

**EVALUATION OF GROUNDWATER
REMEDICATION ALTERNATIVES
AND
REMEDIAL ACTION PLAN**

**1650 65TH STREET PROPERTY
EMERYVILLE, CALIFORNIA**

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Prepared for

**P. O. PARTNERS
Emeryville, California**

JUNE 1990

Prepared by

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15 June 1990
Ref: NC222.08

Mr. Dennis Byrne
Alameda County Environmental Health Services
Hazardous Materials
80 Swan Way, Suite 200
Oakland, California 94621

Subject: Groundwater Remediation Alternative Evaluation, Remedial Action Plan,
1650 65th Street Property, Emeryville, California

Dear Mr. Byrne:

Enclosed is an Evaluation of Groundwater Remediation Alternatives and Remedial Action Plan (RAP) which addresses groundwater contamination remediation at the 1650 65th Street property in Emeryville, California.

This report presents an evaluation of groundwater remediation alternatives and remedial action plan to complete groundwater contamination cleanup at the subject site. This RAP describes the preliminary design, equipment, program and schedule for remediating the dissolved petroleum hydrocarbon groundwater contamination associated with the former on-site underground storage tank. A summary of site characterization studies, including field sampling and aquifer testing, is also discussed.

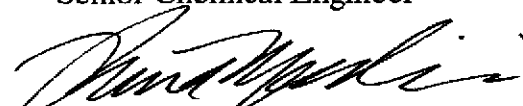
Following your review of this report, Engineering-Science would like to schedule a meeting with Alameda County Environmental Health Services, at your earliest convenience, to discuss our proposed remedial action plan and seek approval to proceed with implementing the proposed remedial action. We trust that this submittal meets the needs of your office in reviewing the proposed remediation program.

Please call if you have any questions or require additional information.

Sincerely,



Clyde Wong, P.E.
Senior Chemical Engineer



Richard S. Makdisi, R.G.
Project Manager and
Manager, Hazardous Waste
Management Department

CW/RSM/dka/143-57.R0

cc: Walt Kaczmarek, P.O. Partners

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SECTION 1

INTRODUCTION

GENERAL

This report presents an evaluation of groundwater remediation alternatives and a remedial action plan to complete groundwater cleanup at the 1650 65th Street project site in Emeryville, California. A summary of site characterization studies, including field sampling and aquifer testing is also discussed. This work follows the Groundwater Contamination characterization reports submitted to P.O Partners and the Alameda County Environment Health Department (ACEH) in November 1989 and March 1989, respectively. A letter of intent and a report for review of this report was also sent to ACEH on 1 June 1990 to facilitate expediting the groundwater cleaning program.

SITE DESCRIPTION

The 1650 65th Street site covers approximately 5.5 acres in northwest Emeryville, California (Figure 1.1). The site is relatively flat and is bounded by Highway 80, the Emeryville-Berkeley boundary (2.5 blocks north), the Southern Pacific Railroad (one block east) and 65th Street (south).

Presently, the site is occupied by a one-story warehouse building (120,000 square feet) with concrete walls, concrete slab floors and a wood roof (Figure 1.2). Concrete aprons flank the west and south sides of the warehouse. The remaining area is covered with asphaltic concrete to the east, south and west sides. The warehouse building is currently undergoing renovation work by P.O. Partners.

SITE USE HISTORY

From the mid-1950's to 1973, the site was used by Louis Stores, a supermarket chain, which used the warehouse as a distribution center. During the 1960's a 2000 gallon underground storage tank (UST) was installed on-site and used to store gasoline and waste oil at various times. The U.S. Postal Service occupied the site from 1973 to 1988, using it for storage, distribution, and repair of postal equipment. The site has been unoccupied since then. P.O. Partners purchased the property from Werehem Development recently. P.O. Partners began rehabilitation of the warehouse and general site construction work in March 1990.

FIGURE 1.1

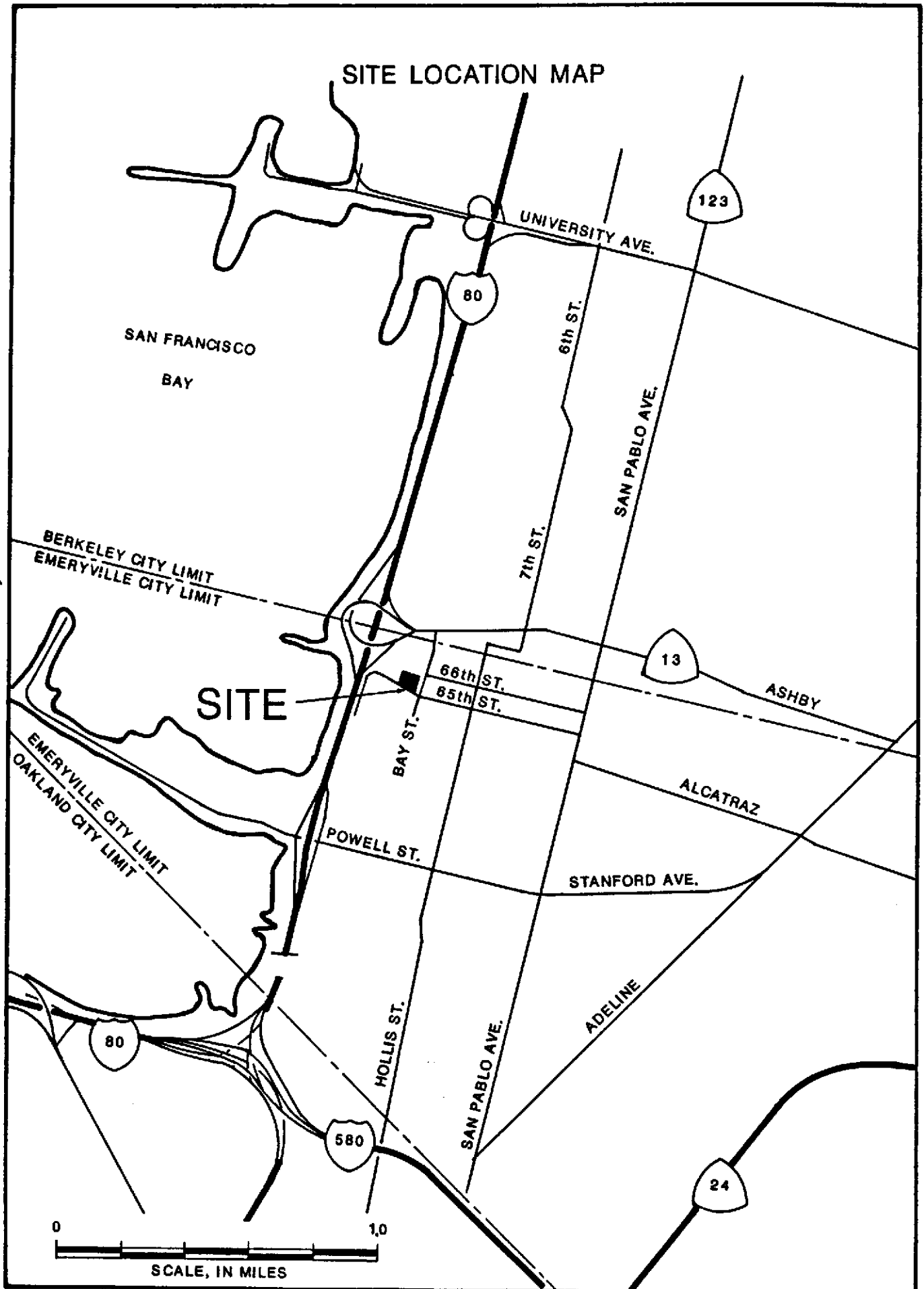
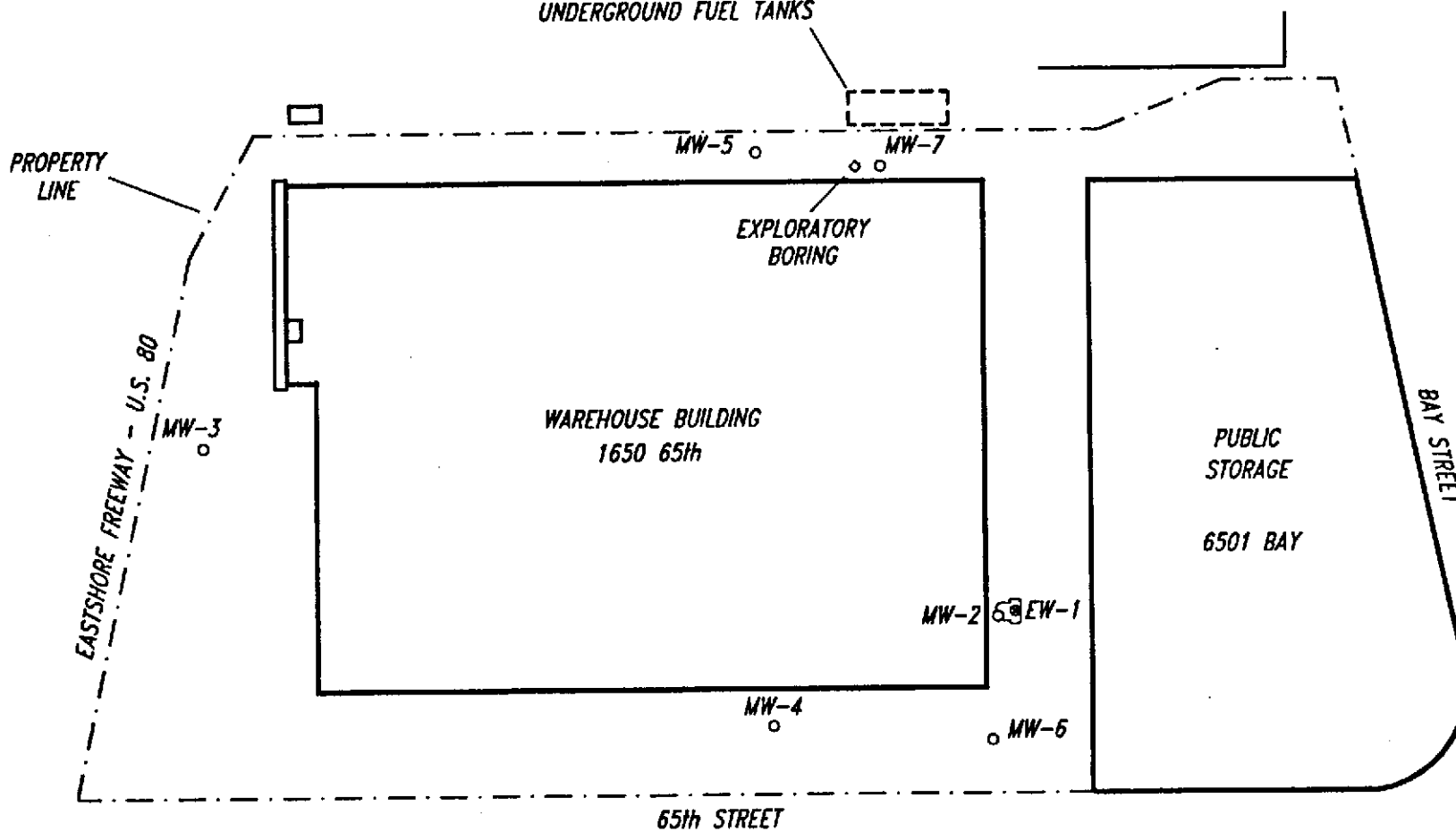


FIGURE 1.2

SITE PLAN

1650 65th Street Property, Emeryville

LOCATION OF FORMER UNDERGROUND FUEL TANKS



- LEGEND:**
- GROUNDWATER EXTRACTION WELL
 - MONITORING WELL
 - UST EXCAVATION



Site Investigations

Soil and groundwater investigations related to the UST's have been conducted by Engineering-Science, Inc. ES and other environmental consults at the project site since April 1987. A tabular chronology summary of site investigations is presented in Table 1.1.

Hydrocarbon contamination was detected in the soil underlying the leaking on-site UST in April 1987. In July 1987, the on-site UST was excavated and Monitoring well MW-1 was installed. In 1988, approximately 60 cubic yards of contaminated soil was excavated to a depth of 16.5 feet below ground surface, approximately 4.5 feet below the water table. Monitoring Well MW-1, inside the area of excavation, was also pulled and properly abandoned at this time. The excavation area was subsequently backfilled and compacted with gravel and sand, and the surface was covered with an aggregate base and 2 inches of asphalt and concrete.

Engineering-Science Inc. (ES) installed monitoring well MW-2 in September 1989 and conducted sampling of the well in October 1989. In November 1989, three groundwater monitoring wells (MW-3, MW-4 and MW-5) were installed and a quarterly groundwater monitoring program integrating the measurements of water levels and collection of water samples in the four wells was implemented. The well monitoring program allowed for the development of a database for evaluating remedial action measures. A summary of groundwater analytical data between October 1989 and April 1990 is presented in Table 1.2.

As a result of two monitoring events (References 1 and 2), two petroleum hydrocarbon contaminant plumes were identified: a contaminant plume originating from the former on-site UST; and a plume originating from former off-site UST's located north (upgradient) of the project site (Reference 1). Also the investigation results indicated that the groundwater contamination resulting from the former on-site UST has not migrated very far from source area (MW-2). This suggested that the backfill may be acting as a low-resistance sink for migration of residual contamination remaining in the former excavation area, and extracting groundwater at the backfill area could effectively "flush" residual contaminants from the contaminated native soil.

Former Off-site Underground Storage Tanks

In September/October 1989, three UST's on an adjacent property, immediately north of the project site, were excavated and removed, and groundwater in the open excavation contained a thin layer of floating hydrocarbon product. These tanks were reported to have contained diesel, unleaded gasoline and regular gasoline.

TABLE 1.1

**SITE INVESTIGATION CHRONOLOGY
1650 65th Street Site, Emeryville**

Investigation Phase	Consultant	Description	Report/Date
Soil Investigation Apr. 1987	PA	Bored exploratory soil samples	Site Characterization and Preliminary Soil Testing - 1987
Tank Removal Operations Jul. 1987	ES	Excavated UST and contaminated soil. Collected confirmation excavation sidewall samples	UST Site Investigation Near Southeast Corner of Warehouse Building - 1987
Groundwater Monitoring Well Installation Jul. 1987	ES	Installed groundwater monitoring well (MW-1)	UST Site Investigation Near Southeast Corner of Warehouse Building - 1987
Soil Remedial Action 1988-1989	ES	Abandoned MW-1 and excavated and disposed of contaminated soil; backfilled with clean soil	Implementation of Remedial Action Plan Report, 1988
Groundwater Monitoring Well Installation Sept. - Oct. 1989	ES	Install groundwater monitoring well (MW-2) and conducted sampling	Letter Report of Results - Oct. 1989
Groundwater Sampling and Well Installation Nov. 1989	ES	Installed groundwater wells MW-3 through MW-5 and conducted 1st quarterly monitoring event. Also obtained "grab" samples at 8 locations	Groundwater Contamination Investigation - Nov. 1989
Groundwater Monitoring Feb. 1990	ES	Conducted 2nd quarterly monitoring event	Letter Report - Second Quarterly Groundwater Monitoring Report - March 1990
Extraction Well Installation, Sampling, and Pump Test Mar. - Apr. 1990	ES	Installed extraction well (EW-1) and two monitoring wells (MW-6, MW-7). Conducted sampling of new wells	Groundwater Investigation and Remedial Action Plan - June 1990

Consultants:

Engineering-Science, Inc. (ES)
Peter Kaldveer and Associates (PA)

TABLE 1.2
HISTORICAL GROUNDWATER ANALYSES
October 1989 through April 1990

All Concentrations in $\mu\text{g/L}$ (ppb)

Well	Compounds	Oct 89	Nov 89	Feb 90	Apr 90
EW-1	TVH	NI	NI	NI	23,000
	TEH	NI	NI	NI	27,000
	BTXE	NI	NI	NI	19,600
	DCA	NI	NI	NI	18
MW-2	TVH	77,000	100,000	54,000	NA
	TEH	NA	NA	NA	NA
	BTXE	23,900	31,200	23,400	NA
	DCA	ND	15	32	NA
MW-3	TVH	NI	130	ND	NA
	BTXE	NI	5.2	2.5	NA
MW-4	TVH	NI	200	ND	NA
	BTXE	NI	2.3	ND	NA
MW-5	TVH	NI	ND	ND	NA
	BTXE	NI	18.2	200	NA
MW-6	TVH	NI	NI	NI	ND
	BTXE	NI	NI	NI	ND
MW-7	TVH	NI	NI	NI	330
	TEH	NI	NI	NI	5,500
	BTXE	NI	NI	NI	181

Explanation: TVH = Total Volatile Petroleum Hydrocarbons (gasoline)
TEH = Total Extractable Petroleum Hydrocarbons (diesel, mineral spirits, light oil)
BTXE = Total Aromatic Hydrocarbons (benzene, toluene, xylenes, ethylbenzene)
DCA = 1,2-Dichloroethane
ND/NA = Not Detected/Not Analyzed
NI = Not Installed

OBJECTIVE AND SCOPE OF WORK

The objective of this current groundwater investigation and remedial action design program is to better define the extent of the contamination, and to evaluate methods of and present a plan for extracting and treating the contaminated groundwater underlying the former on-site UST. The scope of work toward this objective include the following tasks:

- Install additional monitoring wells to better define areal extent of groundwater contaminate plumes, due to the on-site and off-site contamination sources;
- Project contaminated groundwater flow and quality by evaluating the effects of extracting groundwater from the backfill area on contaminate concentration;
- Evaluate remediation alternatives;
- Recommend a treatment system;
- Prepare a remedial action plan.

The scope of work is based on an Engineering-Science (ES) proposal dated 13 December 1990, which entailed the installation of an extraction well and two monitoring wells, implementation of an aquifer pump test, groundwater sampling (of the newly installed wells), evaluation of investigation results, assessment of remediation alternatives, and the completion of a remedial action plan. The two new monitoring wells allowed for better evaluation of the two separate plumes (on-site and offsite). The aquifer pump test allowed for evaluation of extraction rates and response, as well as the evaluation of hydraulic containment and treatment alternatives.

Ideally, a year of groundwater monitoring to determine seasonal hydrologic and hydrochemical trends should be collected before developing and implementing remedial plans. However, because of P. O. Partners' development plans, the integration of planned construction activities in 1990 with installation of a groundwater treatment system would minimize site construction costs, allowing for early containment and remediation of the plume.

SECTION 2

SITE INVESTIGATION PROGRAM

This section describes the field work completed between March 27 and April 16, 1990, which includes installation of new wells, groundwater monitoring for the new wells and performance of aquifer pump test.

WELL INSTALLATIONS

Engineering-Science supervised the drilling and installation of one groundwater extraction well (EW-1) and two additional groundwater monitoring wells (MW-6, MW-7) at the project site between March 27-29, 1990. Locations of the newly installed wells are shown in Figure 2.1. The well installation and construction procedures are discussed in the following section. Appendix A includes the geologic logs of the boreholes describing subsurface soil lithology and well construction details.

Well Installation Procedures

All wells were installed according to procedures recommended by the California Regional Water Quality Control Board (RWQCB) and the California Department of Water Resources (DWR). These procedures were implemented to minimize potential for cross-contamination during the drilling and construction of the wells and to provide quality assurance for analytical data collected from well samples.

Well installations were conducted using the following general specifications:

- Test holes were bored with an 8- or 10.75-inch hollow stem auger.
- During drilling of the test holes, lithologic soil samples were collected every 2.5 feet. Analytical soil samples were collected at a depth of 6.5 to 7.5 feet in the unsaturated zone using a California modified split spoon sampler. Analytical samples were not collected below the top of the saturated zone.

1. For monitoring wells:

The monitoring wells were completed using 10-foot sections of 2- or 4-inch ID (inside diameter) PVC blank and slotted casing (slot size - 0.020 inches). Slotted casings were installed in the zone of saturation, with the slotted interval extending 1 to 2 feet above the top of the zone of saturation.

The blank and slotted PVC casings were threaded together. PVC bottom caps were either threaded or attached with stainless steel screws to the base

of the slotted sections. Glues, solvents, and adhesives were not used in the assembly of the individual casing sections.

2. For extraction well:

The extraction was completed using 10-foot sections of 4-inch ID stainless steel blank and slotted casing (slot size = 0.020 inches). Slotted casings were installed in the zone of saturation, with the slotted interval extending 1 to 2 feet above the top of the zone of saturation.

The blank and slotted stainless steel casings were threaded together. Stainless steel bottom caps were either threaded or attached with stainless steel screws to the base. Glues, solvents, and adhesives were not used in the assembly of the individual casing sections.

