TEXACO REFINING AND MARKETING INC.
108 CUTTING BOULEVARD
RICHMOND CA 94804

February 19, 1991

Mr. Rafat Shahid
Alameda County Environmental
Health Department
80 Swan Way, Room 200
Oakland, CA 94621

Dear Mr. Shahid:

Enclosed is a copy of our [redacted] 1990 for our former Texaco Service Station located at 500 Grand Avenue in Oakland, California. This report is issued to you in lieu of a Quarterly Technical Report for the third quarter of 1990.

Please call me at (415) 236-1770 if you have any questions.

Very truly yours,

R.R. Zielinski
Field Environmental
Supervisor

RRZ:pap

Enclosure

cc: Mr. Tom Callaghan
Regional Water Quality Control Board
1800 Harrison Street, Suite 700
Oakland, CA 94607

KEG

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A Report Prepared for

Texaco Refining and Marketing Inc.
10 Universal City Plaza
Universal City, California 91608

INTERIM REMEDIAL PLAN
FORMER TEXACO STATION NO. 6248800235
500 GRAND AVENUE
OAKLAND, CALIFORNIA

December 7, 1990
1990 Report No. 3

HLA Job No. 2251,114.03

by

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I INTRODUCTION

This report presents an interim remedial plan by Harding Lawson Associates (HLA) for controlling off-site groundwater flow at a service station located at 500 Grand Avenue in Oakland, California (Plate 1). The station was formerly operated by Texaco Refining and Marketing Inc., and is now operated by Exxon Company, U.S.A. (Exxon). In previous HLA soil and groundwater investigations at the site, petroleum hydrocarbons were detected in vadose-zone soils and shallow groundwater. Hydrocarbon concentrations in groundwater exceed the drinking water standards (DWS) established by the California Department of Health Services (DOHS).

The purpose of this report is to outline a remedial system design that will minimize off-site migration of affected groundwater. Specifically, this plan proposes groundwater extraction, using a groundwater interception trench on the downgradient site perimeter. The extracted water will be off-hauled for recycling or treated on-site and discharged into the City of Oakland sanitary sewer system.

II SUMMARY OF PREVIOUS WORK

A. Previous Reports

In May 1988, Texaco Refining and Marketing Inc. retained HLA to investigate soil and groundwater conditions at the subject location. The results of HLA's on-going investigation are documented in the following reports:

- Sensitive Receptor Study, May 24, 1988
- Subsurface Investigation, July 20, 1988
- Environmental Assessment Report, September 22, 1989
- Work Plan for Supplemental Soil and Groundwater Investigation, November 27, 1989
- Quarterly Technical Reports

B. Site Location and Topography

The former Texaco service station is on the northeast corner of the intersection of Grand Avenue and Euclid Avenue in Oakland, California (Plates 1 and 2). It is approximately 200 feet north of the eastern end of Lake Merritt. The surrounding area contains commercial establishments and single- and multi-family residences.

The site is at an approximate elevation of 20 feet above mean sea level, and is surrounded by gently rolling hills that slope toward Lake Merritt. The area is fully developed. Surface water runoff is intercepted by the municipal storm water system.

C. Geologic Setting

Subsurface materials are Quaternary alluvium and shallow marine deposits. Data from borings at the site from 4 to 32 feet deep show that soils mainly consist of lean clay and silt. A two- to four-foot-thick layer of clayey sand was encountered in several borings at an approximate depth of 15 feet. A saturated clayey sand, thought to be a separate stratigraphic unit, was encountered in Boring B-8A at a depth of 23 feet.

D. Hydrology

Local groundwater flow is toward the southeast, ranging from South 36 East to South 57 East (Plate 3). The calculated groundwater gradient is 0.075 foot/foot. Data from monitoring wells across the site show that water levels in most wells have fluctuated 2.5 to 3.0 feet since early 1988. During the same period, water levels in MW-8A varied as much as 8 feet. Because of such wide variation, the data from MW-8A is suspect and was not used to contour the phreatic surface shown on Plate 3.

