40 hours of basic OSHA-SARA training for personnel assigned to hazardous waste sites in compliance with OSHA Standard 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, and all are required to participate in the annual OSHA-SARA 8-hour refresher courses.

XIV. MEDICAL SURVEILLANCE PROGRAM

HETI personnel and subcontractors engaged in field operations shall be participants in their company Medical Surveillance program, and must be cleared by the examining physician(s) to wear respiratory protection devices and protective clothing for working with hazardous materials. The applicable requirements under California Administrative Code (CAC) Title 8, Section 5216, which is available at the HETI office for review, shall be observed. Project-specific medical surveillance is ☐ is not ☑ required.

XV. DOCUMENTATION

All personnel shall sign the compliance agreement (Appendix A).

Daily documentation shall be provided by a daily log, completed by the Site Safety Officer in his/her field notebook. The Site Safety Officer shall record the names of all personnel working for HETI and any site visitor(s). (S)he shall also record accidents, illness and other safety related matters. In the case of an accident, or injury, during field operations, (s)he will prepare and submit an Incident/Accident Report.

In case air monitoring is implemented, OVM readings (including times) shall be recorded in the daily log.

SSP prepared by: _____ Date: 12/7/93

SSP Approved by: _____ Date: 12/7/93

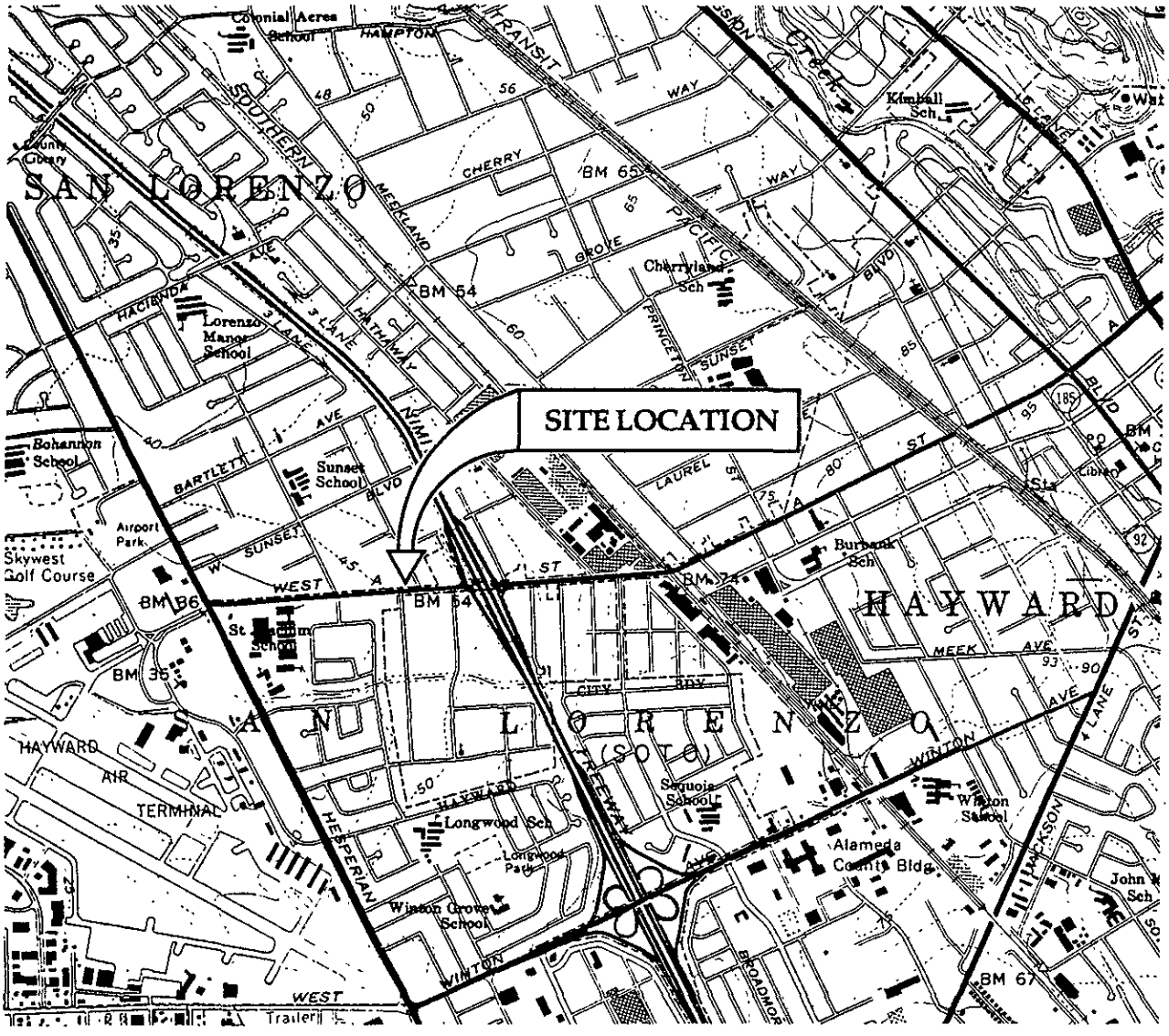
Project Manager

COMPLIANCE AGREEMENT

I have read and understand the Site Safety Plan.

I will comply with the minimum safety requirements set forth in this Site Safety Plan. I agree to notify the responsible employee of HETI should any unsafe acts be witnessed by me while I am on this site.

Print Name	Company	Signature	Date
Tony Ramirez	HETI		1/19/94
Phil Woodward	CEECON		1/19/94
PATRICK LAMB	CEECON		1/19/94



SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

NORTH

Source: USGS 7.5' Quadrangle "Hayward"

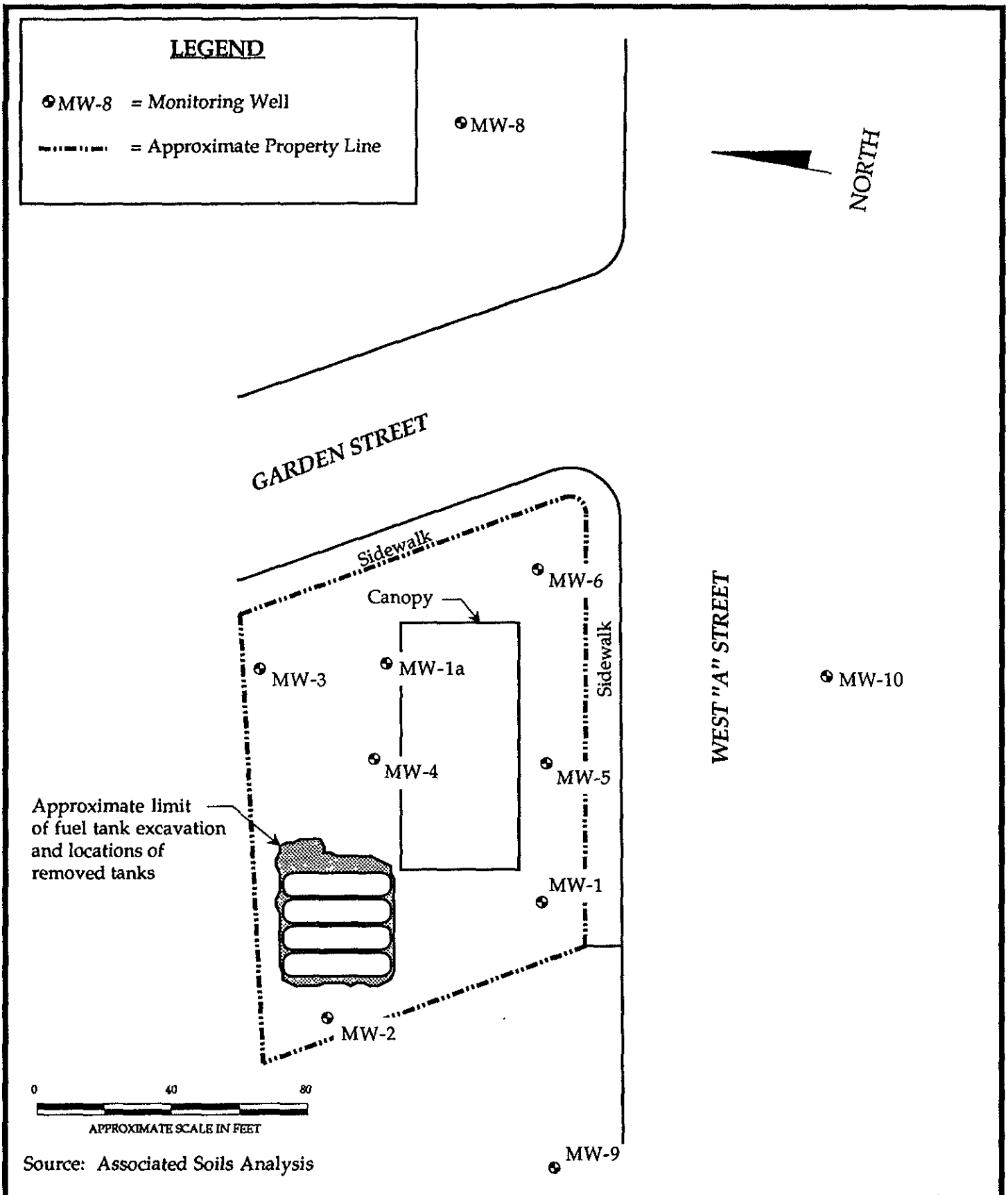
HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