- All casing lengths were steam cleaned prior to installation to prevent contamination of wells with pollutants which could have been acquired during shipment, storage, and transport.
- The annular space surrounding slotted intervals was packed with sand (Monterey Sand No. 3) from the bottom of the screen to a level approximately 1 to 2 feet above the top of the screen. This allows for settlement of the sand and ensures cover for the entire slotted interval.
- Approximately 1 to 2 feet of activated bentonite pellets were placed at the top of the sand pack in each well to prevent vertical migration of contaminants through the annular space.
- The surface seal in each well was completed by filling the remaining annular space with Portland cement from the top of the bentonite seal to a depth of 1-foot below ground surface.
- A traffic-rated 6-5 Christy Box was cemented in-place around the top of each well and a locking cap was inserted into the top of the well casing.
- All soil cuttings produced during well installation were stored on-site in labelled 55-gallon drums.
- Groundwater purged during well development was stored on-site in labelled 55-gallon drums.

Well Installation Details and Observations

The installation details of Wells EW-1, MW-6 and MW-7 are described below. Well logs and construction summaries are contained in Appendix A. Photodocumentation of the well installation are also included in Appendix A.

Extraction Well EW-1

Extraction well EW-1 was installed on 28 March 1990, approximately 101 feet north of the southern property boundary and 46 feet west of the Public Storage building. The purpose of this well is to provide and groundwater extraction point at within the backfilled excavation of the former on-site UST. The well was used for the

aquifer pump test on 4 April 1990 and will be used for future extraction and treatment system.

Well EW-1 was installed to a depth of 29 feet. Observations and organic vapor meter readings (OVM) of soil samples indicated the presence of fuel contamination in the saturated zone from 16 to 25 feet in Well EW-1 (below the former on-site UST). Groundwater was encountered at an approximate depth of 12 feet. A relatively impermeable dark and light brown silty clay was encountered at the bottom of the borehole between depths of 28.5 to 30 feet. Auger cuttings at 30 feet exhibited an OVM reading of 145 ppm. Well EW-1 was constructed with 4-inch stainless steel casing with the slotted interval set between the depths of 8.1 feet and 28.9 feet. Monterey Sand No. 3 was placed in the annulus around the casing between the depths of 6.3 to 30 feet. Bentonite was placed between 5 and 6.3 feet to seal the annulus between the sand pack and the surface seal (cement).

The well was developed on 29 March 1990 for 3 hours. Approximately 20 gallons of water was purged using a 10-foot long steel, rig-mounted bailer before the water became clear. Good recharge was noted.

Monitoring Well MW-6

Monitoring well MW-6 was installed on 27 March 1990, approximately 33 feet north of the southern property boundary and 54 feet west of the Public Storage building. This well is located 72 feet downgradient of the extraction well EW-1. The purpose of this well is to provide a control point for monitoring the southward migration of the contamination plume from the former on-site UST source area.

Well MW-6 was drilled to a depth of 22 feet. Groundwater was encountered at an approximate depth of 8.4 feet. A light brown sandy clay was encountered at the bottom of the borehole between depths of 18.5 to 22 feet. Faint organic vapor meter readings of auger cuttings (maximum 5 ppm) were detected in between 6 and 16 feet. Well MW-6 was constructed with 4-inch PVC casing with the slotted interval set between the depths of 7.1 feet and 21.8 feet. Monterey Sand No. 3 was placed in the annulus around the casing between the depths of 5.7 to 22.1 feet. Bentonite was placed between 4.6 and 5.7 feet to seal the annulus between the sand pack and the surface seal (cement).

The well was developed on 29 March 1990 for a period of 2.5 hours. Approximately 45 gallons of water were purged before the water became clear.

Monitoring Well MW-7

Monitoring well MW-7 was installed on 29 March 1990, approximately 22 feet south of the northern property boundary and 60 feet west of the Public Storage building. This well is located upgradient of the former on-site UST source area and downgradient of the former off-site UST source area. The purpose of this well is to provide a control point for monitoring the southward migration of the contamination plume from the former off-site UST source area, located north of the project site boundary.

Well MW-7 was drilled to a depth of 19 feet. No evidence of fuel contamination was noted during drilling of the borehole. Groundwater was encountered at an approximate depth of 6.9 feet. A firm red brown clay was encountered at the bottom of the borehole between depths of 17.5 to 19 feet. Well MW-7 was constructed with 4-inch PVC casing with the slotted interval set between the depths of 6.7 feet and 18.7 feet. Monterey Sand No. 3 was placed in the annulus around the casing between the depths of 5.0 to 18.7 feet. Bentonite was placed between 4.0 and 5.0 feet to seal the annulus between the sand pack and the surface seal (cement).

The well was developed on 29 March 1990 for 2.5 hours. Approximately 25 gallons of water were purged using a 10-foot long steel bailer before the water became clear.

GROUNDWATER MONITORING

On 2 April 1990, initial groundwater samples were collected from the newly installed wells (EW-1, MW-6 and MW-7). The groundwater monitoring program involves the measurement of water levels, collection of groundwater samples, and analysis of groundwater samples by a DHS certified hazardous waste laboratory using EPA recommended analytical procedures. Groundwater sampling protocol and description of analytical test are provided below. Figure 2.1 shows the groundwater elevations for the monitoring event.

Groundwater Sampling Protocol

Prior to sampling, the static water level in each well was measured using an electronic water level indicator. Groundwater sampling protocol followed recommended RWQCB guidelines for sampling. A quartz Teflon bailer was used to collect a sample from the upper 6 inches of the water table. The sample was field-inspected for free product thickness and the presence of any odor or sheen.

Three (3) well volumes were purged from the well prior to sampling. During the purging of the well, water temperature (T), hydrogen ion index (pH) and electric conductivity were monitored. These parameters were considered stabilized when the last two consecutive readings fell within the following ranges: $\pm 0.5^{\circ}\text{C}$ for T; ± 0.10 for pH; for electric conductivity, measurements should stabilize within ± 5.0 uhmos in the 0 to 500 uhmos range, ± 50 uhmos in the 0 to 5,000 range, and ± 500 uhmos in the 0 to 50,000 range. Since the formation water parameter stabilized after purging 3 well volumes, additional purging was not necessary.

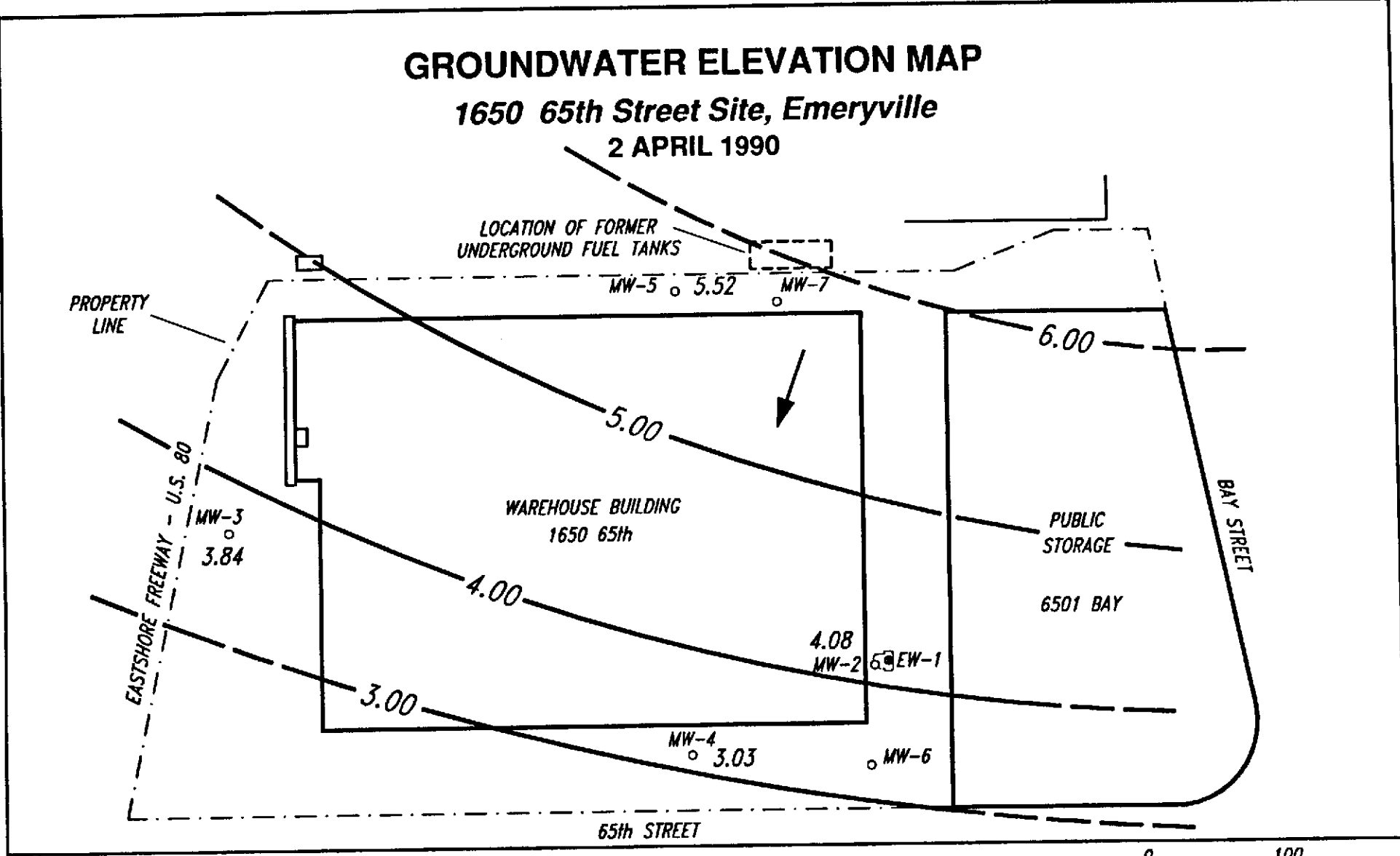
Purging and sample collection was performed with a quartz Teflon bailer. Groundwater samples were transferred to appropriate containers, labelled, refrigerated, and transported to a DHS certified hazardous waster laboratory.

All sampling equipment was rinsed with Alconox solution (a detergent) and deionized water before and after the well was sampled. Purge-water was containerized on-site in clearly labeled, 55-gallon drums. Disposal of the purge water will be the responsibility of P.O. Partners. Groundwater sampling field notes are contained in Appendix B.

FIGURE 2.1

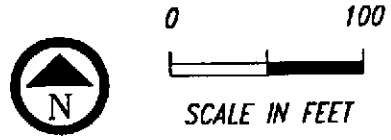
GROUNDWATER ELEVATION MAP

1650 65th Street Site, Emeryville
2 APRIL 1990



- LEGEND:**
- GROUNDWATER EXTRACTION WELL
 - MONITORING WELL
 - UST EXCAVATION

— 5.00 — GROUNDWATER ELEVATION CONTOUR
 ○ 3.03 WATER LEVEL ELEVATION IN FEET ABOVE SEA LEVEL
 ↘ GROUNDWATER FLOW DIRECTION



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FIGURE 2.1

AQUIFER PUMPING TEST

The purpose of the pump test was to determine the hydraulic characteristics of the aquifer, which could be used to determine hydraulic capture zone of the well with time. The results of hydraulic capture zone with time were used to evaluate groundwater remediation alternatives. During the pump test, the extraction well was pumped at variable pumping rates and the corresponding drawdown (water level) in monitoring wells were monitored.

In order to monitor fluctuations in contaminant concentrations, three groundwater samples were collected during different stages of the pump test and analyzed by EPA Method 8015 for total petroleum hydrocarbons (as gasoline) and EPA Method 602 for BTXE.

Preliminary Pump Test Observations

Prior to the actual pump test, a preliminary step-drawdown test was performed on well EW-1 on 2 April 1990 to establish pumping rates for the actual pump test. The well was pumped at variable pumping rates and the corresponding drawdown was monitored. Approximately 110 gallons of water was pumped out of the well, and stored on site, in properly labelled 55-gallon drums. Based on the preliminary pump test, the optimum pumping rate was estimated to be between 6 to 9 gallons per minute. A tabulation of pumping rate with time is presented in the field notes in Appendix B.

Pump Test Observations

On 4 April 1990, the actual short-term stepped drawdown aquifer pump test was performed on extraction well EW-1. Water level drawdown measurements were periodically recorded in the test well and nearby monitoring wells during pumping at 5, 8.5 and 12 gallon per minute (gpm) discharge rate. Drawdown was observed only in well EW-1 and MW-2, located approximately 8 feet away from the extraction well. No other well registered significant change in the water level, which could be associated with the hydraulic stresses created by pumping well EW-1. Table D-1 in Appendix D presents the water levels observed in EW-1 and MW-2 at various extraction rate and elapsed time. After 3.0 hours of continuous pumping at progressively increasing flowrate, the pumping capacity of the extraction well achieved 12 gpm; in the next thirty minutes, the rate declined to an average of 4 to 5 gpm, which is believed to be the natural recharge rate of the aquifer surrounding the former on-site UST.

Immediately following the pump test, a 2-hour recovery test was performed. Water levels were recorded only in wells EW-1 and MW-2 as significant drawdown was not observed in other monitoring wells during pumping stage. Table D-2 in Appendix D presents the post-pump test (recharge test) water levels measured in wells EW-1 and MW-2 at correspond lapsed time after pumping stopped.

Approximately 3,200 gallons of groundwater was purged from well EW-1 during the pump test, and collected on-site in a 6000-gallon capacity Baker tank. The recovered water was greenish-yellow in color and exhibited a moderate to strong petroleum hydrocarbon (gasoline) odor. As part of the pumping test, discharge

samples were collected to assess groundwater contamination levels during the extended well purging; a discussion of analytical results is presented in Section 3. Following receipt of analytical results, as discussed above, the contents of the Baker tank were emptied and transported to treatment, storage and disposal facility on 16 April 1990, by a licensed and certified hazardous materials hauler.

SECTION 3

RESULTS AND EVALUATION

This section presents the hydrologic and hydrochemical results of the March-April 1990, soil/groundwater sampling, and aquifer pump test event conducted at the project site. The results of the new soil and groundwater analysis help to further define the extent of contamination at project site. The aquifer pump test provided the additional aquifer parameters, refined hydrogeologic characteristics, determined the optimum hydraulic extraction rate, and fluctuations in contaminant concentrations during extraction, necessary for final evaluation of groundwater remediation alternatives.

SOIL SAMPLING

Table 3.1 presents the analytical results for two soil samples collected during the installation of wells MW-6 and MW-7 on March 27 and 28, 1990, respectively. One sample was collected at a depth of 6.5 to 7.5 feet from each well. Sampling protocol consisted of driving a clean sampler with 2.5 inch O.D. inner brass tube liners into undisturbed soil. When the sampler was removed from the hole, the appropriate inner brass tube liner was sealed at both ends with Teflon tape and non-reactive caps, refrigerated, and transported to a DHS certified hazardous waste laboratory. The soil samples from the two wells were analyzed by modified EPA Method 8015 for TPH (as gasoline) and by EPA Method 8020 for BTXE. The soil sampling analytical results and chain-of-custody records are included in Appendix C.

TABLE 3.1

SOIL SAMPLE ANALYTICAL RESULTS

Constituent	Borehole MW-6 (6.5 - 7.0 ft)	Borehole MW-7 (5.5 - 6.0 ft)
TPH Gasoline	ND	ND
Benzene	ND	ND
Toluene	ND	ND
Xylenes	ND	ND
Ethyl Benzene	ND	ND

ND = Not detected above method detection limits
(See laboratory reports)

Both of the soil samples did not detect gasoline, benzene, ethyl benzene, and xylenes. The detection limits for gasoline, benzene, ethyl benzene, and xylenes were 500 $\mu\text{g}/\text{kg}$, 2 $\mu\text{g}/\text{kg}$, 2 $\mu\text{g}/\text{kg}$, and 7 $\mu\text{g}/\text{kg}$, respectively.

GROUNDWATER SAMPLING

On 2 April 1990, groundwater samples were collected from the newly installed wells MW-6, MW-7 and EW-1. All wells samples were analyzed by modified 8015 for total petroleum hydrocarbons (TPH) as gasoline, diesel and other extractable hydrocarbon compounds, and by EPA Method 8020 for BTXE. In addition, samples from well EW-1 were analyzed for volatile chlorinated hydrocarbons and selected inorganic constituents and parameters.

Initial Sampling

Table 3.2 presents a summary of the analytical results for organic compounds, and Appendix C contains the complete analytical documentation including chain-of-custody records. Petroleum or aromatic hydrocarbons were not detected in well MW-6. Samples from the upgradient well, MW-7, detected 330 $\mu\text{g}/\text{L}$ (ppb) gasoline, 5,500 ppb extractable petroleum hydrocarbons, including weathered compounds in the mineral spirits and light oil ranges. Also present in the EW-1 baseline sample was 19,000 ppb total BTXE and 18 ppb 1,2-dichloroethane (DCA).

Figure 3.1 is an isoconcentration map of total BTXE for the A-aquifer zone. The map was generated by combining analytical data from the current sampling event (EW-1, MW-6, and MW-7) and the February quarterly monitoring event (MW-2, MW-3, MW-4 and MW-5) (Reference 2). The area of relatively high groundwater contamination appears to be confined to the immediate vicinity of the former on-site UST. The absence of a notable BTXE contamination plume downgradient of the former on-site UST (i.e., MW-6) implies that groundwater is relatively immobile in the shallow aquifer in the site area.

The isoconcentration map also indicate that generally low to moderate levels of TPH and BTXE contamination exist in the upgradient area adjacent to the former off-site USTs. The recent investigation has not confirmed significant soil or groundwater contamination in this area.

Table 3.3 presents a summary of inorganic analytical results for samples from EW-1. Analytical documentation including chain-of-custody records are also contained in Appendix C. This data will be used for final evaluation of treatment and disposal alternatives.

Pump Test Sampling

Also presented in Table 3.2 are analytical results of samples collected at the pump discharge during different stages of the aquifer pump test, at 3 and 4.5 hours into the pump test. The analytical results of samples collected during the pump test were used to monitor the change in contaminant levels under continuous pumping conditions and to evaluate the performance of soil flushing as a remediation option. The data indicate a consistent and substantial reduction in gasoline (from 23,000 to 10,000 ppb in 3 hours) and BTXE levels (from 19,600 to 7,170 ppb in 4.5 hours)

TABLE 3.2
 APRIL 1990 GROUNDWATER ANALYTICAL RESULTS
 1650 65th Street Site, Emeryville

All Concentrations in $\mu\text{g/L}$ (ppb)

Sample ID	Remarks	PETROLEUM HYDROCARBONS				AROMATIC HYDROCARBONS					VOLATILE HALOCARBONS	
		Gasoline	Diesel	Other* Extractables	TOTAL	Benzene	Toluene	Xylenes	Ethyl-B	TOTAL	DCA	Other Halocarbons
MW-6	Well sample	ND	ND	ND	--	ND	ND	ND	ND	--		NA
MW-7	Well sample	330	ND	5,500	5,830	170	4	5	2	181		NA
EW-1	Pre-Test well sample	23,000	ND	27,000	50,000	8,500	3,300	6,500	1,300	19,600	18	ND
EW-1A	Pump Test, after 3 hours	10,000	NA	NA	--	6,000	3,700	3,900	1,100	14,700		NA
EW-1B	Pump Test, after 4 1/2 hours	10,000	NA	NA	--	3,300	1,600	1,800	470	7,170		NA
BT-1	Baker Tank confirmation sample	NA	NA	NA	--	NA	NA	NA	NA	--	1.7	ND