Two single-well slug tests were performed using wells MW-8C and MW-8E. A volume (slug) of water was rapidly removed from each well, using a centrifugal suction pump. Following slug withdrawal, water-level recovery was measured with a pressure transducer placed near the bottom of the well. The output of the transducer was recorded by a data logger for subsequent analysis. The respective hydraulic conductivities of native strata tested in MW-8C and MW-8E were estimated to be 0.03 and 0.02 foot/day. Results indicate that these subsurface materials are relatively impermeable and therefore, groundwater would be expected to move through them slowly.

City of Oakland water is provided by the East Bay Municipal Utilities District (EBMUD) via the Mokelumne Aqueduct, approximately 30 miles to the northeast. HLA's Sensitive Receptor Study revealed that within 1,000 feet of the site there are no public or private water supply wells registered with the California Department of Water Resources (DWR). On the other hand, the site is near Lake Merritt and groundwater flows toward the lake. Lake Merritt is a recreation area used by many people.

E. Petroleum Hydrocarbons in Soils of the Vadose Zone

Samples from 15 soil borings have been chemically analyzed to evaluate the horizontal and vertical extent of petroleum hydrocarbons in the vadose zone. Concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) in the soil are either below detection limits or very low. However, up to 2900 parts per million (ppm) of total petroleum hydrocarbons (TPH) as gasoline were detected in samples from the underground tank area. Contour maps of TPH concentrations in the soil indicate that the hydrocarbons, which apparently originate at the underground tanks and possibly near the dispenser islands, extend off site to MW-8J (Plate 4).

Laterally, the area of affected vadose-zone soils covers a significant portion of the service station property. It appears that the most effective remedial method for hydrocarbon-bearing soil at this site will be excavation and treatment of the soil, followed by disposal at a permitted landfill. HLA proposes to perform interim remediation of the groundwater, as described in Section IV of this report, and coordinate soil remediation with Exxon's plans for future site use.

F. Petroleum Hydrocarbons in Groundwater

Tables 1 and 2, respectively, present the results of water-level measurements and groundwater analyses since 1988. Groundwater from monitoring wells MW-8E, MW-8H, MW-8I, and MW-8J, and observation wells OB-3 and OB-4 contained benzene in concentrations that exceeded the DWS. In groundwater samples from wells MW-8A, MW-8B, and MW-8C, BTEX concentrations were either nondetectable or below the DWS.

Plates 5 and 6 are contour maps of contaminant concentrations in groundwater, with Plate 5 showing benzene and Plate 6 showing TPH as gasoline. These maps suggest the origin of hydrocarbons in groundwater to be near the underground tanks and the dispenser islands. Water from MW-8E, cross-gradient and down-gradient of the dispenser islands, has the highest concentrations of BTEX, TPH as gasoline, and TPH as diesel fuel.

Downgradient from MW-8E, TPH as gasoline was detected in water samples from MW-8H, MW-8I, and MW-8J (Plate 6). Samples from MW-8F and MW-8G contained nondetectable concentrations of BTEX and TPH as gasoline. These data indicate that the edge of the plume containing TPH as gasoline lies under Grand Avenue.

G. Underground Fuel Tanks

There are three 10,000-gallon underground storage tanks at the site: one with regular unleaded gasoline, one with super unleaded gasoline, and one with regular leaded gasoline. According to Exxon representatives, Annual Tank System Integrity Tests indicate that the tanks and lines conform to standards established for fuel dispensing systems. Exxon installed overfill containment systems on the tanks in June 1990.

In September 1990, one single-walled fiberglass underground tank for waste oil was excavated and removed from the site. (Plate 2). Waste oil and hydrocarbon-bearing water was pumped from the excavation. The surrounding soil was overexcavated and removed from the site.