SITE LOCATION MAP

E-Z Serve Station No. 100877
525 West A Street
Hayward, California

Job No. 7-278
Figure 1

12/7/93



Source: Associated Soils Analysis

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.	**SITE PLAN** E-Z Serve Station No. 100877 525 West A Street Hayward, California	**Job No. 7-278** **Figure 2** 12/10/93

Appendix C
Soil Vapor Extraction Pilot Test
Equations and Calculations

Test Methods

The tests were carried out according to the HETI Protocol for Soil Vapor Extraction Tests.

On January 19, 1994, HETI conducted a soil vapor extraction pilot test (SVE test) using wells MW-1 through MW-6 and MW-1A. This testing was conducted by extracting soil vapor from MW-1A, MW-4 and MW-2, one at a time, and monitoring the vacuum influence in the surrounding wells.

Soil Vapor Extraction Pilot Test Results

The extracted concentrations of hydrocarbons and oxygen were used to predict the makeup of extracted soil vapor to be expected for a long term system. The data from the SVE test was analyzed to estimate the vapor flow rate as a function of vacuum, evaluate the permeability to air of soil surrounding wells MW-1A, MW-4 and MW-2, and to obtain a radius of influence for the well.

Vapor Concentrations

The concentration of hydrocarbons and oxygen in the extracted vapor stream was measured using a Gastech combination LEL/O_2 meter. The results from measurements taken at the end of the test on each well were:

Well	Fraction of LEL[a] %	Calculated Concentration ppmv	Oxygen Concentration %
MW-1A	2	260	21
MW-2	29	3,800	18
MW-4	27	3,500	19

Two vapor samples were taken during the test: Vapor sample MW-4-1 was taken 15 minutes into the testing period, and vapor sample MW-4-2 was taken at the end of the test. The samples were analyzed for Non-Methane Hydrocarbons, as n-octane (TPHo) by EPA Method 8015 (modified), and benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8020 (modified).

---

[a] LEL is the lower explosive limit of hydrocarbons in air, assumed to be 13,000 parts per million by volume (ppm_v).

Analysis of sample MW-4-1 yielded non-detectable TPHo at less than 50 milligrams per cubic meter (mg/m^3), and BTEX concentrations of 0.5 mg/m^3, 0.5 mg/m^3, 0.5 mg/m^3, and 1.7 mg/m^3, respectively. Sample MW-4-2 yielded a TPHo concentration of 2,600 mg/m^3, and BTEX concentrations of 120 mg/m^3, 100 mg/m^3, 46 mg/m^3, and 160 mg/m^3, respectively.