Explanation: ND = Not Detected

NA = Not Analyzed

DCA = 1,2-Dichloroethane

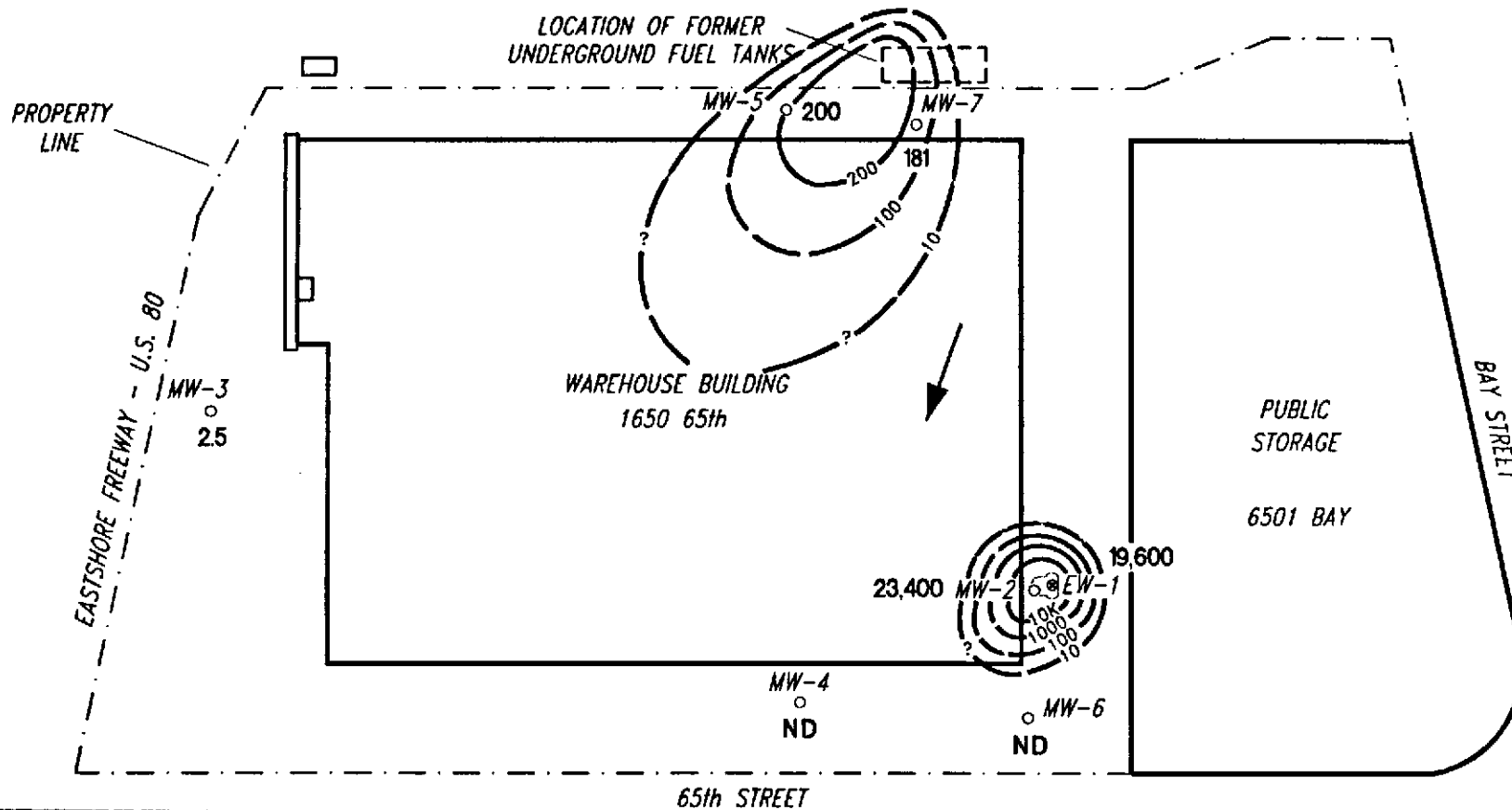
* = Detected hydrocarbon compounds similar to mineral spirits and 30 weight oil

FIGURE 3.1

TOTAL BTXE HYDROCARBONS IN GROUNDWATER

Composite Sampling Data - February & April 1990

1650 65th Street Site, Emeryville



- LEGEND:**
- GROUNDWATER EXTRACTION WELL
 - MONITORING WELL
 - UST EXCAVATION

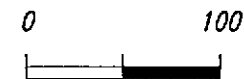
WELLS SAMPLED 2/21/90: MW-2, MW-3, MW-4, MW-5

WELLS SAMPLED 4/2/90: MW-6, MW-7, EW-1

181 TOTAL AROMATIC BTXE HYDROCARBONS IN ug\L (ppb)

-10- ISOCONCENTRATION CONTOUR, DASHED WHERE INFERRED

↙ GROUNDWATER FLOW DIRECTION



SCALE IN FEET

TABLE 3.3**INORGANIC AND OTHER GROUNDWATER ANALYTICAL RESULTS****April 1990
1650 - 65th Street, Emeryville**

Parameter	Concentration in ppm
Calcium	160.0
Iron	0.39
Magnesium	40.0
Potassium	68.0
Sodium	990.0
Chloride	1600.0
Fluoride	5.4
Nitrate	ND
Nitrite	ND
Phosphate	ND
Sulfate	ND
TDS	3500.
Organic Lead	ND
Total Organic Carbon	110.

ND = Not Detected
TDS = Total Dissolved Solids

during extended pumping from this extraction well, which suggests that the average contaminant concentrations expected during continuous groundwater extraction will be substantially less than the relatively high concentrations detected under non-pumping, static conditions.

The contaminant concentration in the groundwater during treatment are better represented by groundwater quality during extended (steady state) pumping. Based on the reduction in contaminant concentrations during the pump test and assuming a corresponding reduction in other extractables during steady state pumping, the quality of the projected extracted groundwater is expected to be similar to the 4.5 hour concentrations which are presented in Table 3.4 as average concentrations.

AQUIFER PUMP TEST RESULTS

The time-drawdown data collected during the pump-test (Appendix D) were analyzed to obtain aquifer parameters. The aquifer parameter were then used as input for the analytical model CAPTURE (McEdwards 1988) to assess the effectiveness of hydraulic containment. The model evaluates the removal or containment of groundwater by extraction well(s) from a confined, homogeneous, isotropic aquifer of infinite lateral extent. The model depicts the zone of drawdown or contaminant capture with time under uniform pumping rate conditions.

TABLE 3.4

PROJECTED EXTRACTED GROUNDWATER QUALITY

Compound(s)	Projected Water Quality (ppb)	
	Maximum	Average
Benzene	8,500	3,300
Toluene	3,300	1,600
Xylenes	6,500	1,800
Ethyl Benzene	1,300	470
DCA	18	1.7
Gasoline	23,000	10,000
TPH	50,000	22,000

Note: The maximum concentration is expected in the groundwater during initial pumping.

DCA = 1,2-Dichloroethane

TPH = Total Petroleum Hydrocarbon

Input parameters required for the proper execution of CAPTURE include: the location of extraction well, the magnitude of the hydraulic gradient, the groundwater flow direction, the pumping rate of the extraction well, the thickness of the aquifer, the effective porosity of the aquifer, and the transmissivity and storativity of the aquifer. The input parameters used in evaluating the hydraulic containment of EW-1 extraction are as follows:

<u>Aquifer Parameter</u>	<u>Value</u>
Hydraulic gradient	0.01
Aquifer Thickness	14 feet
Effective Porosity	0.30
Transmissivity	118 ft ² /day
Storativity	0.078
<u>Extraction Parameter</u>	<u>Pumping Rate</u>
EW-1	5 gpm

The hydraulic gradient and direction was calculated from water level data collected prior to the pump test. The thickness of the aquifer unit was estimated from lithologic logs of wells in the project site. The effective porosity of 0.30 was estimated from lithologic data and published literature (Reference 3). Transmissivity and storativity were estimated using a specialized PC-based software (Hydro Geo Chem Inc.) to aid the plotting of data and numeric calculations. The computer program accounts for time variable pumping by approximating the pumping history using a piecewise linear function and estimates the well parameters by using a combination of "manual trial and error" and "automatic" curve fitting techniques. Both the pump test and recovery test data were analyzed simultaneously. Figure 3.2

shows the plot of drawdown versus time field data (x) and the computer generated curve (solid line) for a transmissivity value of 118 sq. ft./ day, and a storativity value of 0.078.

Using the aquifer parameters and an estimated extraction rate of 5 gpm, CAPTURE (computer model) was used to plot groundwater capture zone by extraction well EW-1. The computer program assumes the aquifer to be confined, homogeneous, and isotropic. Figure 3.3 shows the theoretical groundwater capture zone after pumping at a rate of 5 gpm from well EW-1 for periods of 30 days and 90 days. As suggested in Figure 3.3, groundwater up to 50 feet downgradient and 70 east and west of EW-1 would be captured within 30 days of pumping at the extraction rate of 5 gpm.

FIGURE 3.2

MGC PHASE 3 - PUMP TEST ANALYSIS

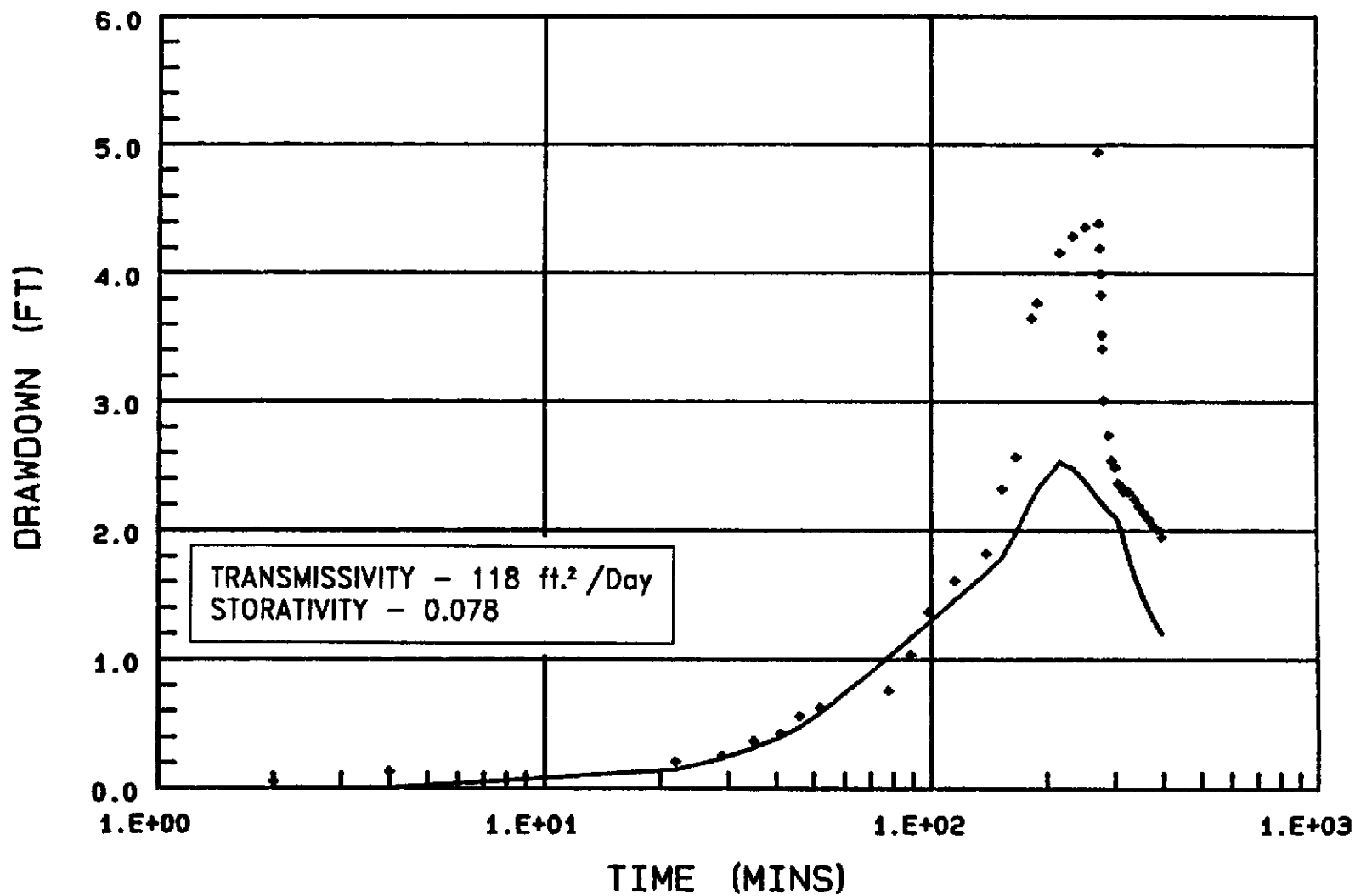
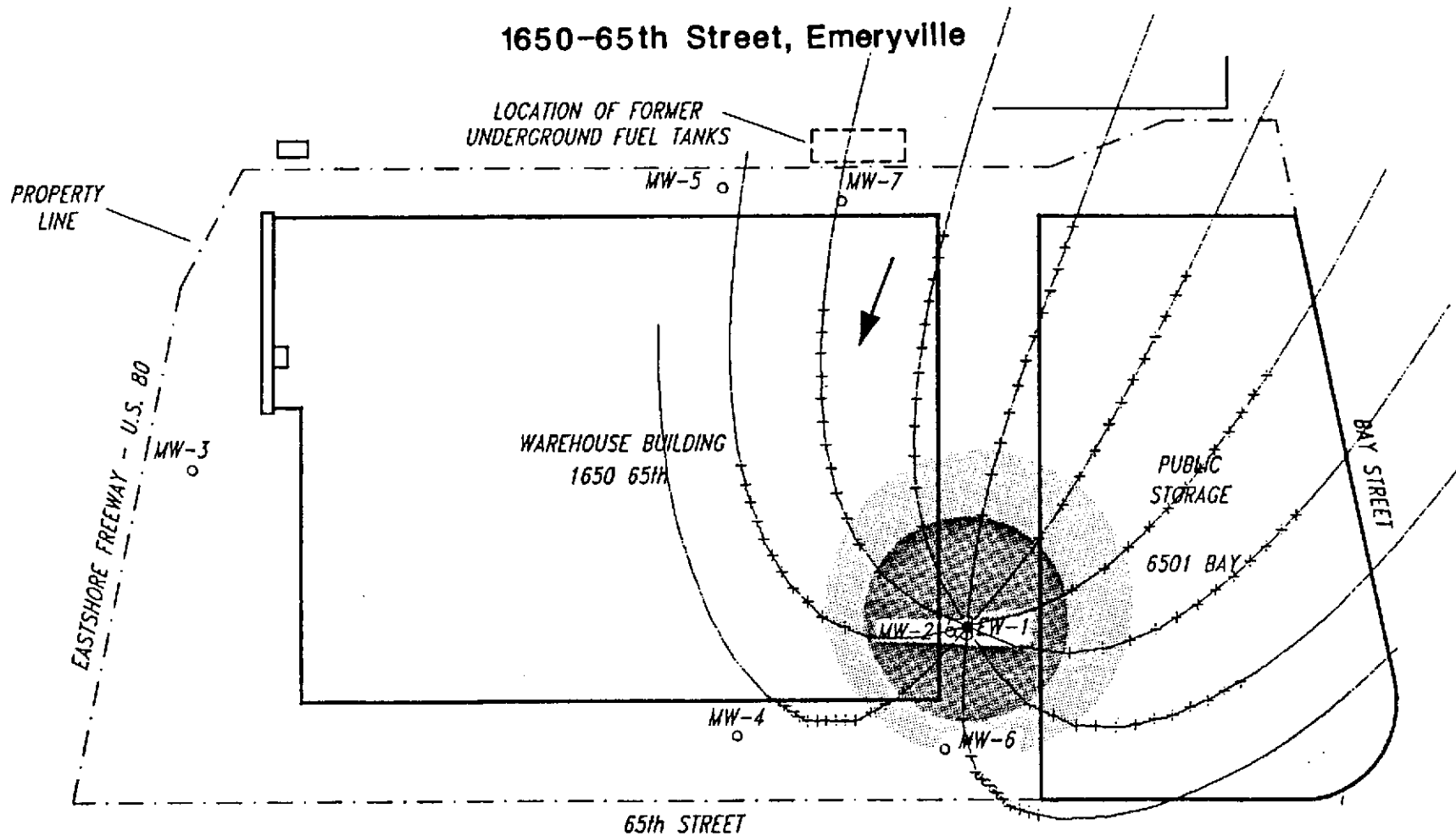


FIGURE 3.3

THEORETICAL HYDRAULIC CAPTURE ZONE

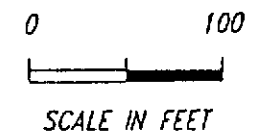
Extraction Well EW-1 at 5 gpm Flowrate

1650-65th Street, Emeryville



- LEGEND:
- GROUNDWATER EXTRACTION WELL
 - MONITORING WELL
 - ⊔ UST EXCAVATION

- ↘ GROUNDWATER FLOW DIRECTION
- 30 DAY CAPTURE ZONE
- 90 DAY CAPTURE ZONE



SECTION 4

EVALUATION OF REMEDIATION ALTERNATIVES

The purpose of this section is to evaluate potentially applicable remediation alternatives and to eliminate those that are not applicable or feasible for site conditions. Alternatives are evaluated for technical implementability and cost effectiveness. The primary focus of this evaluation is restricted to remediation of groundwater contamination originating from the former on-site UST.

GROUNDWATER TREATMENT ALTERNATIVES

Based upon ES experience for sites of this type, there are five potentially feasible treatment alternatives: Carbon Adsorption, Bioremediation, Air Stripping, In-situ Soil Flushing, and No Action. In light of data obtained in the current groundwater investigation event, these alternatives are evaluated below:

Carbon Adsorption

Adsorption is a natural process in which molecules of a liquid or gas are attracted to and held at the surface of a solid. Granular activated carbon is presently the most cost-effective, available adsorbent for removal of VOCs from water.

For removal of multiple contaminants, a staged carbon adsorption system maximizes utilization of the adsorptive capacity of the carbon. A staged adsorption system typically used in this application consists of three single fixed carbon beds in series operation. If the mass transfer zone can be maintained within a single bed, then the second and third stage will be able to maintain effluent quality while the carbon in the first stage is obtaining full use of its adsorptive capacity. When the carbon in the first stage is fully utilized, the second and third stages are moved to the first and second stage, respectively, while a fresh carbon bed is installed in the third stage.

At the project site, it is anticipated that a three stage carbon adsorption system could remove all contaminants (Table 3.4) to the required discharge levels. For the anticipated groundwater flow rate and contaminant concentration, carbon adsorption is a cost-effective remediation alternative. Carbon adsorption is also very flexible in terms of fluctuations in groundwater flow rate and contaminant concentrations due to seasonal fluctuations.

In-situ Bioremediation

In-situ bioremediation is a process where organic compounds are removed from groundwater by stimulating the growth of an indigenous and/or injected microbial population to degrade the contaminants in the aquifer. Oxygen and nutrients are added to the groundwater as appropriate using injection wells infiltration galleries. the groundwater is moved through the formation by pumping wells. Several factors must be considered before in-situ bioreclamation is chosen as the remedial alternative for the cleanup of a particular site, including site, contaminant, and microbial characteristics.

For the groundwater flow rate and contaminant concentration anticipated, bioremediation is comparable to carbon adsorption in cost-effectiveness over two years of operation, and becomes more cost-effective than carbon adsorption beyond two years. However, bioremediation is less flexible to fluctuations in influent flow rate and contaminant concentrations.

Air Stripping

Air stripping is a treatment process frequently used for removal of volatile organic compounds (VOCs) from water. The process is dependent on the kinetic theory of gases which states that molecules of dissolved gases can move between the gas and liquid phase. Consequently, if water contains a volatile contaminant in excess of its equilibrium concentration, the contaminant moves from the liquid phase (water) to the gas phase (air) until equilibrium is reached. Through use of this basic operating principle, the air stripping process eventually allows virtually all of the contaminant to be removed from solution is the air in contact with the water is continuously replenished with contaminant-free air.

Several types of air stripping processes exist, of which the counter-current packed tower is quite effective for VOC removal. In packed towers, water free-flows downward by gravity and air is forced upward through the loose media packing. The packing serves to continually disrupt the liquid flow, producing and renewing the air-to-water interface, thus improving mass transfer or stripping of the contaminant from water.

Based on the significant decrease in contaminant concentration after a short pumping test, expected average concentration of contaminants are relatively low, making air stripping a less cost-effective alternative.

In-situ Soil Flushing

In-situ soil flushing entails the percolation of water through contaminated soils solubilize the VOCs adsorbed in the soil and flush them into the groundwater. This procedure will reduce the residual concentrations in the soil and increase the soluble concentrations in the groundwater, thus accelerating clean up time. The groundwater would then be extracted from existing groundwater well or new extraction wells if necessary, and the water would be transported to a treatment or recycling facility.

Although the contaminate concentrations decreased significantly during the short pumping test, the contaminant concentrations are still high enough to justify eliminating this option.

No Action

The no action alternative may be feasible if the higher contaminant concentrations are restricted to a small area as discussed in the groundwater Characterization report (Engineering-Science, November 1989). If contaminant concentrations decrease significantly during the sampling program, the monitoring may be terminated upon approval by the RWQCB. The no action alternative for groundwater includes continuous monitoring for at least one year.

Based on the contaminant concentrations remaining in the groundwater after two quarterly monitoring events, the contaminant concentration has not decreased significantly. However, it was determined that the contaminant plume has not migrated very far from the source. It would be most feasible to remediate the groundwater contamination as early as possible, before the plume migrates any further.

TREATED GROUNDWATER DISPOSAL ALTERNATIVES

Several treated groundwater disposal alternatives were evaluated for the selected groundwater treatment system including: discharge to sanitary sewer system; discharge to storm drain system; and reclamation as irrigation water.

Sanitary Sewer

Discharge to the sanitary sewer is regulated by East Bay Municipal Utility District (EBMUD). The District allows the discharge of treated groundwater of less than 25,000 gallons per day, after issuance of a Wastewater Discharge Permit.

Based on EBMUD Groundwater Discharge Guidelines (Appendix E) the effluent discharge limits for the compounds of concern at the project site are shown in Table 4.1.

It is anticipated that a 3-stage carbon adsorption system could efficiently treat the average groundwater contaminant concentrations anticipated at the project site (Table 3.4) to the discharge concentrations (Table 4.1). The sanitary sewer is the most feasible disposal alternative for the project site based on the relatively short permitting period, and quantity and quality of the water.