III REMEDIAL ALTERNATIVES

A. Objectives of Interim Remedial Action

The objectives of the proposed interim remedial action at the site are to minimize off-site migration of affected groundwater, and to treat the groundwater so that it may be properly discharged.

B. Screening Criteria for Remedial Alternatives

Remedial alternatives were screened using the following criteria:

- Ability to mitigate risks to human health and the environment,
- Acceptability to regulatory agencies,
- Proven technologies that do not require extensive maintenance,
- Length of time required to complete remediation,
- Minimal disruption to existing site operations, and
- Relative costs (capital, operating, and maintenance).

C. General Groundwater Remediation Alternatives

The following remedial alternatives were considered and are further discussed below:

- Groundwater monitoring,
- Extraction for off-site disposal,
- Extraction for on-site treatment,
- Extraction with supplemental soil venting, and
- In-situ bioremediation.

1. Groundwater Monitoring

Because unaided natural processes are relatively slow, we did not select monitoring to measure effects of natural remediation processes (bioremediation, oxidation, and volatilization) on groundwater. The current condition at this site warrants more timely remedial actions so that further hydrocarbon migration is avoided.

2. Groundwater Extraction

Extraction of groundwater is a direct means of recovering released hydrocarbons and preventing their migration; it is accomplished by either installing extraction wells or by intercepting groundwater flow with a trench. Extraction by pumping from wells is not considered physically or economically practical at this site because of the low hydraulic conductivity of shallow soils and resulting limited radius of influence for extraction wells. The preferred method of remediation, therefore, is a recovery trench on the perimeter of the site. Although use of a trench may not significantly reduce the concentration of on-site hydrocarbons in the short term, it will minimize their off-site migration. The intercepted groundwater can be hauled off site or treated on site, depending on the rate of groundwater inflow to the trench.

a. Off-site Disposal

If groundwater flows into the interception trench at less than 100 gallons per day (gpd), it will be more economic to evacuate the trench periodically. For such low flow rates, the overhead expenses involved with maintaining and operating an on-site treatment system cannot be justified. After water is pumped from the trench using a vacuum truck , it will be off-hauled to a licensed recycler. This method is further described in Subsection D, below.

b. On-Site Treatment

If groundwater flows into the trench faster than approximately 100 gpd, it may be preferable to treat it on site and then to discharge the water to sanitary sewer.

3. Extraction of Groundwater with Supplemental Soil Venting

Soil venting in conjunction with groundwater extraction can expedite the remediation of hydrocarbons present in the soil and groundwater on site. Gasoline hydrocarbons in partially saturated soils, sometimes inaccessible by groundwater extraction alone, can be effectively volatilized using a vacuum-induced air flow. At this site, however, the following factors exclude soil venting as a feasible option:

- Shallow groundwater limits the radius of influence of vapor extraction wells,
- The low permeability of subsurface material limits the radius of influence, and
- Many of the heavier hydrocarbons are non-volatile and cannot be significantly removed with soil venting.

4. In-situ Bioremediation

Natural in-situ bioremediation can be enhanced by stimulating microbial populations that metabolize hydrocarbons, thereby producing water, carbon dioxide, and biomass. At this site, the option is impractical because the near-surface soil has low permeability. Furthermore, in-situ bioremediation involves the control of nutrient injection and groundwater extraction systems at a very small site. Such control requires high maintenance costs that make this option unfeasible.

D. Water Treatment Design Alternatives

The following five methods were evaluated for treatment of extracted groundwater:

Off-hauling to a licensed recycler,

Filtering with granular activated carbon (GAC),

Air stripping,

Biological degradation, and

Catalytic oxidation, using hydrogen peroxide and ultraviolet light.

1. Off-hauling

Off-site disposal of groundwater is accomplished by extracting groundwater with a vacuum truck for hauling to a licensed recycler. To maintain a hydraulic sink, the water level in the interception trench must be held below the static water level. If groundwater flow rates are very low, this method is more economical than operating an on-site treatment system.