Vapor Flow Rate

The data from the test was used to determine the flow rate per unit screen length for the well. The results are as follows:

Well Number	Well Vacuum in. WC[b]	Flow Rate (scfm)[c]	Flow Rate per Screen Length scfm/ft
MW-1A	10	22	5.4
	20	34	10.3
	40	39	23.2
	60	51	—[d]
MW-2	10	6.7	1.5
	20	11	3.0
	30	18	6.0
	40	21	9.7
	50	24	18.4
	60	27	56.9
MW-4	10	25	6.9
	30	46	23.9
	40	50	45.6
	60	59	—
	90	64	—

The vacuum versus flow rate was plotted and appears as Figure C-1.

The vapor flow rate per unit length of well screen, Q/H, is described by the equation (Johnson, et al [1990]):

$$\frac{Q}{H} = \pi \frac{k}{\mu} P_w \frac{[1 - (P_{Atm} / P_w)^2]}{\ln (R_w / R_I)}$$

b in. WC is inches of water
c scfm is the standard cubic feet per minute at one atmosphere.
d The calculations yielded an undefined result.

The flow rates per unit screen length were used to estimate the permeability to air of the subsurface soils by inserting a range of permeabilities into the above equation until the flow rates per screen length most closely approximated the data gathered during the field test. In all three wells, the measured results matched the predicted flow rates of a medium sand. The calculated permeability in well MW-1A is approximately 60 darcy (5×10^{-3} centimeters per second—cm/s). The results for all three wells were similar: 11 darcy to 60 darcy in well MW-2 and 70 darcy to 140 darcy in well MW-4.

These equations were solved with the aid of the "Hyperventilate®" computer program (Johnson, et al).

Estimation of Radius of Influence

While extracting vapor for wells MW-1A and MW-4, the induced vacuum was measured in surrounding wells using sensitive pressure/vacuum gauges. A summary of the data follows:

Applied Vacuum in. WC (Well)	Observation Well	Distance feet	Observed Vacuum in. WC
40 (MW-1A)	MW-6	44.1	0.005
	MW-3	54.2	0.004
	MW-4	61.4	0.02
	MW-5	79.3	0.0
	MW-1	117.2	0.0
60 (MW-4)	MW-3	44.9	0.003
	MW-5	50.6	0.0
	MW-1A	61.4	0.55
	MW-1	69.5	0.0
	MW-6	75.4	0.0