Storm Drain

Discharge to the storm drain is regulated by the Region Water Quality Control Board (RWQCB). The RWQCB requires an issuance of a NPDES Permit prior to discharge. The application period for an NPDES Permit is extensive, and usually require 3 to 6 months. The RWQCB also require the application to demonstrate that no other disposal options are feasible.

TABLE 4.1

**EFFLUENT QUALITY REQUIREMENTS
TREATED GROUNDWATER DISCHARGE**

Compound	Discharge Limit Concentrations
Benzene	3 µg/L
Toluene	3 µg/L
Ethylbenzene	5 µg/L
Xylene	42 µg/L
DCA	5 µg/L
Lead	2 mg/L
TPH	NA (not a specified parameter)

DCA = 1,2 Dichloroethane
TPH = Total Petroleum Hydrocarbon

Reclamation

Reclamation of treated groundwater includes options such as process use or irrigation of landscapes. The project site is planned for office use and therefore the possibility of process use is eliminated. Landscaping on the proposed site plan is limited to small area, and would not be able to handle the anticipated flowrate of 7,200 gallon per day of treated groundwater, or any fluctuation due to seasonal conditions.

SECTION 5

GROUNDWATER REMEDIAL ACTION PLAN

The objective of the proposed site remediation program is to cleanup subsurface contamination in a safe, environmentally sound and cost-effective manner to restore and protect groundwater resources. Based on site investigations and analytical data completed to-date, areas of contamination at the site include the following:

- A dissolved total petroleum hydrocarbon (TPH) groundwater contamination plume in the area of the former on-site UST tanks.
- A dissolved TPH groundwater contamination plume in the northern area of the site apparently related to upgradient, former off-site UST's.

The remediation program will be designed to contain and capture contaminated groundwater resulting from the former on-site UST at the project site. This Remedial Action Plan (RAP) addresses the preliminary design, equipment, program and schedule for implementing remediation of the former on-site UST TPH plume. Initiating cleanup of this contamination plume is considered the priority remedial action. Assessment and consideration of potential remedial actions that address the other contamination issues should be evaluated at a future time based on results of continued site monitoring.

Based on the short-term stepped drawdown aquifer pump test of Well EW-1 performed in April 1988, a flow rate of 5 gpm is anticipated. Based on the same pump test and analytical data, the groundwater quality is expected to be the average concentrations presented in Table 3.4.

CLEANUP CRITERIA

Completion of remediation will be measured by sampling of both the influent to the remediation system and quarterly groundwater sampling. However, since groundwater sampling is costly, reflects upgradient sources as well as the source of interest, and has some inherent variability seasonally and otherwise, groundwater sampling should not be the primary basis upon which effectiveness is determined. In order to meet the CERCLA requirement of compliance with Applicable or Relevant and Appropriate Requirements (ARARs), the removal and treatment of contaminants should be sufficient to bring the groundwater into compliance with ARARs if this is possible. At this site, sources upgradient of this point source are already sufficiently degrading the groundwater quality such that the contaminant levels may exceed ARARs before they reach the project site area. In which case, the

cleanup goal is to reduce the groundwater contamination to the levels observed upgradient rather than ARARs.

OVERVIEW OF SYSTEM

Based on the results of the evaluation of remediation technologies summarized in Section 4, a groundwater extraction and activated carbon adsorption treatment system was selected as the most feasible alternative. Activated carbon is an effective and reliable means of removing the low concentrations of dissolved petroleum and aromatic hydrocarbons identified in site groundwater, and is considered as a best available technology (BAT) for treatment of many organic compounds. As activated carbon adsorption is not particularly sensitive to changes in concentration or flowrate, it is ideal for the fluctuations of contaminant concentrations and flowrates anticipated at the site.

The proposed groundwater remediation system is a continuous groundwater extraction and activated carbon treatment system. The preliminary design of the system presented in this section includes a groundwater extraction system using existing monitoring wells and a series of granular activated carbon canisters. Figure 5.1 presents a preliminary process flow diagram for the system and Figure 5.2 shows a preliminary equipment layout for the proposed location of the piping and treatment facilities.

Extraction System

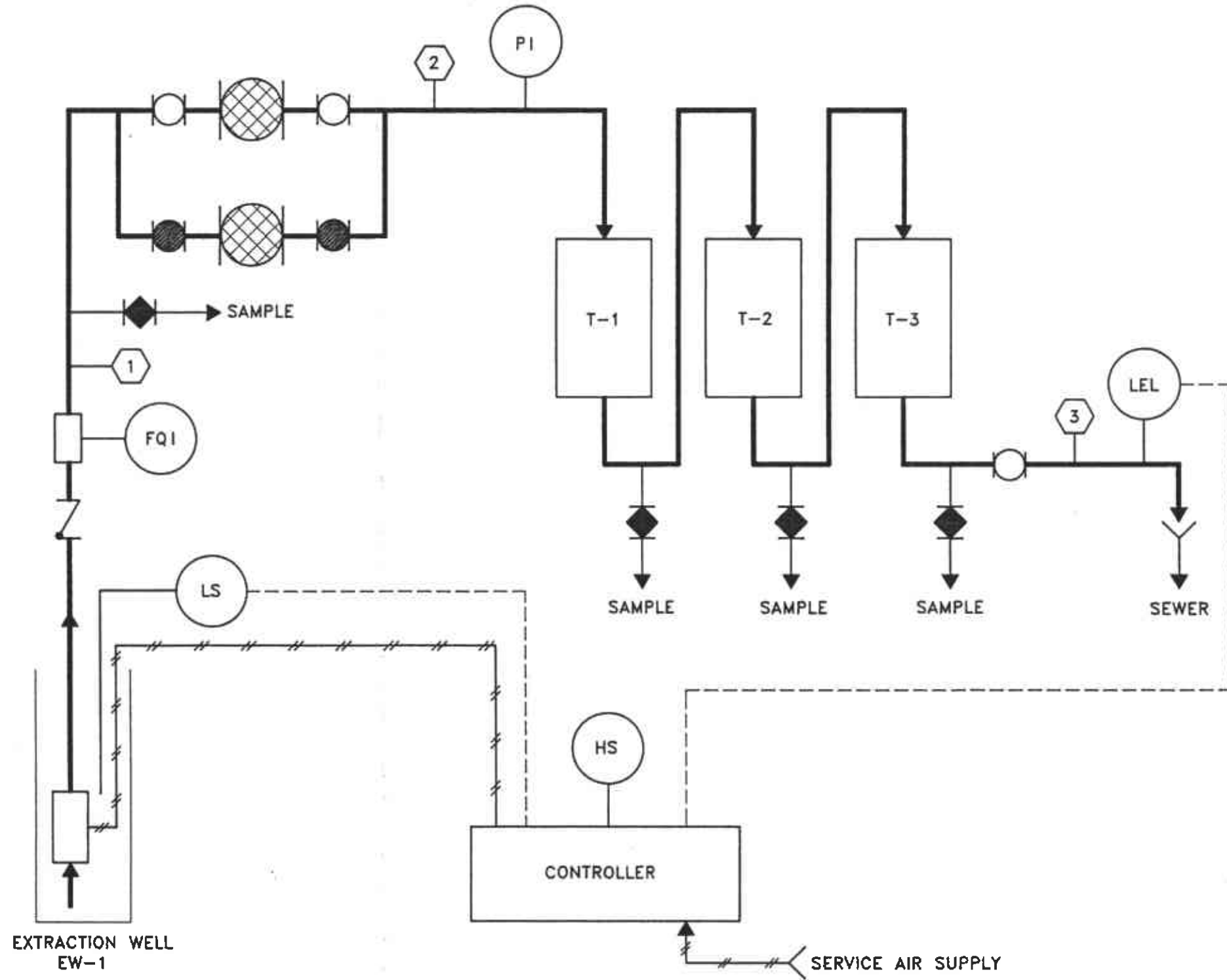
The extraction system consists of one air-pneumatic ejector pump, a compressor, a control system and associated piping and instrumentation. Extraction well EW-1, a 4-inch diameter stainless steel well, would be used to extract contaminated groundwater. The total depth of EW-1 is 29 feet below ground surface, and the screened portions of the wells are between 8.3 and 28.9 feet below ground surface.

The proposed extraction pump system operates pneumatically, which makes the system intrinsically safe for use with the potentially explosive liquids. Additional advantages of pneumatic ejector pumps include their mechanical simplicity and ability to accommodate sediment-laden groundwater. A compressor supplies air to the pump controller, which delivers compressed air pulses to the pumps. The compressed air forces liquid out of the pump body and up through discharge lines to the treatment system. The discharge line from each well is equipped with a flow totalizer and a check valve.

A groundwater level switch installed in the well activates and deactivate the pumps in response to the water level in the well, while allowing adequate suction head for the pump (approximately 2 feet above pump suction). The anticipated maximum flowrate from the wells is 5 gallons per minute (gpm). The well is equipped with an adjustable well cap to allow all lines to the well to be moved up and down through the cap, according to seasonal changes in water level.

PRELIMINARY PROCESS FLOW DIAGRAM ACTIVATED CARBON GROUNDWATER TREATMENT SYSTEM

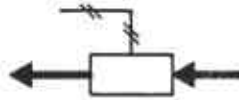











P.O. PARTNERS, 1650 65th STREET, EMERYVILLE



PARAMETER	UNIT	1	2	3
FLOW RATE (MAX.)	GPM	5	5	5
	GPD	7,200	7,200	7,200
TEMPERATURE	F	60	60	60
PRESSURE	PSIG	6	6	6
TPH*	ug/L	22,000	22,000	-
BTXE*	ug/L	7,200	7,200	<80

* ANTICIPATED AVERAGE CONCENTRATION

LEGEND

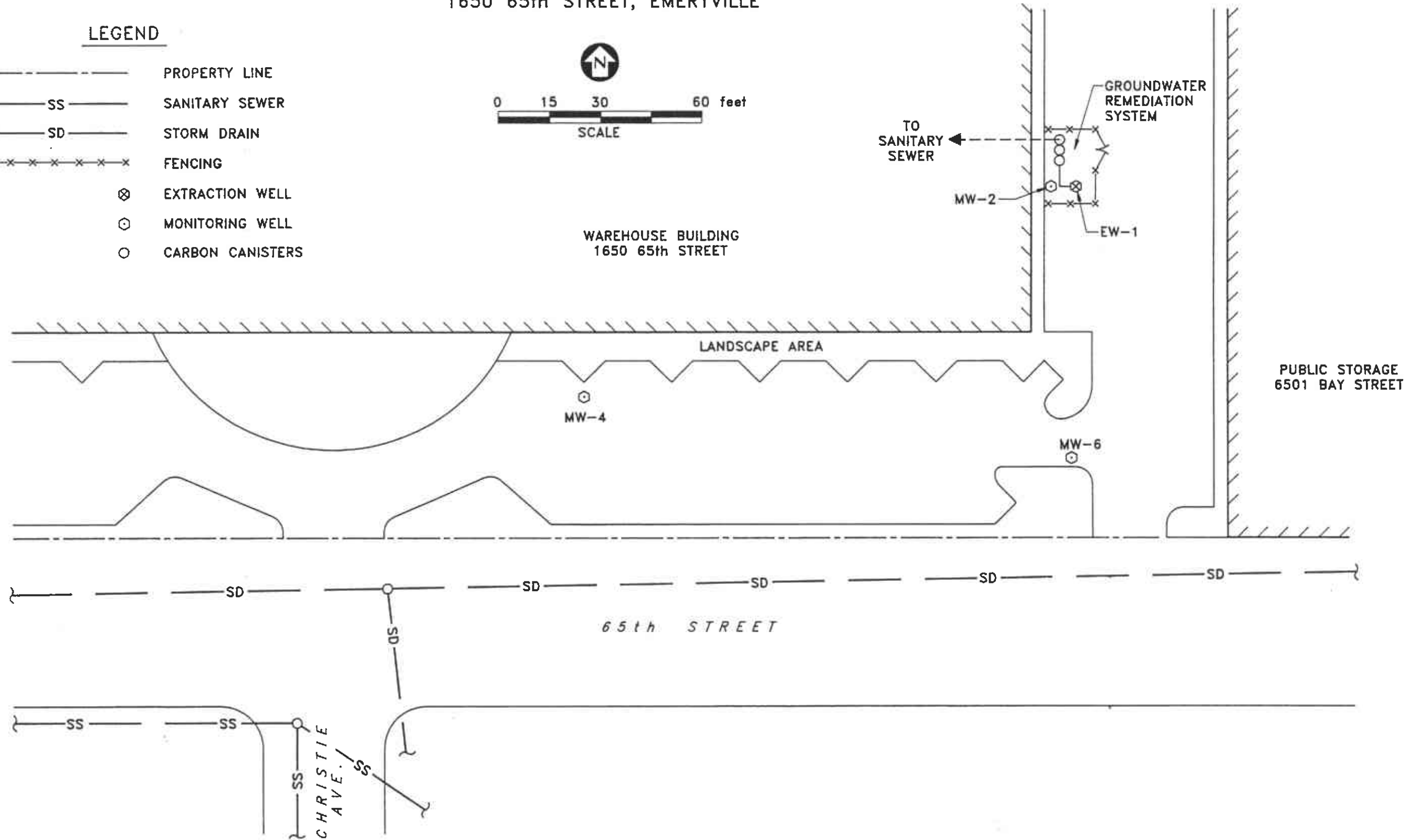
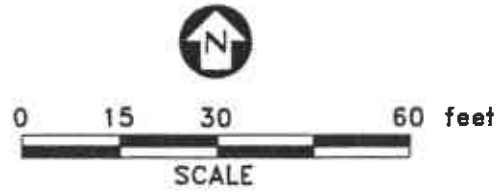
-  EDUCTOR PUMP
-  BALL VALVE (NORMALLY OPEN)
-  BALL VALVE (NORMALLY CLOSED)
-  COCK VALVE
-  FILTER/STRAINER
-  CHECK VALVE
-  PNEUMATIC LINE
-  HS HAND SWITCH
-  LS WATER LEVEL SWITCH
-  FQI FLOW QUANTITY INDICATOR
-  PI PRESSURE INDICATOR
-  LEL LOWER EXPLOSION LIMIT SENSOR

GROUNDWATER REMEDIATION SYSTEM SITE PLAN

1650 65th STREET, EMERYVILLE

LEGEND

- PROPERTY LINE
- SS — SANITARY SEWER
- SD — STORM DRAIN
- ××××× FENCING
- ⊗ EXTRACTION WELL
- ⊙ MONITORING WELL
- CARBON CANISTERS



Manual emergency shutoff of the system can be achieved either by shutting off the compressor or by shutting off the ejector pump at the pump controllers.

Treatment System

The groundwater treatment system consists of two basket sediment filters and three activated carbon canisters in series. Groundwater from the well is pumped through a basket filter for removal of particulates. The redundant basket filter provides backup service when the allowable differential pressure for the first filter is reached. From the basket filter, the groundwater is passed through three downflow activated carbon canisters piped in series to remove organic contaminants and is then discharged to a sanitary sewer inlet located in the main warehouse building. The first canister will adsorb the contaminants, while the last canister will provide final polishing to ensure all contaminants are removed.

The process rate is expected to be approximately 7,200 gallons per day (gpd). Based on conservative carbon consumption estimates by vendors, using maximum flowrate and expected concentrations of contaminants from Table 3.4, a 200 pound carbon canister will have a service life of over 30 days. The BXTE contaminant concentrations of the final effluent is anticipated to be below effluent quality requirements shown in Table 4.1.

Based on the low contaminant concentrations expected in the effluent, it is unlikely that the lower explosion limit of any petroleum hydrocarbon compound would be reached. However, as an additional safety measure, an in-line lower explosion limit (LEL) sensor, set at approximately 10% of LEL for gasoline, is located at the sewer drain to automatically shutoff the system if the set point is reached.

The configuration of three canisters in series provides substantial increase in life of the canisters, and also provides an additional margin of safety. When breakthrough (the first indication of contaminants in the effluent) occurs after the first canister, there is still considerable adsorption capacity before the carbon in the first canister is completely saturated. In order to best utilize the complete adsorption capacity of the canister, the first canister will continue to be used to adsorb contaminants, after breakthrough. When breakthrough occurs after the second canister, it is moved up to the first position in line and a fresh canister is put into the last position. The first canister is then removed and is properly disposed of or regenerated by the carbon canister supplier.

Equipment Description

Preliminary Equipment specifications are provided in Appendix F.

VERIFICATION SAMPLING

After startup of the system, verification sampling would be conducted in two phases. The startup phase consists of biweekly sampling events to establish the time for breakthrough of the first and second the carbon beds. Once breakthrough time periods are established, normal operation sampling events will be conducted based on the establish breakthrough times (which is expected to be at least 1 month).

Upon approval of the proposed remediation plan, a detailed written verification sampling program will be prepared, which is anticipated to include the following key components for startup and normal operation sampling events:

Startup Sampling

- biweekly sampling
- log total flow from each well
- obtain samples from the following sample ports:
 - influent
 - after T-1
 - after T-2
 - effluent
- analyze samples for the following:
 - BTXE
- evaluate data for efficiency based on:
 - T-1 and T-2 breakthrough time
 - flowrate
 - influent concentrations
 - effluent concentrations

Normal Operation Sampling

- sampling interval at breakthrough time for T-2
- log total flow from each well
- obtain samples from the following sample ports
 - influent (as needed)
 - after T-2
 - effluent
- analyze samples for the following
 - BTXE
- evaluate to track progress of cleanup

The system will continue to operate until cleanup criteria specified by the implementing regulatory agency are achieved for the influent in at least two consecutive sampling events.

PERMITTING AND REPORTING

The treated groundwater will be discharged to a sanitary sewer inlet located in the warehouse building, and must be permitted through the East Bay Municipal Utility District (EBMUD). A permit application along with proposed system description, equipment description, program and schedule for implementation will be submitted to EBMUD upon finalization of this Remedial Action Plan. EBMUD review of the permit is expected to be completed within 2 to 4 weeks after submittal.

Summary reports describing the verification sampling, analytical results, discharge quantity and evaluation of the remediation system would be submitted to the EBMUD and the Alameda County Department of Environmental Health (ACDEH) on a monthly basis. Should the effluent concentrations exceed non-detectable values for any sampling event, the extraction system would be shutdown and the EBMUD and the ACDEH would be notified immediately.

SECTION 6

REMEDATION AND MONITORING SCHEDULE

The following section discusses the proposed schedule for implementation of the groundwater extraction and treatment system and continued groundwater monitoring at the project site. Figure 6.1 is a preliminary schedule of the design, permitting, installation and operation of the proposed groundwater remediation system. As part of the design and permitting phase, a technical review meeting should be scheduled at ACDEH offices at an early date to discuss the proposed remediation program and to seek approval to proceed with final design. Pending approval of this RAP and issuance of a discharge permit from EBMUD for the proposed treatment system, equipment procurement and installation of the system could be completed by November 1990.

SYSTEM STARTUP AND OPERATIONS

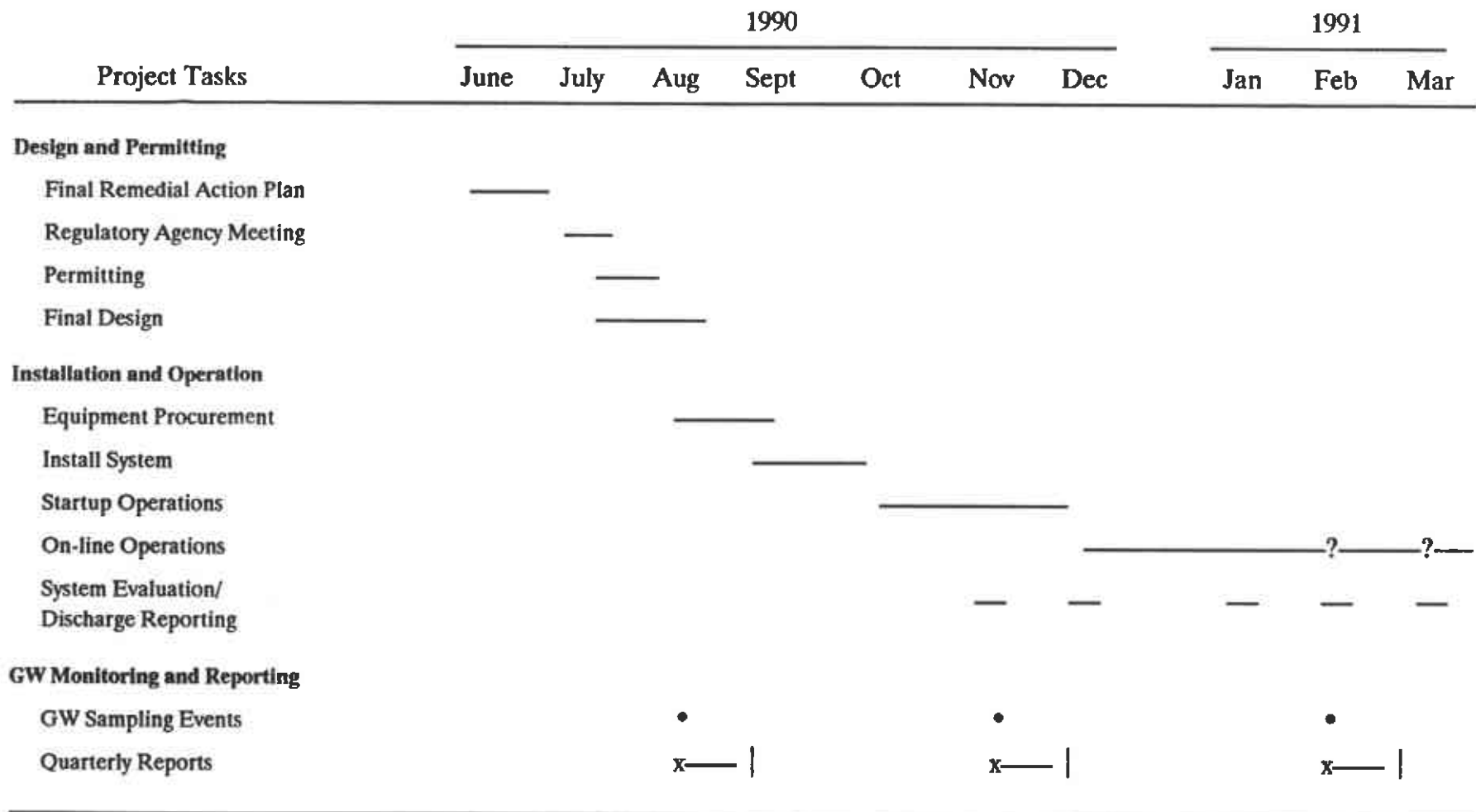
As shown in the preliminary schedule, the preliminary design will be modified based on agency input and a final design completed in August 1990. The operation of the proposed groundwater extraction and treatment system would tentatively commence in October 1990 following equipment purchase and installation and include an estimated two-month startup period. During the startup period, biweekly verification sampling would be performed to determine the operating service life of the individual carbon treatment canisters, as described in Section 5. Additionally, the operating parameters of the extraction system will be periodically checked and adjustments to the well pumps and control system will be made as needed.