2. Filtering with Granular Activated Carbon (GAC)

If groundwater flow rates are great enough to justify on-site treatment of extracted groundwater, use of GAC is reliable and can meet discharge requirements to the sanitary sewer. It is recommended that GAC be incorporated into the groundwater treatment system to remove organic compounds from the water prior to effluent discharge. This technology has low maintenance costs, but may require significant operating capital to replace the spent GAC.

3. Air Stripping

Extraction and treatment with air stripping is ineffective in removing non-volatile hydrocarbon constituents from groundwater at this site.

4. Biological Degradation

If flow rates are high enough to justify on-site treatment, this remedial alternative is a cost-effective, proven technology. A bioreactor can reduce hydrocarbon concentrations upstream of the GAC media, thereby reducing the rate of GAC utilization. Once trench inflow rates and concentrations have been established, the economic feasibility of incorporating a bioreactor with GAC media will be evaluated.

5. Catalytic Oxidation

In catalytic oxidation systems, ultraviolet light is used to stimulate the oxidation of hydrocarbons with hydrogen peroxide and/or ozone. This method is not feasible for on-site treatment of extracted groundwater at this site because commercially available systems are designed for much larger flow rates; they are typically used for secondary polishing at wastewater treatment plants.

IV DESCRIPTION OF SELECTED REMEDIAL ACTION

A. General Project Description

The selected interim remedial action involves extracting water from an interception trench on the downgradient site perimeter. The extracted water will be off-hauled for recycling, or treated on-site using GAC and discharged to the sanitary sewer.

B. Area of Groundwater Interception

The proposed interception trench, shown on Plates 7 and 8, is designed to intercept groundwater migrating off site. It will be installed to a depth of 15 feet along the Grand Avenue side of the site to intercept groundwater flowing in the directions shown on Plate 3. To maximize the volume of hydrocarbon-bearing groundwater that can be removed, the trench will be connected to the pea gravel backfill of the existing underground gasoline fuel tanks.

C. Determination of Groundwater Flow Rate

To determine the groundwater flow rate into the trench, an inflow rate test will be conducted. Because of the small hydraulic conductivity of the strata underlying this site, it is necessary to measure inflow rate before selecting the method for treatment and/or disposal of extracted groundwater. A permanent groundwater treatment system would require a flow rate greater than 100 gpd. Once the interception trench is installed, vacuum trucks will be used to extract water from the sumps for subsequent disposal by a licensed recycler.

D. <u>Groundwater Treatment Design</u>

If the sustainable groundwater inflow rate is less than 100 gpd, we anticipate that periodic extraction and off-hauling will be more feasible than on-site treatment. If the sustainable recharge rate is greater than 100 gpd, a treatment system will be installed on site using GAC.

The off-site disposal option would initially entail evacuating all water from the trench system; we expect the initial volume of extracted water to be approximately [redacted] gallons. A vacuum truck would periodically evacuate the trench when about two feet of water has accumulated in it. The head differential created by this procedure is expected to maintain a flow gradient toward the trench to inhibit off-site migration of petroleum hydrocarbons.

The proposed on-site treatment option, shown on Plate 9, consists of a retention tank and three GAC canisters connected in series to maximize carbon utilization efficiency. In the event of a system failure, a tank overflow prevention switch will shut off the extraction pumps in the trench sumps.

The retention tank will provide the following three functions:

1. Prevent air in the groundwater collection system from entering the GAC media,

2. Retain any free product that enters the collection system to prevent fouling of GAC media until a free-phase separator can be installed upstream, and

3. Retain fluid to accommodate biological treatment if feasible.

Flow will be transferred through the treatment system via PVC pipe and flexible hoses (1/2-inch-diameter). Use of flexible hoses will facilitate changing the flow sequence between GAC canisters as they are replaced. Sampling ports will be installed in the influent line, the effluent line, and between canisters. To quantify effluent discharge, an in-line cumulative flow meter will be installed between the treatment system and the sanitary sewer.