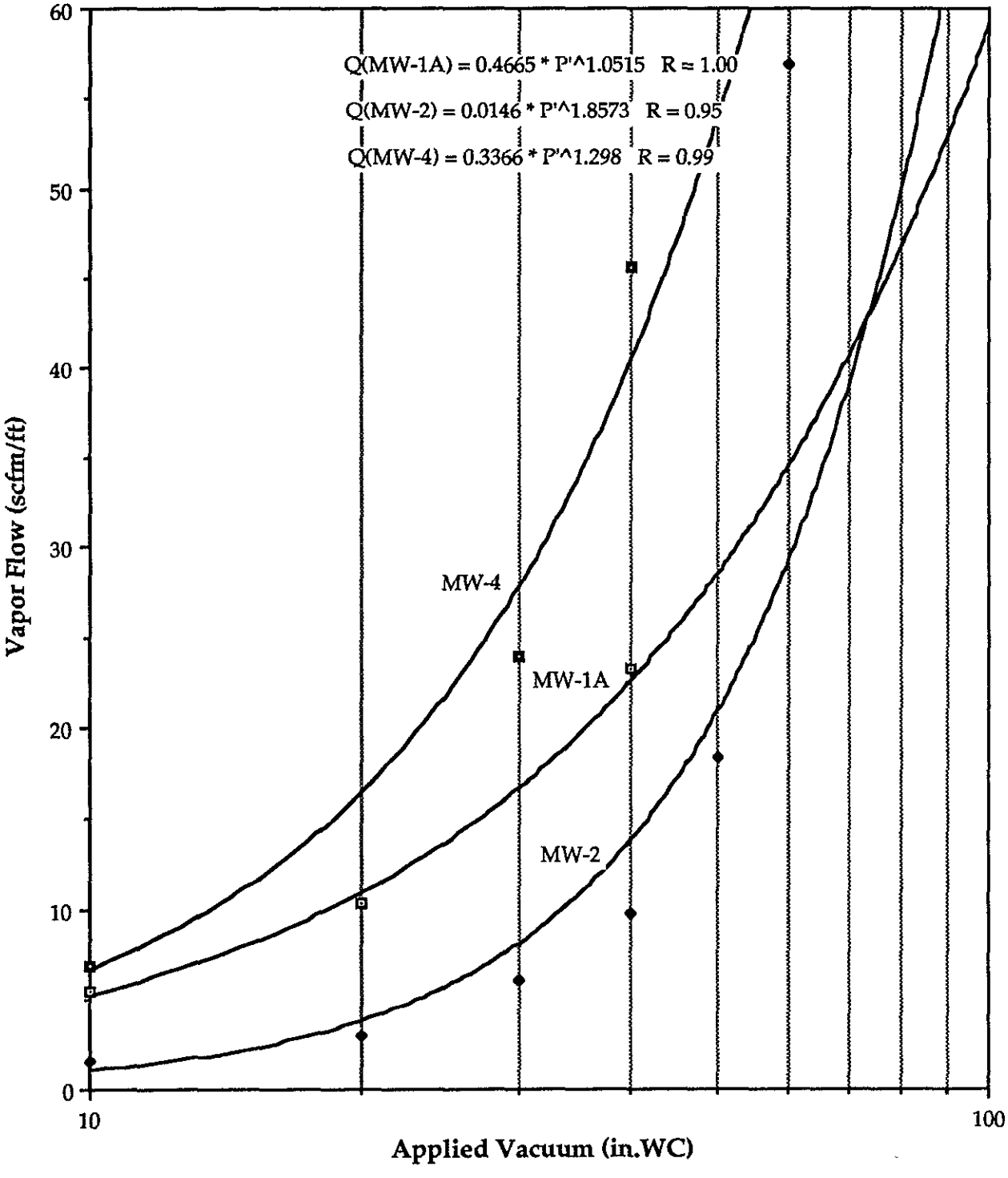
As can be seen from the table, when vapor was extracted from well MW-1A the observed vacuums in wells MW-3 and MW-6 were much lower than in well MW-4. When vapor was extracted from well MW-4, the observed vacuums in wells MW-3 and MW-5 were much lower than in well MW-1A. This indicates an atypical connection between wells MW-1A and MW-4. Based on the observed results, a conservative radius of influence would be 45 feet, approximately the distance from well MW-1A to MW-6 or MW-4 to MW-3.

References

Johnson, P.C., et al, 1990. A Practical Approach to the Design, Operation, and Monitoring of In-Situ Soil Venting Systems, *Ground Water Monitoring Review*, Spring 1990.

Figure C-1

Vapor Flow per Unit Screen Length



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REPORT OF LABORATORY ANALYSIS

January 24, 1994

Mr. John Turney
Hydro Environmental Tech., Inc.
2363 Mariner Square Dr.
Suite 243
Alameda, CA 94501

RE: PACE Project No. 440120.506
Client Reference: E.Z Serve/Hayward

Dear Mr. Turney:

Enclosed is the report of laboratory analyses for samples received January 20, 1994.

Footnotes are given at the end of the report.

If you have any questions concerning this report, please feel free to contact us.

Sincerely,

Ronald M. Chew

Ronald M. Chew
Project Manager

Enclosures

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

pace INCORPORATED
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REPORT OF LABORATORY ANALYSIS

January 24, 1994
PACE Project Number: 440120506

Hydro Environmental Tech., Inc.
2363 Mariner Square Dr.
Suite 243
Alameda, CA 94501