Based on the results of the startup operation, approval will be requested from EBMUD and ACDEH to initiate less frequent verification sampling that corresponds to established carbon bed service life. It is anticipated that system adjustments, maintenance and verification sampling would be performed on approximately a monthly schedule during the normal operations phase of groundwater remediation. The system will continue to operate under these conditions until cleanup criteria are met, as specified by ACDEH.

SYSTEM EVALUATION

The status of the proposed groundwater extraction and treatment system will be evaluated during startup and continued operations to comply with discharge requirements specified by EBMUD under the pending discharge permit. As part of

FIGURE 6.1
PRELIMINARY PROJECT SCHEDULE
GROUNDWATER REMEDIATION PROGRAM
1650 65th Street Site - Emeryville



Legend:

- x = Draft Report
- | = Final Report
- = GW Monitoring/Laboratory Analysis Event

this evaluation program, the analytical results of verification sampling and the operating parameters of the system will be submitted in monthly letter reports to EBMUD and ACDEH for documentation. The monthly reports will include an updated status of carbon canister service life and discussion of any anticipated or warranted modifications or adjustments to the proposed remediation system.

GROUNDWATER MONITORING PROGRAM

Groundwater monitoring of the project site wells will continue during the installation and operation of the proposed groundwater remediation system. It is recommended that the continued monitoring program consist of quarterly sampling events in which water level measurements and groundwater analytical samples are collected. The monitoring data will document hydrochemical and hydraulic flow conditions at the site to help assess the performance and effectiveness of the groundwater extraction system.

A summary and evaluation of groundwater monitoring and remediation activities will be presented in upcoming quarterly site progress reports. Included in the quarterly reports will be documentation of the permitting, installation and operation of the groundwater extraction and treatment system as well as evaluation of hydrochemical and hydrologic data. A performance evaluation of the proposed remediation system and potential modifications, if warranted, will also be addressed in future quarterly reports.

SECTION 7

REFERENCES

1. Engineering-Science, Inc., Groundwater Contamination Investigation, 1650-65th Street Property, Emeryville, California, November 1989.
2. Engineering-Science, Inc., Second Quarterly Groundwater Monitoring Report, 1650-6th Street Site, Emeryville, California, March 1990.
3. Carl Terzaghi, soil Mechanics in Engineering Practice, John Wiley and Sons, 1967.

CLIENT P.O. PARTNERS
 LOCATION 1650 65th STREET,
 EMERYVILLE, CALIFORNIA
 DATE 28 March 1990
 GEOLOGIST P.F. BERTUCCI, R.G.

TEST HOLE NUMBER EW-1
 DRILLER ASE DRILLING, INC.
 DRILLING METHOD HOLLOW-STEM AUGER
 HOLE DIAMETER 10.75-INCHES

WELL CONSTRUCTION

CHRISTY BOX
 LOCKING CAP

CEMENT GROUT:
 (0.3-4 feet)

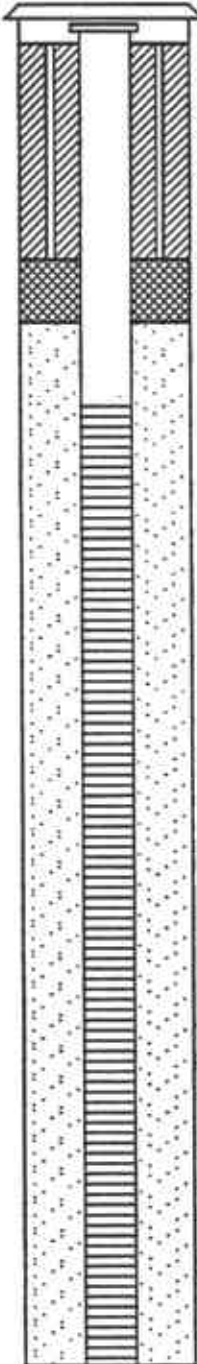
BENTONITE
 SPACER
 (5-6.3 feet)

4" ID
 STAINLESS STEEL
 BLANK CASING
 (0.1-8 feet)

#3 MONTEREY
 SAND PACK
 (6.3-30 feet)

WELL SCREEN
 COLLAR BREAK
 (18.1 feet)

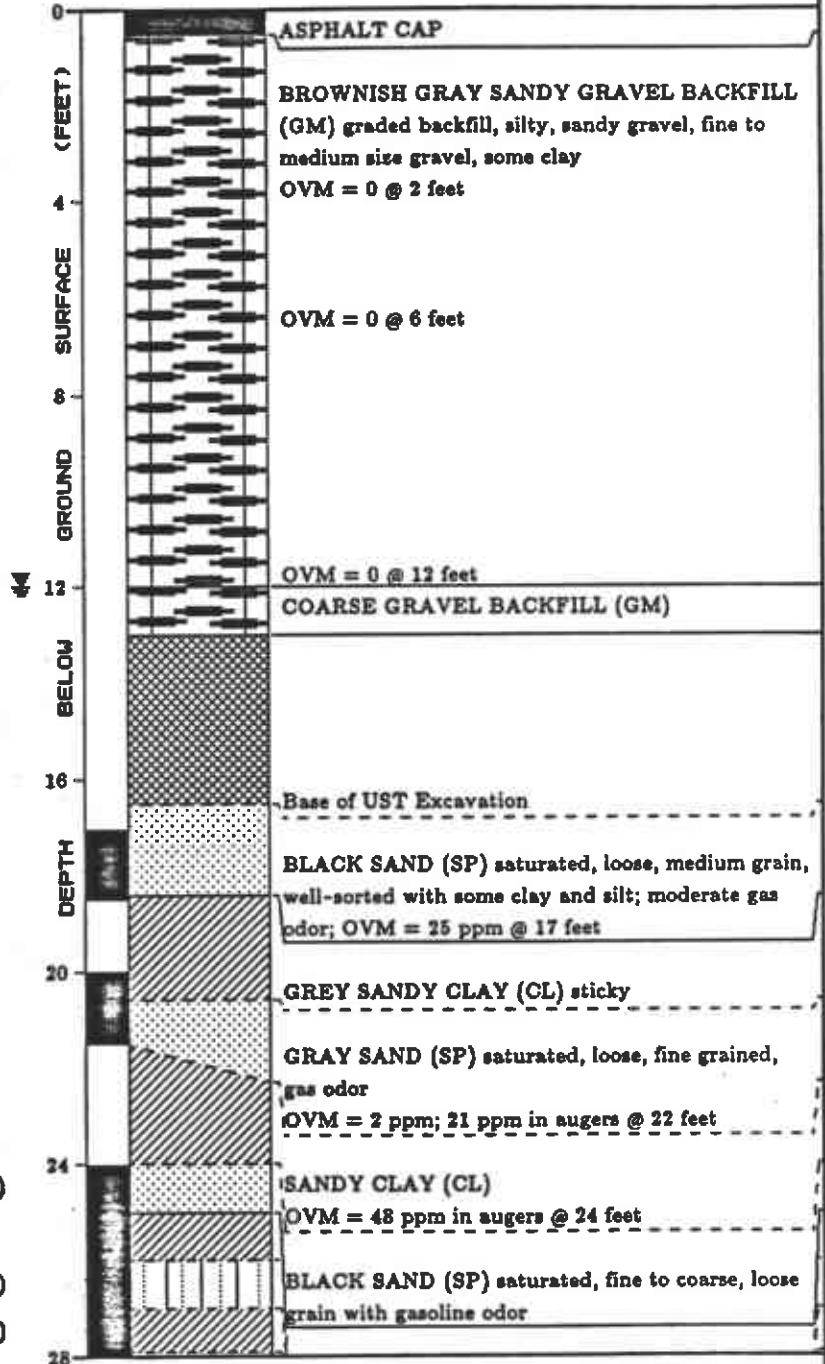
4" ID
 STAINLESS STEEL
 SLOTTED CASING
 SLOT SIZE = 0.020"
 (8.3-28.9 feet)



(5/7/6)
 ((5/7/7)
 (4/8/12)

LITHOLOGY

DESCRIPTION



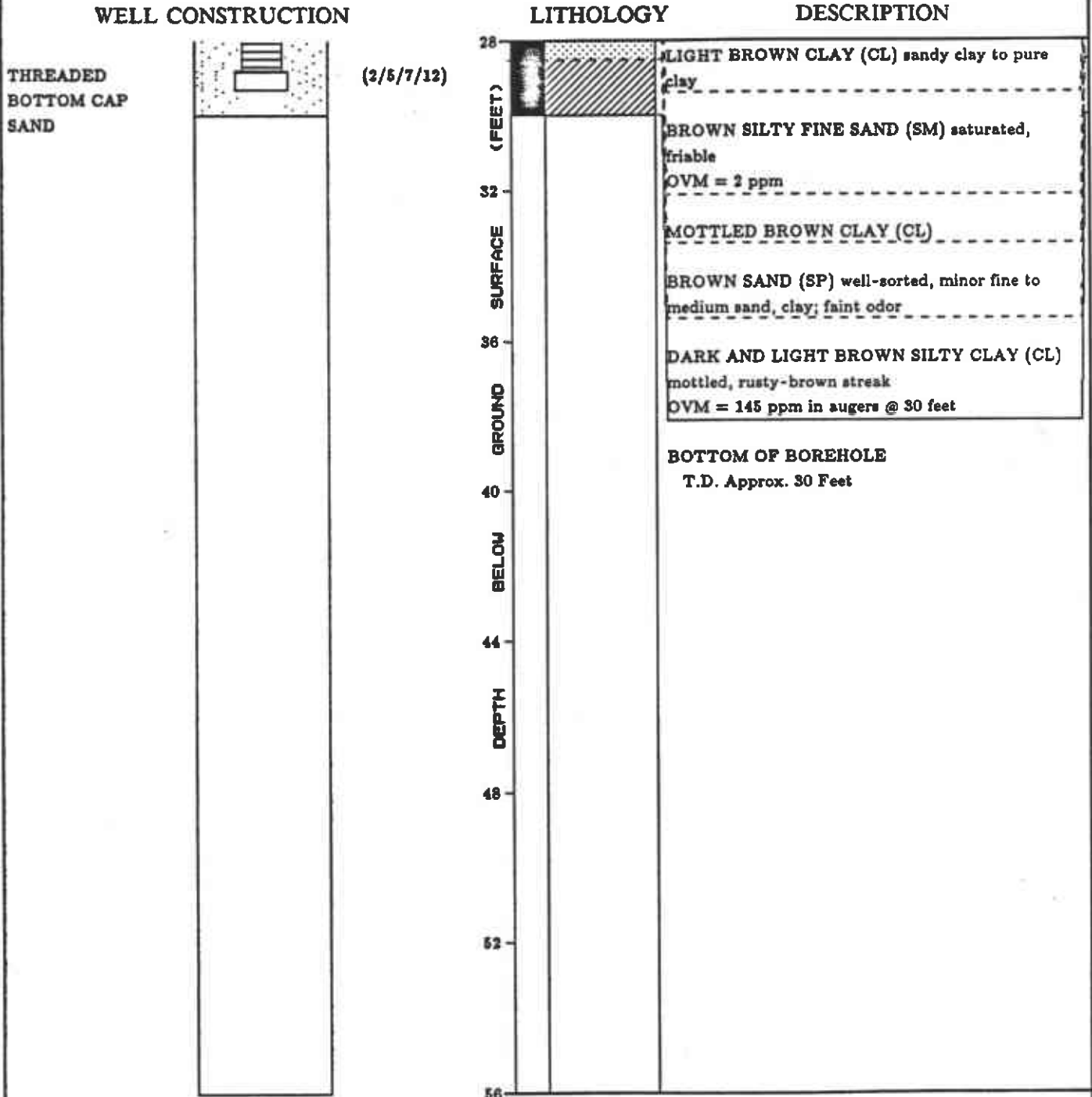
EXPLANATION

∇ Water level during drilling
 OVM Organic Vapor Meter Reading

--- Contact (dashed where approximate)
 ■ Location of sample

CLIENT P.O. PARTNERS
 LOCATION 1650 65th STREET,
 EMERYVILLE, CALIFORNIA
 DATE 28 March 1990
 GEOLOGIST P.F. BERTUCCI, R.G.

TEST HOLE NUMBER EW-1
 DRILLER ASE DRILLING, INC.
 DRILLING METHOD HOLLOW-STEM AUGER
 HOLE DIAMETER 10.75-INCHES



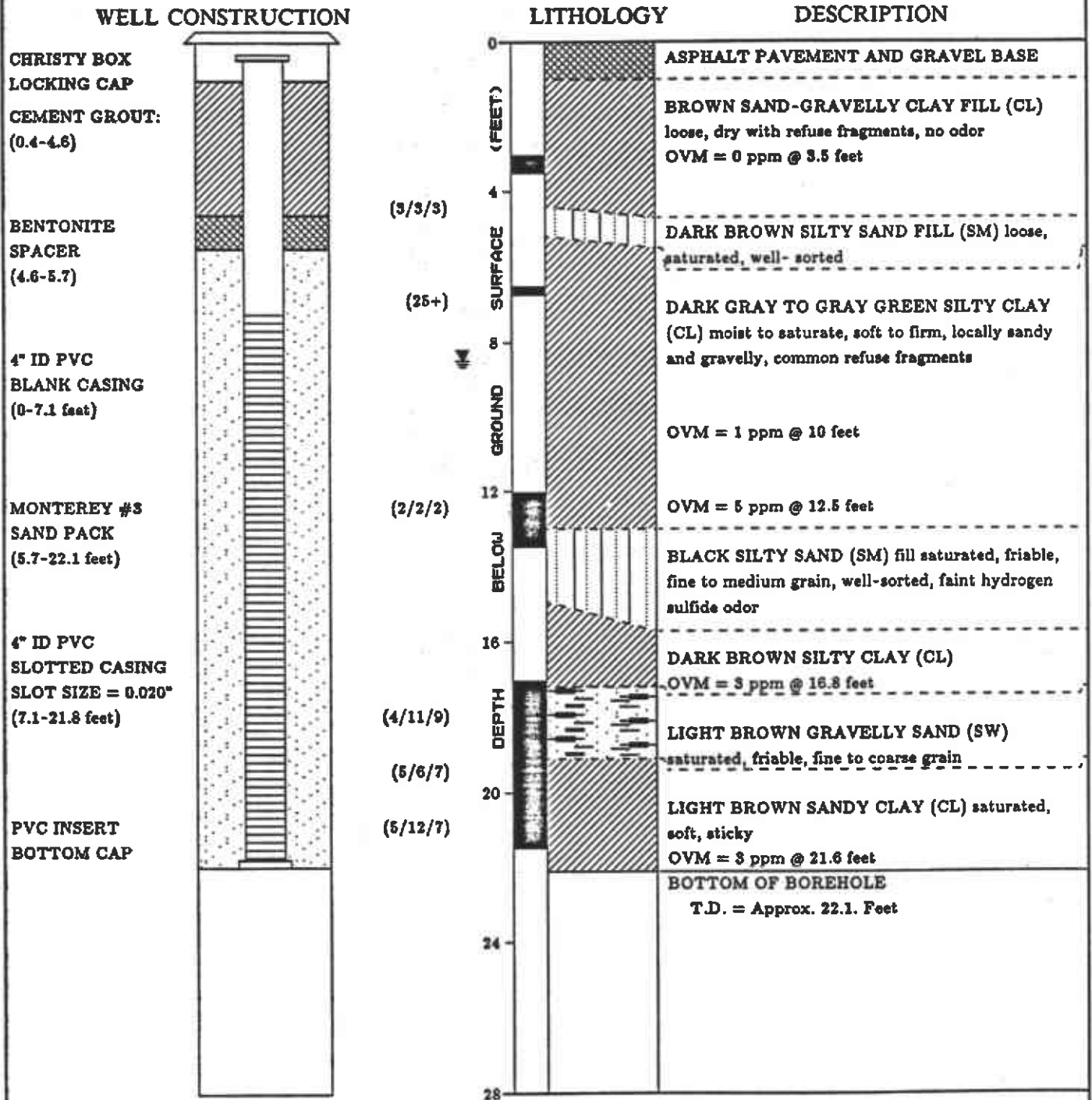
EXPLANATION

∇ Water level during drilling
 OVM Organic Vapor Meter Reading

--- Contact (dashed where approximate)
 ■ Location of sample

CLIENT P.O. PARTNERS
 LOCATION 1650 65th STREET,
 EMERYVILLE, CALIFORNIA
 DATE 27 March 1990
 GEOLOGIST P.F. BERTUCCI, R.G.