V IMPLEMENTATION OF THE SELECTED REMEDIAL ACTION

A. Scope of Work

The work will be conducted as five tasks (with Tasks 4 and 5 dependent on the results of Task 3):

Task 1 - Excavate interception trench

Task 2 - Install extraction sumps and groundwater collection system

Task 3 - Conduct inflow rate test

Task 4 - Install water treatment system, if indicated

Task 5 - If indicated, start-up and monitor the water treatment system.

1. Task 1 - Excavate Interception Trench

A 2-foot-wide by 15-foot-deep trench will be excavated along the Grand Avenue side of the service station as shown on Plate 7. The trench will connect with the backfill containing the existing underground gasoline tanks. Graded material* will be placed in the trench excavation, to filter particulates that might otherwise enter the trench with groundwater.

Partial closure of the station will be necessary for two to three weeks during installation of the subdrain and piping. Areas under active construction will be roped off for the safety of the public and workers. However, inactive construction areas will be covered with trench plates to allow

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* The material will conform with State of California Department of Transportation Standard Specifications, Section 68-1.025 (January, 1988).

public access to at least one pump island and the station's service bays.

Although excavated soil can be aerated or bioremediated on site, the limited space at this site makes those options unlikely. The soil will be characterized and disposed of at an appropriate landfill.

2. Task 2 - Install Groundwater Collection System

A groundwater collection system will be constructed inside the interception trench (Plate 8). Extraction sumps will be constructed using 4-inch PVC pipe to accommodate pneumatic pumps, if they are necessary. A PVC line, connecting the extraction sumps to a common collection point, will be installed at a depth of 2 feet below grade. It will accommodate the following lines:

- A flexible hose to transport extracted groundwater
- A pressurized air line to operate pneumatic pumps, and
- A pneumatic level sensor line to monitor the water level in each sump.

The trench will be backfilled with permeable material, compacted to a minimum of 95 percent relative compaction*, to a total depth of two feet below grade. The piping will be installed and the trench backfilled with baserock, compacted to

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* Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil determined by ASTM D1557-78 laboratory test procedure.

within four inches of final grade. A four-inch-thick asphalt layer will be placed and compacted to match existing grade.

The top of each extraction sump will be completed below ground surface and equipped to attach to the collection system piping. A water-tight, 2-foot-deep by 2-foot-diameter traffic box will be installed over the sump to enclose and secure well-head attachments.

3. Task 3 - Conduct Subdrain Inflow Rate Test

Vacuum trucks will be used to evacuate the water from the trench system for disposal by a licensed recycler. A pressure transducer will be placed near the bottom of an extraction sump to measure the rate of water-level recovery. The output of the transducer will be recorded by a data logger for subsequent evaluation.

4. Task 4 - Install Water Treatment System

If groundwater flow rates into the trench are sufficient to justify an on-site treatment system, extracted groundwater will be processed through a water treatment system consisting of a retention tank and GAC canisters, as shown on Plate 9. More detailed discussion of treatment system design is presented in Section IV, Subsection D.

The treatment system will be prefabricated on a skid, transported to the site, and enclosed by a 6-foot-high fence at the location shown on Plate 7. An 8-inch-high retaining wall will surround the skid to provide secondary containment capacity (exceeding the largest vessel volume at the site [100-gallon retention tank] plus the expected effects of the 100-year rainstorm).

After receipt of a discharge permit from EBMUD, we will subcontract a licensed contractor to proceed as follows:

- Construct a concrete pad to accommodate the treatment skid,
- Construct a cyclone fence around the treatment system,
- Connect the groundwater collection system to the treatment system inlet,
- Connect the effluent line from the treatment system to a sanitary sewer lateral, and
- Provide a PG&E power drop and connect the service to the treatment system.