Attn: Mr. John Turney

Client Reference: E.Z Serve/Hayward

PACE Sample Number:			70 0232341	
Date Collected:			01/19/94	
Date Received:			01/20/94	
Client Sample ID:			MW-4-1	
Parameter	Units	MDL		DATE ANALYZED
ORGANIC ANALYSIS				
GASOLINE AND AROMATICS-AIR (M8015/8020)				
Non-Methane Hydrocarbons, as n-octane	ug/L	50	ND	01/21/94
Volatile Aromatic Compounds (EPA M8020)			-	01/21/94
Benzene	ug/L	0.5	0.5	01/21/94
Toluene	ug/L	0.5	0.5	01/21/94
Ethylbenzene	ug/L	0.5	0.5	01/21/94
Xylenes, Total	ug/L	0.5	1.7	01/21/94

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

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REPORT OF LABORATORY ANALYSIS

January 24, 1994
PACE Project Number: 440120506

Mr. John Turney
Page 2

Client Reference: E.Z Serve/Hayward

PACE Sample Number:			70 0232350	
Date Collected:			01/19/94	
Date Received:			01/20/94	
Client Sample ID:			MW-4-2	
Parameter	Units	MDL		DATE ANALYZED
ORGANIC ANALYSIS				
GASOLINE AND AROMATICS-AIR (M8015/8020)				
Non-Methane Hydrocarbons, as n-octane	ug/L	50	2600	01/21/94
Volatile Aromatic Compounds (EPA M8020)			-	01/21/94
Benzene	ug/L	0.5	120	01/21/94
Toluene	ug/L	0.5	100	01/21/94
Ethylbenzene	ug/L	0.5	46	01/21/94
Xylenes, Total	ug/L	0.5	160	01/21/94

These data have been reviewed and are approved for release.

Darrell C. Cain
Regional Director

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

Mr. John Turney
Page 3

FOOTNOTES
for pages 1 through 2

January 24, 1994
PACE Project Number: 440120506

Client Reference: E.Z Serve/Hayward

MDL Method Detection Limit
ND Not detected at or above the MDL.

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Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

Mr. John Turney
Page 4

QUALITY CONTROL DATA

January 24, 1994
PACE Project Number: 440120506

Client Reference: E.Z Serve/Hayward

GASOLINE AND AROMATICS-AIR (M8015/8020)
Batch: 70 27857
Samples: 70 0232341, 70 0232350

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Non-Methane Hydrocarbons, as n-octane	ug/L	50	ND
Volatile Aromatic Compounds (EPA M8020)			-
Benzene	ug/L	0.5	ND
Toluene	ug/L	0.5	ND
Ethylbenzene	ug/L	0.5	ND
Xylenes, Total	ug/L	0.5	ND

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Non-Methane Hydrocarbons, as n-octane	ug/L	50	1241	110%	111%	0%
Benzene	ug/L	0.5	160	110%	108%	1%
Toluene	ug/L	0.5	191	110%	110%	0%
Ethylbenzene	ug/L	0.5	220	114%	112%	1%
Xylenes, Total	ug/L	0.5	671	113%	111%	1%

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415-883-2673

Client Reference: E.Z Serve/Hayward

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

11 Digital Drive
Novato, CA 94949
TEL: 415-883-6100
FAX: 415 883-2673

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138417

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client: Hydro-Environmental Tech, Inc.
Address: 2363 Mariner Square Dr. #243
Alameda, CA. 94501
Phone: (510) 521-2684

Report To: John Turney
Bill To: HETI
P.O. # / Billing Reference: 7-278
Project Name / No.: E-Z Serve/Hayward

Pace Client No.:
Pace Project Manager:
Pace Project No.: 4401120-506
*Requested Due Date:

Sampled By (PRINT): Tony Ramirez
Sampler Signature: [signature]
Date Sampled: 1/19/94

ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	VOA	darkness	ANALYSES REQUEST: TPH-G / BTEX	REMARKS
1	MW-4-1	1245	air	232341	1					X	X X	
2	MW-4-2	1255	air	232350	1					X	X X	
3												
4												
5												
6												
7												
8												

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT / DATE	SHIPMENT METHOD RETURNED / DATE	ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME
					[signature] / Hetl	Ed Hall / Hetl Sandra Briones / Pace	1/20/94 1/20/94	1021 1300

Additional Comments

GCMS/3

ORIGINAL

SEE REVERSE SIDE FOR INSTRUCTIONS