TEST HOLE NUMBER MW-6
 DRILLER ASE DRILLING, INC.
 DRILLING METHOD HOLLOW-STEM AUGER
 HOLE DIAMETER 10.75-INCHES



CHRISTY BOX
 LOCKING CAP
 CEMENT GROUT:
 (0.4-4.6)

BENTONITE
 SPACER
 (4.6-5.7)

4" ID PVC
 BLANK CASING
 (0-7.1 feet)

MONTEREY #3
 SAND PACK
 (5.7-22.1 feet)

4" ID PVC
 SLOTTED CASING
 SLOT SIZE = 0.020"
 (7.1-21.8 feet)

PVC INSERT
 BOTTOM CAP

(3/3/3)

(25+)

(2/2/2)

(4/11/9)

(5/6/7)

(5/12/7)

LITHOLOGY		DESCRIPTION
0		ASPHALT PAVEMENT AND GRAVEL BASE
4		BROWN SAND-GRAVELLY CLAY FILL (CL) loose, dry with refuse fragments, no odor OVM = 0 ppm @ 3.5 feet
4		DARK BROWN SILTY SAND FILL (SM) loose, saturated, well-sorted
8		DARK GRAY TO GRAY GREEN SILTY CLAY (CL) moist to saturate, soft to firm, locally sandy and gravelly, common refuse fragments OVM = 1 ppm @ 10 feet
12		OVM = 5 ppm @ 12.5 feet
16		BLACK SILTY SAND (SM) fill saturated, friable, fine to medium grain, well-sorted, faint hydrogen sulfide odor
16		DARK BROWN SILTY CLAY (CL) OVM = 3 ppm @ 16.8 feet
20		LIGHT BROWN GRAVELLY SAND (SW) saturated, friable, fine to coarse grain
20		LIGHT BROWN SANDY CLAY (CL) saturated, soft, sticky OVM = 3 ppm @ 21.6 feet
24		BOTTOM OF BOREHOLE T.D. = Approx. 22.1 Feet
28		

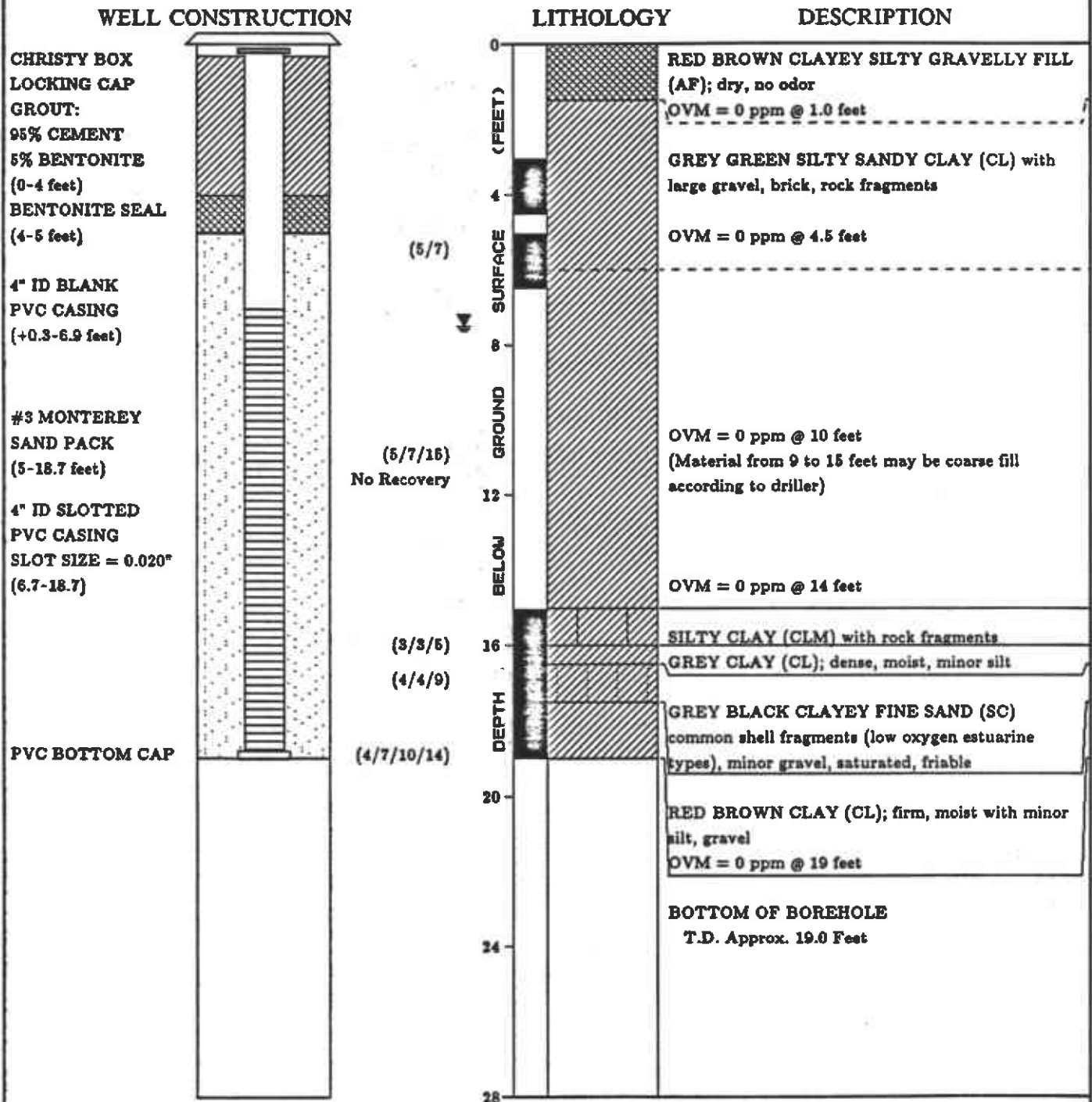
EXPLANATION

∇ Water level during drilling
 OVM Organic Vapor Meter Reading

--- Contact (dashed where approximate)
 ■ Location of sample

CLIENT P.O. PARTNERS
 LOCATION 1650 65th STREET,
 EMERYVILLE, CALIFORNIA
 DATE 29 March 1990
 GEOLOGIST HENRI ROCA III

TEST HOLE NUMBER MW-7
 DRILLER ASE DRILLING, INC.
 DRILLING METHOD HOLLOW-STEM AUGER
 HOLE DIAMETER 6-INCHES



EXPLANATION

▼ Water level during drilling
 OVM Organic Vapor Meter Reading

--- Contact (dashed where approximate)
 ■ Location of sample

CLIENT P.O. PARTNERS
 LOCATION 1650 65th STREET,
 EMERYVILLE, CALIFORNIA
 DATE 29 March 1990
 GEOLOGIST JON HOFFMAN, R.G.

TEST HOLE NUMBER EB-1
 DRILLER ASE DRILLING, INC.
 DRILLING METHOD HOLLOW-STEM AUGER
 HOLE DIAMETER 8-INCHES

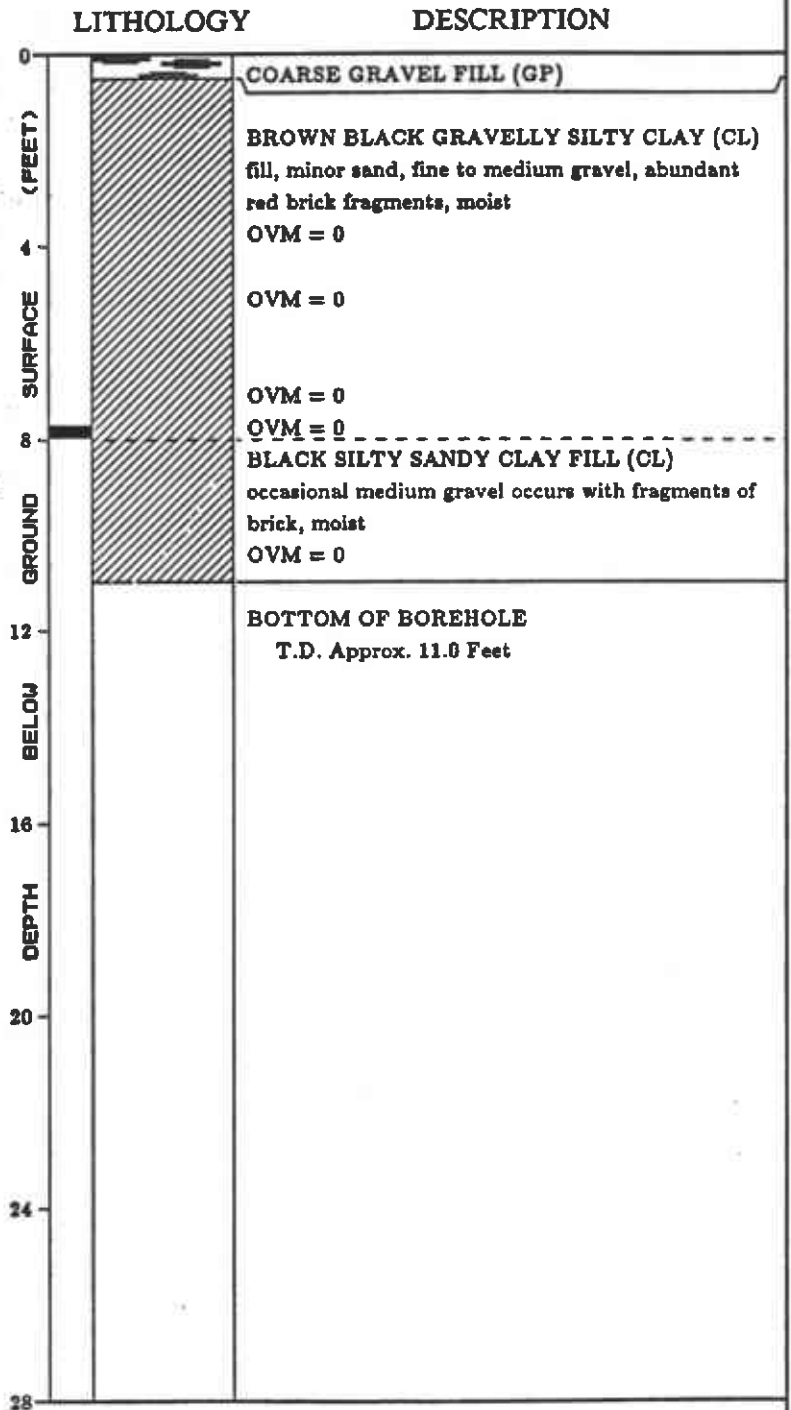
NOT COMPLETED
 AS MONITORING
 WELL

EXPLORATORY
 BORING;
 GROUTED TO
 SURFACE

(14/16/18)
 No Recovery

(5/7/10)

(18/12/14)
 No Recovery



EXPLANATION

☒ Water level during drilling
 OVM Organic Vapor Meter Reading

--- Contact (dashed where approximate)
 ■ Location of sample

ENGINEERING-SCIENCE

Client P.O. PARTNERS Job No. NC222.05 Sheet 1 of 2
1650 65TH STREET PROPERTY
Subject EMERYVILLE, CA By PFB/PLY Date 27-29 MARCH 1990

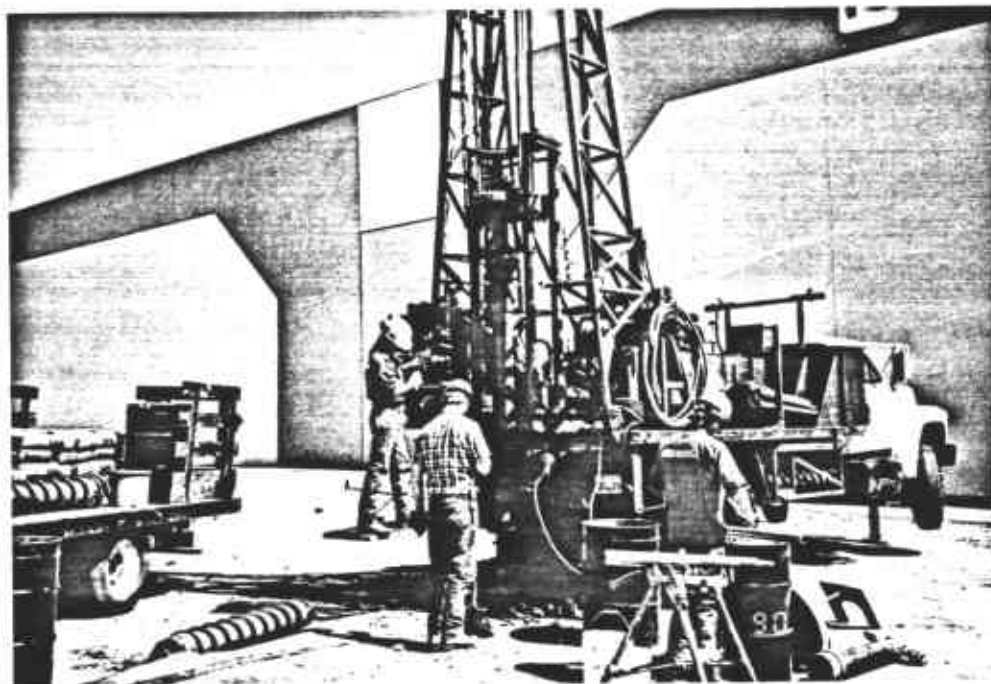


PHOTO 1

Drilling Operation for Monitoring Well MW-6.



PHOTO 2

Well Development of Upgradient Monitoring Well MW-7.

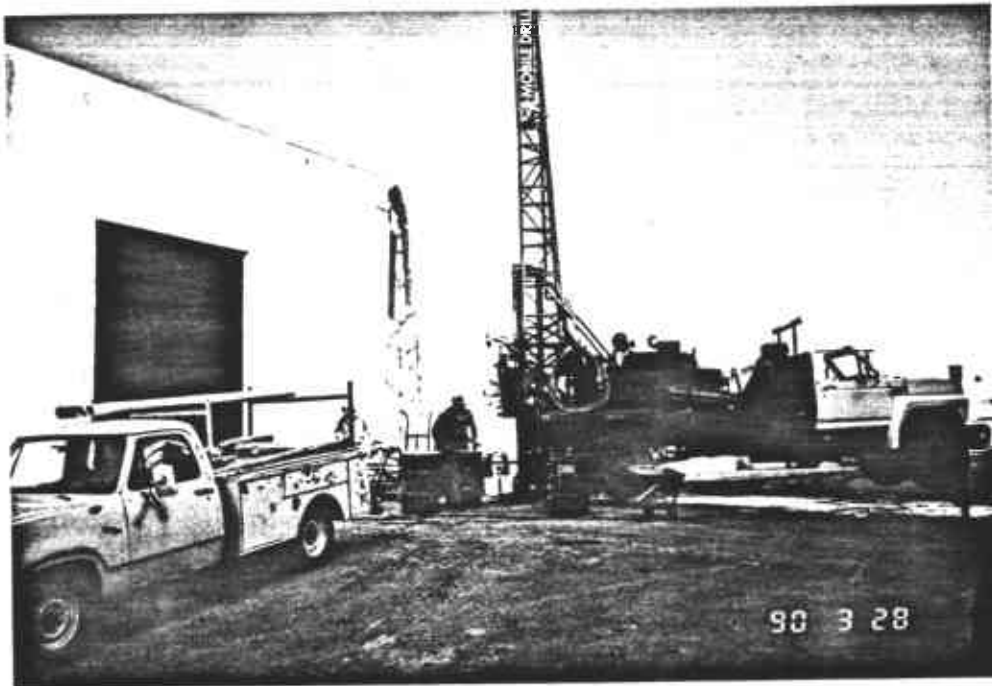


PHOTO 3

Drilling Operation for Extraction Well EW-1.



PHOTO 4

Installation of 4-inch ID Stainless Steel Well Casing and Screen, Extraction Well EW-1.

GROUNDWATER SAMPLING FIELD NOTES

PROJECT/LOCATION P.O. Partners/Emeryville

PROJ. NO. NC222.03 DATE 4/2/90

WELL ID	SAMPLE DATE, TIME AND SAMPLER	WATER LEVEL BEFORE; WELL DIAMETER AND DEPTH	WATER LEVEL AFTER*	GALLONS PER CASING VOLUME	WELL PURGING METHOD **	PUMP TIME (MINUTES)	WATER LEVEL	GALLONS PURGED	TEMPERATURE °C	SPECIFIC CONDUCTIVITY (UMHOS / CM)	PH	TOTAL WATER PURGE (GALLONS)	SAMPLE COLLECTION METHOD **	ANALYSIS AND PRESERVATIVE	NO. AND TYPE OF CONTAINERS	COMMENTS (SAMPLE TURBIDITY, SAMPLE ODOR, WEATHER CONDITIONS, ETC.) *	
MW-7	4/2/90	7.07							13.3	2890	7.96		EPA Method TPH (Diesel) BTXE + Gasoline	(2)L amber	Semi-turbid; no odor;	Bottles	
	10:05	4"	16.94	B	--	--	--		13.6	3520	9.23						Well went dry after 40ml purging 20g, had to wait 10min.
	AS/HJR	18.54	22						13.8	3580	8.63	22					
MW-6	4/2/90	8.40							15.7	4100	7.37		" "	" "	Semi-turbid; no odor		
	11:00	4"	18.12	B	--	--	--		17.1	2100	6.93	25				B	
EW-1	4/2/90	11.66							15.9	5000	8.26		EPA Methods TPH (diesel) BTXE+Gasoline	(2)L amber	Semi-turbid; no odor		
	11:45	4"		G	Initial	11.64			17.0	5000	8.32					Purgeable Halocarbons Organic Lead Carbon	(3) 40ml VOAs
AS/HJR	28.07	32			1m	11.71	2g		16.7	5000	8.12		Total Organ. Carbon	(1)L plastic Bottle			
					2m	11.70	4g										
					3m	11.70	6g										
					4m	11.70	8g										
					5m	11.70	10g										
					6m	11.74	14g										
					7m	11.73	18g										
					8m	11.76	22g										
					9m	11.77	26g										
					10m	11.79	30g										
					11m	11.86	35g										
AS/HJR					12m	11.90	40g										
					13m	11.90	45g										
					14m	11.91	50g										
					15m	12.07	58g										
					16m	12.10	66g										

* WATER LEVEL FROM GROUND SURFACE

** WW-WELL WIZARD; G-GRUNDFOS PUMP; B-BAILER



ENGINEERING-SCIENCE, INC.

600 BANCROFT WAY
BERKELEY, CA 94710
Tel: (415) 548-7970 Fax: (415) 548-7635

Report Date: 04/06/90

Work Order No.:1755

Client: Paul Bertucci
ES Berkeley/P.O. Partners
1650 65th Street/Emeryville
600 Bancroft Way
Berkeley, CA. 94710

Date of Sample Receipt: 04/02/90

Your samples identified as:

WELL MW-7
WELL MW-6
WELL EW-1

were analyzed for TPH according to EPA Method 8015, Diesel according to EPA Method 8015 and BTEX according to EPA Method 8020

Finally, your sample identified as:

WELL EW-1

was analyzed for volatile halogenated organics according to EPA Method 601, organic lead, total organic carbon, TDS, Anions: fluoride, chloride, nitrite, phosphate, sulfate, nitrate by IC, calcium, magnesium, iron, sodium and potassium.

The analytical reports for the samples listed above are attached.

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
GASOLINE by MOD 8015(LUFT)

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL EW-1

Unit: UG/L

Laboratory ID: 1755-03

Date Collected: 04/02/90

Date Analyzed: 04/06/90

Dilution Factor: 5

Compound	Result	Reporting Limit
Gasoline	23000	200

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:



10 APR 90

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
PETROLEUM HYDROCARBON

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL EW-1

Unit: UG/L

Laboratory ID: 1755-03

Date Collected: 04/02/90

Date Extracted: 04/03/90

Date Analyzed: 04/07/90

Dilution Factor: 1

Compound	Result	Reporting Limit
MINERAL SPIRITS(C9-C12)	15000	500
30 WEIGHT OIL(C22-C32)	12000	1000
DIESEL(C10-C17)	ND	500

Chromatographic pattern of the sample was similar to but not identical to 30 weight oil and mineral spirits.

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:



ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
BTEX / 8020

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL EW-1

Unit: ug/l

Laboratory ID: 1755-03

% Moisture: N/A

Date Collected: 4/2/90

Date Analyzed: 4/5/90

Dilution Factor: 200

Compound

Result

Reporting
Limit

Benzene

8500

400

Ethyl Benzene

1300

400

Toluene

3300

400

Xylenes (total)

6500

800

ND-Not Detected
NA-Not Applicable

ANALYST



GROUP LEADER:



10 APR 90

GC ANALYTICAL REPORT
Analytical Method
601 Volatile Compounds

Work Order NO.:1755

% Moisture:NA

Client ID:WELL EW-1

Matrix:Water

Laboratory ID:1755-03

Unit:ug/L

Date Collected:4/2/90

Date Analyzed:4/5/90
Date Confirmed:NA

Dilution Factor: 1

Compound	Result	Reporting Limit
BROMODICHLOROMETHANE	ND	1
BROMOFORM	ND	2
BROMOMETHANE	ND	12
CARBON TETRACHLORIDE	ND	1.2
CHLOROENZENE	ND	2.5
CHLOROETHANE	ND	5.2
2CHLOROETHYLVINYLETHER	ND	1.3
CHLOROFORM	ND	0.5
CHLOROMETHANE	ND	0.8
DIBROMOCHLOROMETHANE	ND	0.9
12 DICHLOROENZENE	ND	1.5
13 DICHLOROENZENE	ND	3.2
14 DICHLOROENZENE	ND	2.4
DICHLORODIFLUOROMETHANE	ND	18
11 DICHLOROETHANE	ND	0.7
12 DICHLOROETHANE	18	0.3
11 DICHLOROETHENE	ND	1.3
t-12 DICHLOROETHENE	ND	1
12 DICHLOROPROPANE	ND	0.4
c-13 DICHLOROPROPENE	ND	3.4
t-13 DICHLOROPROPENE	ND	2
METHYLENE CHLORIDE	ND	2.5
1122 TETRACHLOROETHANE	ND	0.3
TETRACHLOROETHENE	ND	0.3
111 TRICHLOROETHANE	ND	0.3
112 TRICHLOROETHANE	ND	0.2
TRICHLOROETHENE	ND	1.2
TRICHLOROFLUOROMETHANE	ND	5
VINYL CHLORIDE	ND	1.8

ND-Not Detected
NA-Not Applicable

ANALYST: *[Signature]*

GROUP LEADER:

[Signature] 10 APR 90

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
GASOLINE by MOD 8015(LUFT)

Work Order NO.: 1755

Matrix:WATER

Client ID: WELL MW-6

Unit:UG/L

Laboratory ID: 1755-02

Date Collected: 04/02/90

Date Analyzed:04/06/90

Dilution Factor: 1

Compound	Result	Reporting Limit
Gasoline	ND	200

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:



10 APR 90

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
PETROLEUM HYDROCARBON

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL MW-6

Unit: UG/L

Laboratory ID: 1755-02

Date Collected: 04/02/90

Date Extracted: 04/03/90

Date Analyzed: 04/07/90

Dilution Factor: 1

Compound	Result	Reporting Limit
MINERAL SPIRITS(C9-C12)	ND	500
30 WEIGHT OIL(C22-C32)	ND	1000
DIESEL(C10-C17)	ND	500

Chromatographic pattern of the sample was similar to but not identical to 30 weight oil and mineral spirits.