5. Task 5 - Start-up and Monitor Water Treatment System

Once an on-site treatment system is installed, we will monitor the system according to the proposed schedule presented in Table 3. Discharge water from the treatment system will initially be retained in a storage tank on site. After effluent standards are confirmed by results of chemical analyses, the storage tank will be emptied to the sanitary sewer and removed from the system. At that time, the treatment system effluent line will be connected to the sanitary sewer for direct disposal.

To evaluate the life expectancy of the carbon canisters, midstream samples will be obtained weekly to monitor hydrocarbon breakthrough. The first canister will be removed upon breakthrough of the second canister and a clean GAC canister will be installed downstream of the remaining two canisters. The second canister will be monitored on the basis of initial breakthrough times and EBMUD requirements.

B. <u>Schedule</u>

We anticipate that the proposed groundwater interception system will be installed within three months after we receive approval to proceed from Texaco Refining and Marketing Inc., and regulatory agencies (see Anticipated Remediation Schedule, Plate 10). The inflow rate test will require a month because of the anticipated low rate of inflow.

If on-site treatment is feasible, HLA will submit an application for a permit to discharge treated groundwater to the sanitary sewer. We expect that the permit will require two to three months for processing. During the permitting process, HLA will prepare design drawings and specifications, and solicit bids from licensed contractors to construct components of the treatment system, install electrical wiring, and connect plumbing.

Table 1. Historical Record of Depth to Groundwater

Well		MW-8A	MW-8B	MW-8C	MW-8E	MW-8F	MW-8G	MW-8H	MW-8I	MW-8J
Top of Casing Elev.		99.72	101.11	98.41	99.38	97.94	97.24	98.57	97.94	97.38
Date										
JAN 24, 90	GW ELEV	91.47	100.60	90.87	96.07	88.06	86.57	94.97	91.94	91.44
FEB 27, 90	GW ELEV	95.21	100.73	91.15	96.13	87.95	86.68	95.06	92.03	91.60
MAR 27,90	GW ELEV	95.64	100.66	91.24	96.09	88.69	87.45	95.03	92.02	91.58
APR 24,90	GW ELEV	96.10	100.69	91.51	96.07	88.95	87.59	95.02	91.98	91.39
MAY 29, 90	GW ELEV	97.37	100.84	87.88	96.36	89.67	86.61	PAVED	PAVED	PAVED
JUNE 28, 90	GW ELEV	97.37	100.71	89.79	96.24	88.95	87.45	PAVED	PAVED	PAVED

Well		MW-8A	MW-8B	MW-8C	MW-8E	MW-8F	MW-8G	MW-8H	MW-8I	MW-8J
Top of Casing Elev.		99.72	101.11	98.41	99.38	97.94	97.24	98.90	98.27	97.69
Date										
JUL 24, 90	GW ELEV	97.31	100.62	90.98	96.06	88.74	87.54	95.14	92.05	91.21
AUG 24, 90	GW ELEV	94.74	100.60	90.30	95.90	87.13	86.08	92.14	91.93	93.89
SEPT 25, 90	GW ELEV	95.24	100.56	91.05	95.94	87.25	BLOCKED	95.10	91.90	91.01
OCT 18, 90	GW ELEV	96.11	100.55	90.92	95.86	86.89	85.62	95.07	91.85	90.96

All measurement are in feet
TOC = Top of casing elevation relative to arbitrary datum of 100 feet
GW Elev = Groundwater elevation relative to arbitrary datum

Table 2. Results of Groundwater Analyses
Concentrations in µg/l (ppb)