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:



ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
BTEX / 8020

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL MW-6

Unit: ug/L

Laboratory ID: 1755-02

% Moisture: NA

Date Collected: 4/2/90

Date Analyzed: 4/5/90

Dilution Factor: 1

Compound	Result	Reporting Limit
Benzene	ND	2
Ethyl Benzene	ND	2
Toluene	ND	2
Xylenes (total)	ND	4

ND-Not Detected
NA-Not Applicable

ANALYST: *JJ*

GROUP LEADER: *87*

10APR90

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
GASOLINE by MOD 8015(LUFT)

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL MW-7

Unit: UG/L

Laboratory ID: 1755-01

Date Collected: 04/02/90

Date Analyzed: 04/06/90

Dilution Factor: 1

Compound	Result	Reporting Limit
Gasoline	330	200

ND-Not Detected
NA-Not Applicable

ANALYST



GROUP LEADER:



10 APR 90

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
PETROLEUM HYDROCARBON

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL MW-7

Unit: UG/L

Laboratory ID: 1755-01

Date Collected: 04/02/90

Date Extracted: 04/03/90

Date Analyzed: 04/07/90

Dilution Factor: 1

Compound	Result	Reporting Limit
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MINERAL SPIRITS(C9-C12)	500	500
30 WEIGHT OIL(C22-C32)	5000	1000
DIESEL(C10-C17)	ND	500

Chromatographic pattern of the sample was similar to but not identical to 30 weight oil and mineral spirits.

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:



ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
BTEX / 8020

Work Order NO.: 1755

Matrix: WATER

Client ID: WELL MW-7

Unit: ug/L

Laboratory ID: 1755-01

‡ Moisture: NA

Date Collected: 4/2/90

Date Analyzed: 4/5/09

Dilution Factor: 1

Compound	Result	Reporting Limit
----------	--------	-----------------

Benzene	170 D	20
Ethyl Benzene	2	2
Toluene	4	2
Xylenes (total)	5	4

D - Additional dilution factor = 10
ND-Not Detected
NA-Not Applicable

ANALYST: 

GROUP LEADER: 

10 APR 2009

CLIENT: ENGINEERING-SCIENCE, INC. BERKELEY
 PROJECT MANAGER: P.F. Bestucci
 PROJ. NO.: NC222.04

PROJECT, NAME / LOCATION: The Martin Group
 1650, 65th Street, Emeryville

SAMPLER(S): (SIGNATURE)
 Ajay Singh, Henci Roca.

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION
EW-1	4/2/90	1145	Water	Well EW-1

NO. OF CONTAINERS	ANALYSES REQUIRED						PRESERVED	TO BE COMPOSITED BY LAB	TURNAROUND TIME	REMARKS
	TDS	MAJOR ANIONS	MAJOR CATIONS							
3	✓	✓	✓				NO	NO	2 WKS	
										175X-03 J, K, M, N

RELINQUISHED BY: (SIGNATURE) Ajay Singh	DATE/TIME 4/2/90/1220	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
--	--------------------------	--------------------------	------------------------------	-----------	--------------------------

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME 4/2/90 1:18pm.	REMARKS Samples received cool + intact (7.8°C) TR
------------------------------	-----------	---	-----------------------------	---

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

INORGANIC ANALYTICAL REPORT

Work Order No.: 1672

% Moisture: NA

Client ID: WELL MW-2

Matrix: WATER

Laboratory ID: 1672.01A

Unit: mg/L

Parameter	Result	Reporting Limit	Analytical Method	Date Analyzed
LEAD	0.021	0.005	GF-AA	3/7/90

NA- Not Applicable
ND- Not Detected

ANALYST:

J. Michaels

GROUP LEADER:

Michael J. Bay

INORG 1

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

INORGANIC ANALYTICAL REPORT

Work Order No.: 1672

% Moisture: NA

Client ID: WELL MW-3

Matrix: WATER

Laboratory ID: 1672.03A

Unit: mg/L

Parameter	Result	Reporting Limit	Analytical Method	Date Analyzed
LEAD	0.011	0.005	GF-AA	3/7/90

NA- Not Applicable

ND- Not Detected

ANALYST:

J. Michael

GROUP LEADER:

Michael S. Day

INORG 1

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

INORGANIC ANALYTICAL REPORT

Work Order No.: 1672

% Moisture: NA

Client ID: WELL MW-4

Matrix: WATER

Laboratory ID: 1672.02A

Unit: mg/L

Parameter	Result	Reporting Limit	Analytical Method	Date Analyzed
LEAD	0.006	0.005	GF-AA	3/7/90

NA- Not Applicable

ND- Not Detected

ANALYST:

J. Mitchell

GROUP LEADER:

Walter J. Long

INORG 1

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

INORGANIC ANALYTICAL REPORT

Work Order No.: 1672

% Moisture: NA

Client ID: WELL MW-5

Matrix: WATER

Laboratory ID: 1672.04A

Unit: mg/L

Parameter	Result	Reporting Limit	Analytical Method	Date Analyzed
LEAD	0.012	0.005	GF-AA	3/7/50

NA- Not Applicable

ND- Not Detected

ANALYST:

J. Michael

GROUP LEADER:

Michael J. ...

INORG 1

INORGANICS ANALYTICAL REPORT

Client: ES-Berkeley
Project: P.O. Partners

Work Order: 1755
Matrix: Water

Client's ID: EW-1
Well
EW-1
1145

Sample Date: 04/02/90
% Moisture: NA
Lab ID: 1755.03

Parameter	Results	Method	Normal Report Limit	Units	Date Analyzed
Calcium	160.	P	1	mg/L	04/13/90
Iron	0.39	P	.05	(PPM)	04/11/90
Magnesium	40.	P	1	in	04/11/90
Potassium	68.	P	1	Water	04/11/90
Sodium	990.	P	1	"	04/13/90
Chloride	1600.	IC	.1	"	04/13/90
Fluoride	5.4	IC	1	"	04/13/90
Nitrate	ND	IC	1	"	04/13/90
Nitrite	ND	IC	1	"	04/13/90
Phosphate	ND	IC	1	"	04/13/90
Sulfate	ND	IC	1	"	04/13/90
TDS	3500.	Grav.	10	"	04/09/90

ND- Not Detected

ANALYST: *K. Lushinski*

GROUP LEADER: *William D. Kelly*

=====

ORGANIC LEAD
CALIFORNIA LUFT MANUAL METHOD
and
TOTAL ORGANIC CARBON

Work Order NO.: 1755

Date Analyzed: 04/12/90

Client ID: WELL EW-1

Matrix: WATER

Laboratory ID: 1755-03

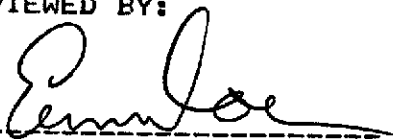
Unit: mg/L

=====

Parameter	Result	Detection Limit
ORGANIC LEAD	ND	0.1
TOTAL ORGANIC CARBON	110	5.0

NA_ Not Analyzed
ND_ Not Detected

REVIEWED BY:





ENGINEERING-SCIENCE, INC.

600 BANCROFT WAY
BERKELEY, CA 94710
Tel: (415) 548-7970 Fax: (415) 548-7835

Report Date: 04/10/90

Work Order No.:1741

Client: Paul Bertucci
ES Berkeley/ P.O. Partner/MGC
1650 65th Street Site/Emeryville
600 Bancroft Way
Berkeley, Ca. 94710

Date of Sample Receipt: 03/29/90

Your samples identified as:

WELL MW-6

WELL MW-7

were analyzed for TPH gasoline by modified EPA Method 8015 and
BTEX by EPA Method 8020.

The analytical reports for the samples listed above are
attached.

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
GASOLINE by MOD 8015(LUFT)

Work Order NO.: 1741

Matrix:SOIL
LEVEL:LOW

Client ID: WELL MW-06

Unit:ug/Kg

Laboratory ID: 1741-01

Date Collected: 03/27/90

Date Analyzed:04/08/90

Dilution Factor: 1

Compound	Result	Reporting Limit
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GASOLINE	ND	500
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ND-Not Detected
NA-Not Applicable

ALL RESULTS ARE REPORTED AS RECEIVED WITH NO CORRECTIONS FOR MOISTURE.

ANALYST:

DS.

GROUP LEADER:



ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
BTEX / B020

Work Order NO.: 1741

Matrix: SOIL

Client ID: WELL MW-6

Unit: ug/Kg

Laboratory ID: 1741-01

% Moisture: NA

Date Collected: 3/27/90

Date Analyzed: 4/6/90

Dilution Factor: 1

Compound	Result	Reporting Limit
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Benzene	ND	2
Ethyl Benzene	ND	2
Toluene	ND	2
Xylenes (total)	ND	4

ND-Not Detected
NA-Not Applicable

ANALYST:

SF

GROUP LEADER:

SF

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
GASOLINE by MOD 8015(LUFT)

Work Order NO.: 1741

Matrix:SOIL
LEVEL:LOW

Client ID: WELL MW-07

Unit:ug/Kg

Laboratory ID: 1741-02

Date Collected: 03/28/90

Date Analyzed:04/08/90

Dilution Factor: 1

Compound

Result

Reporting
Limit

GASOLINE

ND

500

ND-Not Detected
NA-Not Applicable

ALL RESULTS ARE REPORTED AS RECEIVED WITH NO CORRECTIONS FOR MOISTURE.

ANALYST:

DS

GROUP LEADER:

8F

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
BTEX / 8020

Work Order NO.: 1741

Matrix:SOIL

Client ID: WELL MW-7

Unit:ug/Kg

Laboratory ID: 1741-02

% Moisture:NA

Date Collected: 3/27/90

Date Analyzed:4/6/90

Dilution Factor: 1

Compound	Result	Reporting Limit
Benzene	ND	2
Ethyl Benzene	ND	2
Toluene	ND	2
Xylenes (total)	ND	4

ND-Not Detected
NA-Not Applicable

ANALYST:

87

GROUP LEADER:

87

**ENGINEERING - SCIENCE, INC.
CHAIN OF CUSTODY RECORD**

To: ES Lab

W: 0.1741

PAGE ___ OF ___

CLIENT: ENGINEERING-SCIENCE, INC. BERKELEY		PROJECT MANAGER: P.F. Bertucci		PROJ. NO.: NC222.04		NO. OF CONTAINERS	ANALYSES REQUIRED				REMARKS		
PROJECT NAME / LOCATION: P.O. Partners MGC Emeryville, 1650 65th St. Site							1	1	1	1		1	PRESERVED TO BE COMPOSITED BY LAB
SAMPLER(S): (SIGNATURE) H.R. Roca													
SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION									
MW-7	3-28-90	3:30	SOIL	Soil Boring - Well MW-7	1	1	1	1	1	1	1741-02A		
MW-7	"	"	water	"	1	1	1	1	1	1	Standard 2-wk. turnaround (Please run & report results with Soil Sample submitted 3/27/90 TPH gasoline + BTXE		
				Grabwater samples not submitted for analysis. PFB 3/28/90									

TPH Gasoline (4-8015) purge
BTXE (8020) trap
TPH diesel (4-8015)
TPH Gasoline ONLY!
PFB 3/28/90

RELINQUISHED BY: (SIGNATURE) <i>Scott Kitten</i>	DATE/TIME 3-28-90 5:40 pm	RECEIVED BY: (SIGNATURE) <i>Paul Bertucci</i>	RELINQUISHED BY: (SIGNATURE) <i>Paul Bertucci</i>	DATE/TIME 3/29/90 8:40 AM	RECEIVED BY: (SIGNATURE) <i>Mindy Chen</i>
RELINQUISHED BY: (SIGNATURE) <i>H.R. Roca</i>	DATE/TIME 3-28-90 16:55	RECEIVED FOR LABORATORY BY: (SIGNATURE) <i>[Signature]</i>	DATE/TIME 3-28-90 16:55	REMARKS Sample for TPH/BTXE received in 1-L instead of J0A5	



ENGINEERING-SCIENCE, INC.

600 BANCROFT WAY
BERKELEY, CA 94710
Tel: (415) 548-7970 Fax: (415) 548-7635

Report Date: 04/06/90

Work Order No.:1780

Client: Paul Bertucci
ES Berkeley/P.O. Partners
1650 65th Street/Emeryville
600 Bancroft Way
Berkeley, CA. 94710

Date of Sample Receipt: 04/04/90

Your samples identified as:

EW-1A

EW-1B

were analyzed for TPH according to EPA Method 8015, and BTEX according to EPA Method 8020

The analytical reports for the samples listed above are attached.

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
BTEX / 8020

Work Order NO.: 1780

Matrix: WATER

Client ID: EW-1A

Unit: ug/L

Laboratory ID: 1780-01

Moisture: NA

Date Collected: 4/4/90

Date Analyzed: 4/5/90

Dilution Factor: 100

Compound

Result

Reporting
Limit

Benzene

6000

200

Ethyl Benzene

1100

200

Toluene

3700

200

Xylenes (total)

3900

400

ND-Not Detected

NA-Not Applicable

ANALYST:

OF

GROUP LEADER:

OF

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
GASOLINE by MOD 8015 (LUFT)

Work Order NO.: 1780

Matrix: WATER

Client ID: WELL EW-1A

Unit: UG/L

Laboratory ID: 1780-01

Date Collected: 04/04/90

Date Analyzed: 04/06/90

Dilution Factor: 2

Compound

Result

Reporting
Limit

Gasoline

10000

200

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:



ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
GASOLINE by MOD 8015(LUFT)

Work Order NO.: 1780

Matrix: WATER

Client ID: WELL EW-1B

Unit: UG/L

Laboratory ID: 1780-02

Date Collected: 04/04/90

Date Analyzed: 04/06/90

Dilution Factor: 5

Compound

Result

Reporting
Limit

Gasoline

10000

200

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:


10 APR 90

ES-ENGINEERING SCIENCE, INC.

600 Bancroft Way
Berkeley, CA 94710

GC ANALYTICAL REPORT
Analytical Method
BTEX / 8020

Work Order NO.: 1780

Matrix: WATER

Client ID: EW-1B

Unit: ug/L

Laboratory ID: 1780-02

% Moisture: NA

Date Collected: 4/4/90

Date Analyzed: 4/5/90

Dilution Factor: 50

Compound	Result	Reporting Limit
Benzene	3300	100
Ethyl Benzene	470	100
Toluene	1600	100
Xylenes (total)	1800	200

ND-Not Detected
NA-Not Applicable

ANALYST: *Jmf*

GROUP LEADER: *8F*

10 APR 90

ENGINEERING - SCIENCE, INC.
CHAIN OF CUSTODY RECORD

W.O. 1780

PAGE 1 OF 1

CLIENT: ENGINEERING-SCIENCE, INC. BERKELEY		PROJECT MANAGER: <i>Paul Bertucci</i>		PROJ. NO.: NC 222.06		NO. OF CONTAINERS	ANALYSES REQUIRED				REMARKS	
PROJECT NAME / LOCATION: <i>P.O. Partners / 1650 65th St, Emeryville, CA</i>							TPH + BTX/E	PRESERVED	TO BE COMPOSITED BY LAB	TURNAROUND TIME		
SAMPLER(S): (SIGNATURE) <i>[Signature]</i>												
SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION								
EW-1A	4-4-90	1346	Water	EW-1 discharge sample		3	✓			HCL	48 hrs 24 hrs	1780-1A, B, C
EW-1B	4-4-90	1517	Water	EW-1 discharge sample <i>during pump test</i>		3	✓			HCL	48 hrs 24 hrs	1780-2A, B, C
RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>		DATE/TIME 4-4-90 1610		RECEIVED BY: (SIGNATURE) <i>Amy Leigh</i>		RELINQUISHED BY: (SIGNATURE)		DATE/TIME		RECEIVED BY: (SIGNATURE)		
RELINQUISHED BY: (SIGNATURE)		DATE/TIME		RECEIVED FOR LABORATORY BY: (SIGNATURE) <i>[Signature]</i>		DATE/TIME 4/4/90 1625		REMARKS <i>Samples 7.3E + Intact</i>				



ENGINEERING-SCIENCE, INC.

600 BANCROFT WAY
BERKELEY, CA 94710
Tel: (415) 548-7970 Fax: (415) 548-7635

Report Date: 04/12/90

Work Order No.:1792

Client: Paul Bertucci
ES Berkeley/P.O. Partners/MGC, Phase III
1650 65th Street/Emeryville
600 Bancroft Way
Berkeley, CA. 94710

Date of Sample Receipt: 04/10/90

Your sample identified as:

BT-1

was analyzed for volatile halogenated organics according to
EPA Method 601.

The analytical report for the sample listed above are
attached.

GC ANALYTICAL REPORT
Analytical Method
601 Volatile Compounds

Work Order NO.: 1792

% Moisture: NA

Client ID: BT-1

Matrix: Water

Laboratory ID: 1792-1

Unit: ug/L

Date Collected: 4/10/90

Date Analyzed: 4/11/90

Date Confirmed: NA

Dilution Factor: 1

Compound	Result	Reporting Limit
BROMODICHLOROMETHANE	ND	1
BROMOFORM	ND	2
BROMOMETHANE	ND	12
CARBON TETRACHLORIDE	ND	1.2
CHLOROBENZENE	ND	2.5
CHLOROETHANE	ND	5.2
2-CHLOROETHYL VINYLETHER	ND	1.3
CHLOROFORM	ND	0.5
CHLOROMETHANE	ND	0.8
DIBROMOCHLOROMETHANE	ND	0.9
1,2-DICHLOROBENZENE	ND	1.5
1,3-DICHLOROBENZENE	ND	3.2
1,4-DICHLOROBENZENE	ND	2.4
DICHLORODIFLUOROMETHANE	ND	18
1,1-DICHLOROETHANE	ND	0.7
1,2-DICHLOROETHANE	1.7	0.3
1,1-DICHLOROETHENE	ND	1.3
t-1,2-DICHLOROETHENE	ND	1
1,2-DICHLOROPROPANE	ND	0.4
c-1,3-DICHLOROPROPENE	ND	3.4
t-1,3-DICHLOROPROPENE	ND	2
METHYLENE CHLORIDE	ND	2.5
1,1,2,2-TETRACHLOROETHANE	ND	0.3
TETRACHLOROETHENE	ND	0.3
1,1,1-TRICHLOROETHANE	ND	0.3
1,1,2-TRICHLOROETHANE	ND	0.2
TRICHLOROETHENE	ND	1.2
TRICHLOROFLUOROMETHANE	ND	5
VINYL CHLORIDE	ND	1.8

ND-Not Detected
NA-Not Applicable

ANALYST:



GROUP LEADER:



ENGINEERING - SCIENCE, INC.
CHAIN OF CUSTODY RECORD

To *ES Lab Berkeley*

W.O. 1792

PAGE OF

CLIENT: ENGINEERING-SCIENCE, INC. BERKELEY		PROJECT MANAGER: <i>Paul Bertucci</i>		PROJ. NO.: <i>NC222.06</i>	NO. OF CONTAINERS	ANALYSES REQUIRED					REMARKS			
PROJECT NAME / LOCATION: <i>MCC Phase III, 165065th St., Emeryville</i>						3	✓						48 hrs	<i>1792-01A, B, C</i>
SAMPLER(S): (SIGNATURE)														
SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION										
<i>BT-1</i>	<i>4-10-90</i>	<i>1115</i>	<i>Water</i>	<i>From Boiler Tank</i>										
RELINQUISHED BY: (SIGNATURE)		DATE/TIME		RECEIVED BY: (SIGNATURE)		RELINQUISHED BY: (SIGNATURE)		DATE/TIME		RECEIVED BY: (SIGNATURE)				
<i>[Signature]</i>		<i>4/10/90 11:55</i>		<i>[Signature]</i>		<i>4/10/90</i>		<i>11:55</i>		REMARKS <i>Samples 215°C + Intact</i>				



ENGINEERING-SCIENCE, INC.

600 BANCROFT WAY
BERKELEY, CA 94710
Tel: (415) 548-7970 Fax: (415) 548-7635

Report Date: 04/20/90

Work Order No.:1812

Client: Paul Bertucci
ES Berkeley/P.O.Partners/MGC Phase III
1650-65th St./Emeryville
600 Bancroft Way
Berkeley, CA. 94710

Date of Sample Receipt: 04/18/90

Your samples identified as:

VT-1
was analyzed for volatile organics EPA Method 8240.

The analytical report for the sample listed above are attached.

GC/MS ANALYTICAL REPORT
VOLATILE ORGANICS

Work Order No: 1812

Date Analyzed: 04/19/90

Laboratory ID: 1812-01

Matrix: WATER

Client ID: VT-1

Level: LOW

Dilution Fact: 1.0

Compound	Analytical Results ug/L	Reporting Limit
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl Chloride	ND	10
Chloroethane	ND	10
Methylene Chloride	ND	5
Acrolein	ND	10
Acetone	ND	100
Acrylonitrile	ND	10
Carbon Disulfide	ND	10
Trichlorofluoromethane	ND	10
1,1-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
trans-1,2-Dichloroethene	ND	5
Chloroform	ND	5
1,2-Dichloroethane	ND	5
2-Butanone	ND	100
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Vinyl Acetate	ND	50
Bromodichloromethane	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
Trichloroethene	ND	5
Benzene	17	5
Dibromochloromethane	ND	5
1,1,2-Trichloroethane	ND	5
trans-1,3-Dichloropropene	ND	5
2-Chloroethylvinylether	ND	10
Bromoform	ND	5
2-Hexanone	ND	50
4-Methyl-2-pentanone	ND	50
Tetrachloroethene	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
m/p-Xylene	3900 D	5
o-Xylene	4500 D	5
1,3-Dichlorobenzene	ND	5
1,2/1,4-Dichlorobenzene	ND	5

Analyst:

Nicki Heath

Group Leader:

Robert P. Wood

Table D.1

THE MARTIN GROUP - PUMP TEST
 1650 - 65th STREET SITE, EMERYVILLE
 APRIL 4, 1990

TIME ELAPSED (MINUTES)	W.L. FROM TOC (MW-2) (FEET)	DRAWDOWN (MW-2) (FEET)	W.L. FROM TOC (EW-1) (FEET)	DRAWDOWN (EW-1) (FEET)	PUMPING RATE (GPM)
0	11.62	0	11.61	0.00	0
2	11.67	0.05	11.66	0.05	4
4	11.75	0.13			4
6			11.83	0.22	4
11			11.88	0.27	4
15			11.96	0.35	5
22	11.83	0.21	12.04	0.43	5
29	11.88	0.26	12.10	0.49	6
35	11.99	0.37	12.28	0.67	6
41	12.05	0.43	12.40	0.79	8.5
46	12.18	0.56	12.58	0.97	8.5
52	12.25	0.63	12.65	1.04	8.5
78	12.38	0.76	13.14	1.53	8.5
89	12.66	1.04	13.34	1.73	8.5
99	12.99	1.37	13.50	1.89	8.5
116	13.23	1.61	13.77	2.16	8.5
140	13.44	1.82	14.00	2.39	8.5
154	13.94	2.32	15.30	3.69	12
167	14.19	2.57	20.50	8.89	12
178			20.67	9.06	12
181			21.80	10.19	12
184	15.27	3.65	24.50	12.89	12
190	15.39	3.77	24.50	12.89	12
217	15.78	4.16	25.47	13.86	6.7
229			25.48	13.87	6.7
235	15.91	4.29	25.50	13.89	5.5
253	15.98	4.36	25.45	13.84	4.6
265			25.50	13.89	4.3
273	16.56	4.94	25.50	13.89	4.3
298			25.70	14.09	4.3

← collect 1st sample EW-1A

← collect 2nd sample EW-1B

Test Ends at 5 Hours

Table D.2

THE MARTIN GROUP - RECHARGE TEST
 1650 - 65th STREET SITE, EMERYVILLE
 APRIL 4, 1990

TIME ELAPSED (MINUTES)	W.L. FROM TOC (MW-2) (FEET)	RESIDUAL DRAWDOWN (MW-2) (FEET)	TIME ELAPSED (MINUTES)	W.L. FROM TOC (EW-1) (FEET)	RESIDUAL DRAWDOWN (EW-1) (FEET)	PUMPING RATE (GPM)
0.0	16.52	4.91	0.5	22.20	10.59	0.00
1.0	16.00	4.39	1.5	22.18	10.57	0.00
2.3	15.80	4.19	2.5	17.46	5.85	0.00
3.2	15.60	3.99	3.75	15.52	3.91	0.00
4.1	15.44	3.83	4.75	14.21	2.60	0.00
5.1	15.13	3.52	6.3	14.25	2.64	0.00
6.1	15.02	3.41	7.3	14.21	2.60	0.00
8.1	14.62	3.01	11.16	14.19	2.58	0.00
10.8	14.35	2.74	15	14.18	2.57	0.00
15.0	14.15	2.54	22.0	14.13	2.52	0.00
22.0	14.10	2.49	27.0	14.09	2.48	0.00
27.0	13.98	2.37	32.0	14.00	2.39	0.00
32.0	13.95	2.34	37.0	14.00	2.39	0.00
37.0	13.91	2.30	47.0	14.00	2.39	0.00
47.0	13.91	2.30	58.0	14.00	2.39	0.00
58.0	13.86	2.25	67.0	13.79	2.18	0.00
67.0	13.80	2.19	77.0	13.79	2.18	0.00
77.0	13.75	2.14	87.0	13.76	2.15	0.00
87.0	13.70	2.09	97.0	13.73	2.12	0.00
97.0	13.65	2.04	108.0	13.67	2.06	0.00
108.0	13.62	2.01	118.0	13.63	2.02	0.00
118.0	13.56	1.95				0.00

TEST ENDS

GROUNDWATER DISCHARGE GUIDELINES

The District has developed general policy for the discharge of groundwater into the sanitary sewer.

The District does not intend to permit one time ballast water discharges or discharges greater than 25,000 gallons per day. The Regional Water Quality Control Board has committed to providing permits for discharge to the storm sewer for these discharges. All other groundwater cleanups may be discharged to the sanitary sewer after issuance of a Wastewater Discharge Permit.

The limits for various organic compounds the District will enforce will be the average influent concentration at the District's wastewater treatment plant. For example, groundwater contaminated by gasoline has revealed significant concentrations of Total Petroleum Hydrocarbons (TPH), Lead, Benzene, Toluene, Ethylbenzene and Xylene. In this case the District will impose limits of:

TPH	No limit, not a specific parameter
Lead	2 mg/l (existing limit found in Ordinance 270)
Benzene	3 ug/l (POTW background level for the past year)
Toluene	31 ug/l (POTW background level for the past year)
Ethylbenzene	5 ug/l (POTW background level for the past year)
Xylene	42 ug/l (POTW background level for the past year)

Because Not Detected is not a practical limit, the discharge limit for compounds not found in the influent over the past year or those found in less than 50% of the samples collected, will be the detection limit plus 3 ug/l.

Compliance monitoring for specific organic pollutants can be expensive and time consuming. Real time results will not be available to control the pretreatment unit. The District may allow the discharger to substitute a test method that generates timely results as an alternative to more complex, specific parameter tests, provided a correlation can be demonstrated between the faster indicator test and the specific parameter test. The District will, however, monitor compliance using a specific parameter test.

The District will require compliance monitoring. The initial sampling frequency will be daily until the reliability of the treatment unit has been established. The subsequent monitoring frequency will reflect the following factors:

- o Design capacity of treatment unit
- o Treatment unit redundancy
- o Level of preventive maintenance
- o Frequency of indicator samples from various treatment stages
- o Consistent compliance with discharge limits

The District will charge various fees for providing this service. These fees include:

- o Capacity fee
- o A minimum Permit fee equivalent to a strength permit
- o Monitoring charges based on the District's monitoring and testing fee schedule
- o Treatment charges for wastewater disposal service, applied to the volume, CODF and TSS discharged

Prior to discharging wastewater into the sanitary sewer, the discharger must be issued a Wastewater Discharge Permit. A complete application for discharge is to include a full description including but not limited to the following:

- o Site history indicating how contamination originated
- o Sample analyses from the various monitoring wells for heavy metals, EPA 524.2 and any other material that may have been suspected to have contaminated the site
- o A plot map that indicates the location of the contamination plume
- o Treatment facilities
- o The expected discharge rate from the treatment unit

Prior to commencement of discharge to the sewer, samples demonstrating compliance must be submitted.

WEM:wem

SUMMARY OF GROUNDWATER DISCHARGE GUIDELINES

- I. The District will not accept discharges greater than 25,000 gpd or one time ballast water discharges
- II. Limits will be the average of the past one year of plant influent data or the detection limit + 3 ppb.
 - A. District will monitor for parameter specific compliance
 - B. Discharger may substitute an inexpensive monitoring method that gives real time results for treatment process control. This must be correlated to specific limited parameter.
- III. A discharge permit application will contain:
 - A. A history of the site
 - B. Samples data for Metals, EPA 524.2, and any other suspected pollutants
 - C. Plot plans indicating the limits of the plume
 - D. Hydrological data that indicates the expected groundwater yield
- IV. Sampling frequencies
 - A. Will be initially high and decrease with time
 - B. May be reduced by:
 1. Treatment redundancy
 2. Batch discharges, sampled prior to discharge
 3. Over designed
- V. Cost recovery
 - A. Monitoring charges to be based actual District charges
 - B. Treatment charges to be based on actual District charges
 - C. Permit fees will be equivalent to a strength permit
 - D. Capacity fees will be applied based on the current fee resolution. Wastewater capacity fees will be prorated if the discharge period will be less than 5 years.

WEM:wem

in ug/l	INFLUENT				EFFLUENT			
	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED
Acid Extractables								
2,4,6-Trichlorophenol	0	0	0	0	0	0	0	0
p-Chloro-m-cresol	0	0	0	0	0	0	0	0
2-Chlorophenol	0	0	0	0	0	0	0	0
2,4-Dichlorophenol	0	0	0	0	0	0	0	0
2,4-Dimethylphenol	0	0	0	0	0	0	0	0
2-Nitrophenol	0	0	0	0	0	0	0	0
4-Nitrophenol	0	0	0	0	0	0	0	0
2,4-Dinitrophenol	0	0	0	0	0	0	0	0
4,6-Dinitro-o-cresol	0	0	0	0	0	0	0	0
Pentachlorophenol	0	0	0	0	0	0	0	0
Phenol	6.9	11	2	11	1.6	3	1	5
Base neutrals								
Acenaphthene	0	0	0	0	0	0	0	0
Benzidine	0	0	0	0	0	0	0	0
1,2,4-Trichlorobenzene	0	0	0	0	0	0	0	0
Hexachlorobenzene	0	0	0	0	0	0	0	0
Hexachloroethane	0	0	0	0	0	0	0	0
Bis (2-chloroethyl) ether	0	0	0	0	0	0	0	0
2-Chloronaphthalene	0	0	0	0	0	0	0	0
1,2-Dichlorobenzene	4.1	9	2	15	1.5	2	1	12
1,3-Dichlorobenzene	0	0	0	0	0	0	0	0
1,4-Dichlorobenzene	2.5	5	2	15	1.9	4	1	18
2,4-Dinitrotoluene	0	0	0	0	0	0	0	0
2,6-Dinitrotoluene	0	0	0	0	0	0	0	0
Chlordane	0	0	0	0	0	0	0	0
Fluoranthene	0	0	0	0	1	1	1	1
4-Bromophenyl phenyl ether	0	0	0	0	0	0	0	0
Bis-(2-chloroisopropyl	0	0	0	0	0	0	0	0
Bis-(2-chloroethoxy) methane	0	0	0	0	0	0	0	0
Hexachlorobutadiene	0	0	0	0	0	0	0	0
Hexachlorocyclopentadiene	0	0	0	0	0	0	0	0
Isophorone	3	5	2	5	1.6	4	1	8
Naphthalene	3.0	6	1	28	0	0	0	0
Nitrobenzene	0	0	0	0	0	0	0	0
N-Nitrosodimethylamine	0	0	0	0	0	0	0	0
N-Nitrosodiphenylamine	0	0	0	0	0	0	0	0
N-Nitrosodi-N-Propylamine	0	0	0	0	0	0	0	0
Bis-(2-ethylhexyl) phthalate	14.4	20	8	9	4.8	10	2	13
Butyl Benzylphthalate	6	10	2	2	1	1	1	1
Di-N-Butylphthalate	0	0	0	0	5.7	13	1	7
Di-N-octylphthalate	2	2	2	1	2	2	2	1
Diethylphthalate	0	0	0	0	1	1	1	1
Dimethylphthalate	0	0	0	0	0	0	0	0
Benzo(A)anthracene	0	0	0	0	0	0	0	0

* 28 influent samples; 27 effluent samples

in ug/l	INFLUENT				EFFLUENT			
	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED
Benzo(a)pyrene	0	0	0	0	1	1	1	1
3,4-Benzofluoranthene	0	0	0	0	2	2	2	1
Benzo(k)fluoranthene	0	0	0	0	0	0	0	0
Chrysene	0	0	0	0	1	1	1	1
Acenaphthylene	6	6	6	1	0	0	0	0
Anthracene	0	0	0	0	0	0	0	0
Benzo(g,h,i)perylene	0	0	0	0	0	0	0	0
Fluorene	0	0	0	0	0	0	0	0
Phenanthrene	0.2	0.2	0.2	1	0	0	0	0
Dibenzo(A,B)anthracene	0	0	0	0	0	0	0	0
Indeno (1,2,3-cd) pyrene	0	0	0	0	0	0	0	0
Pyrene	0	0	0	0	2	2	2	1
1,2-Diphenyl hydrazine	0	0	0	0	0	0	0	0
saturated hydrocarbons	1715.8	3600	300	19	171.3	260	60	24
unsaturated hydrocarbons	1074.0	4200	200	20	102.7	170	20	24
aromatic hydrocarbons	539.5	920	90	19	70.6	110	30	24
Aniline	0	0	0	0	0	0	0	0
Benzyl alcohol	43.4	100	15	5	0	0	0	0
2-Cresol	9.3	20	4	7	0	0	0	0
4-Cresol	19.7	24	15	3	0	0	0	0
Benzoic acid	112.0	260	10	12	5	7	3	5
4-Chloroaniline	0	0	0	0	0	0	0	0
2-Methylnaphthalene	2.1	3	1	7	0	0	0	0
2,4,5-Trichlorophenol	0	0	0	0	0	0	0	0
2-Nitroaniline	0	0	0	0	0	0	0	0
3-Nitroaniline	0	0	0	0	0	0	0	0
Dibenzofuran	0	0	0	0	0	0	0	0
4-Nitroaniline	0	0	0	0	0	0	0	0
Volatiles								
Acrolein	0	0	0	0	1	1	1	1
Acrylonitrile	0	0	0	0	0	0	0	0
Benzene	2.2	8	1	27	0	0	0	0
Bromodichloromethane	2	3	1	26	14.0	22	9	26
Bromoform	0	0	0	0	2.8	10	1	15
Bromoethane	2	2	2	2	0	0	0	0
Carbon tetrachloride	0	0	0	0	0	0	0	0
Chlorobenzene	1.9	4	1	7	0	0	0	0
Chloroethane	2.5	4	1	2	1.5	2	1	2
2-Chloroethylvinyl ether	0	0	0	0	0	0	0	0
Chloroform	24.3	34	9	28	35.0	49	18	27
Chloromethane	8.2	27	1	11	3.2	5	1	9
Dibromochloromethane	0	0	0	0	5.9	16	2	27
1,2-Dichlorobenzene	13.9	59	2	28	5.5	28	1	26
1,3-Dichlorobenzene	1.5	2	1	2	1	1	1	1
1,4-Dichlorobenzene	11.1	37	3	28	8.5	25	2	26

* 28 influent samples; 27 effluent samples

in ug/l	INFLUENT				EFFLUENT			
	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED
1,1-Dichloroethane	1	1	1	1	1	1	1	1
1,2-Dichloroethane	4.5	7	1	4	4.4	10	1	5
1,1-Dichloroethene	0	0	0	0	0	0	0	0
Trans-1,2-dichloroether	0	0	0	0	0	0	0	0
1,2-Dichloropropane	0	0	0	0	0	0	0	0
Cis-1,3-dichloropropene	0	0	0	0	0	0	0	0
Trans-1,3-dichloroprop	0	0	0	0	0	0	0	0
Ethyl benzene	4.5	10	1	28	1	1	1	3
Methylene chloride	23.0	66	1	27	21.4	100	1	23
1,1,2,2-Tetrachloroether	0	0	0	0	0	0	0	0
Tetrachloroethene	61.7	920	6	28	31.5	150	7	27
Toluene	31.3	83	6	28	1.7	6	1	23
1,1,1-Trichloroethane	6.1	22	1	26	4.7	26	1	24
1,1,2-Trichloroethane	0	0	0	0	0	0	0	0
Trichloroethene	2.1	4	1	27	1.5	2	1	24
Vinyl chloride	0	0	0	0	0	0	0	0
Acetone	206.4	860	26	27	12.4	32	6	16
Dibromochloropropane	0	0	0	0	0	0	0	0
Ethylene dibromide	5	5	5	1	2	2	2	1
Methylethyl ketone	10.7	16	8	6	3	3	3	1
Methyl isobutyl ketone	11.3	42	2	23	5.9	18	1	21
Styrene	1	1	1	1	0	0	0	0
Tetrahydrofuran	11	12	10	2	0	0	0	0
Freon 113	0	0	0	0	0	0	0	0
saturated hydrocarbons	373.2	810	140	28	54.7	150	24	26
unsaturated hydrocarbons	125.4	250	50	28	62.3	116	28	26
aromatic hydrocarbons	320.8	800	61	28	25.8	90	3	25
Xylenes	42.0	130	6	28	6.7	23	2	18
1,2,4-Trichlorobenzene	0	0	0	0	0	0	0	0
Fluorotrichloromethane	5	5	5	1	0	0	0	0
Dichlorodifluoromethane	0	0	0	0	0	0	0	0
Dibromomethane	0	0	0	0	0	0	0	0
1,3-Dichloropropane	0	0	0	0	0	0	0	0
Bromochloromethane	0	0	0	0	0	0	0	0
1,2,3-Trichloropropane	0	0	0	0	0	0	0	0
1,2,3-Trichlorobenzene	0	0	0	0	0	0	0	0
N-propylbenzene	8.9	43	2	21	1.8	3	1	4
1,1,1,2-Tetrachloroeth	0	0	0	0	0	0	0	0
Pentachloroethane	0	0	0	0	0	0	0	0
Bis(2-chloroisopropyl) ether	0	0	0	0	0	0	0	0
Sec-dichloropropane	0	0	0	0	0	0	0	0
1,2,4-Trimethylbenzene	20.3	47	3	7	2	2	2	2
N-butylbenzene	1.6	2	1	13	0	0	0	0
Naphthalene	4.0	7.4	2	21	1.8	2	1	5
Hexachlorobutadiene	0	0	0	0	0	0	0	0
p-Chlorotoluene	0	0	0	0	0	0	0	0

* 28 influent samples; 27 effluent samples

in ug/l	INFLUENT				EFFLUENT			
	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED	AVERAGE	MAXIMUM	MINIMUM	TIMES * DETECTED
1,3,5-Trimethylbenzene	7.6	16	1	25	0	0	0	0
p-Isopropyltoluene	4.3	8	2	26	0	0	0	0
1,1-Dichloropropane	0	0	0	0	0	0	0	0
Isopropylbenzene	4.3	20	1	23	2	4	1	5
Tert-butylbenzene	0	0	0	0	0	0	0	0
Sec-butylbenzene	2	2	2	1	0	0	0	0
Bromobenzene	0	0	0	0	0	0	0	0
Cis-1,2-dichloroethane	2.2	3	2	14	1.3	2	1	12
O-chlorotoluene	16	16	16	1	1	1	1	1
Carbon disulfide	15.2	34	4	11	4.6	10	2	9
1,1-Dichloropropene	0	0	0	0	0	0	0	0

* 28 influent samples; 27 effluent samples

APPENDIX F

PRELIMINARY EQUIPMENT SPECIFICATION SUMMARY FOR PROPOSED GROUNDWATER REMEDIATION SYSTEM

Specification summary for major equipment of the proposed groundwater remediation system is as follows:

1. GRANULAR ACTIVATED CARBON VESSELS

- a. Five granular activated carbon vessels are required, three for operation and two as standby. The granular activated carbon vessels shall be drum type of DOT steel construction, and epoxy lined. Each drum shall contain approximately 200 pounds of virgin liquid phase carbon.

- b. Influent conditions:

Flowrate: 5 gpm

Average TPH concentration: 22,000 ppb

Average BTXE concentrations (ppb):

Benzene	3,800
Toluene	1,600
Xylene	1,800
Ethyl benzene	500

Temperature: 65° F

Pressure: 6 psig

- c. Effluent requirements:

maximum BTXE concentrations (ppb):

Benzene	3
Toluene	31
Xylene	42
Ethyl benzene	5

- c. Potential suppliers:

Carbtrol Corporation, model L-1

Westates Carbon, Inc., model ASC-200

2. PNEUMATIC EJECTOR PUMPS AND CONTROLLER

- a. One pneumatic ejector pump Teflon or stainless steel wetted parts.
- a. Fluid pumped: water with organic contaminants
 - Temperature; 65 F
 - Flowrate: 5 gpm
- b. Minimum Total Dynamic Head of at least 35 feet with 2 feet suction submergence
- c. Accessories for the pump:
 - one controller
 - one liquid level control
 - one 4-inch adjustable well cap
- d. Potential Supplier
 - QED Environmental Systems, Inc.
 - model LP4600

3. BASKET FILTERS

- a. Two filter strainers for removal of particulates from process stream. Operating conditions are as follow:
 - flowrate: 5 gpm
 - inlet pressure: 16 psig
- b. Potential supplier
 - Rosedale Products, Inc., model 4