Well	Depth (feet)	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes	TPH as Gasoline	TPH as Diesel	TPH Other**
MW-8A	32	06/14/88	<0.5*	1.5	<2	6.6	NA	NA	NA
		10/28/88	<0.5	<1	<2	<1	NA	NA	NA
		09/28/89	<0.5	<0.5	<0.5	<3	<50	NA	NA
		11/29/89	<0.5	1.0	<0.5	<0.5	<50	1,200	<50
		01/24/90	<0.5	<0.5	<0.5	<0.5	<100	NA	2,800
		04/26/90	<0.5	<0.5	<0.5	<0.5	<2,500	<50	890
		07/26/90	6.0	<0.5	<0.5	<0.5	<50	<50	<50
		10/18/90	<0.5	<0.5	<0.5	<0.5	<50	<50	NA
MW-8B	20	06/14/88	<0.5	<1	<2	<1	NA	NA	NA
		10/21/88	<0.5	<1	<2	3.1	NA	NA	NA
		09/28/89	<0.5	<0.5	<0.5	<3	<50	NA	NA
		11/29/89	<0.5	<0.5	<0.5	<0.5	<50	<50	380
		01/24/90	<0.5	<0.5	<0.5	<0.5	<100	NA	350
		04/26/90	<0.5	<0.5	<0.5	<0.5	<50	<50	110
		07/26/90	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		10/18/90	<0.5	<0.5	<0.5	<0.5	<50	<50	
MW-8C	24.5	06/14/88	5.3	3.5	2.6	13.0	NA	NA	NA
		10/21/88	<0.5	<1	<2	<1	NA	NA	NA
		09/28/89	<0.5	<0.5	<0.5	<3.0	<50	NA	NA
		11/29/89	<0.5	<0.5	<0.5	<0.5	<50	<50	190
		01/24/90	0.9	<0.5	<0.5	<0.5	<100	NA	480
		04/26/90	<0.5	<0.5	<0.5	<0.5	<50	<50	160
		07/26/90	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		10/18/90	<0.5	<0.5	<0.5	<0.5	<50	<50	NA
MW-8E	20	10/25/88	1,400	510	2.9	420	NA	NA	NA
		09/28/89	5,600	3,100	<500	<3,000	22,000	NA	NA
		11/29/89	4,900	2,600	<250	1,490	15,000	6,800	<50
		01/24/90	10,100	3,340	540	1,790	36,000	NA	4,900
		04/26/90	11,000	5,700	840	2,900	48,000	1,400	<50
		07/26/90	15,000	6,200	520	4,700	56,000	<50	<50
		(10/18/90)	1,500	1,300	170	1,800	15,000	620	<50
MW-8F	16.5	04/14/89	<0.5	<1	<2	<1	NA	NA	NA
		09/28/89	<0.5	<0.5	<0.5	<3	<50	NA	NA
		11/29/89	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		01/24/90	<0.5	<0.5	<0.5	<0.5	<100	NA	<300
		04/26/90	<0.5	<0.5	<0.5	<0.5	<50	<50	110
		(07/26/90)	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		10/18/90	<0.5	<0.5	<0.5	<0.5	<50	[illegible]60	<50

NA = Compounds not analyzed

Table 2. (continued)

Well	Depth (feet)	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes	TPH as Gasoline	TPH as Diesel	TPH Other**
MW-8G	16.5	04/14/89	<0.5	<1	<2	<1	NA	NA	NA
		09/28/89	<0.5	<0.5	<0.5	<3	<50	NA	NA
		11/29/89	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		01/24/90	<0.5	<0.5	<0.5	<0.5	<100	NA	650
		04/26/90	<0.5	<0.5	<0.5	<0.5	<50	<50	120
		(07/26/90)	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		10/18/90	<0.5	<0.5	<0.5	<0.5	<50	460	<50
MW-8H	16.5	01/24/90	14.8	14.8	10.8	38.8	460	NA	<300
		04/26/90	67	19	43	64	830	<50	820
		(07/26/90)	45	1.3	12	8.2	190	<50	<50
		10/18/90	[illegible]	2.1	14	8.5	300	<50	NA
MW-8I	16.5	01/24/90	116	2.9	13	30.5	580	NA	440
		04/26/90	2,400	100	230	350	4,400	<50	1,400
		(07/26/90)	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		10/18/90	92	4.1	37	21	530	<50	NA
MW-8J	16.5	01/24/90	2.7	<0.5	1	2.6	<100	NA	<300
		04/26/90	28	7.7	19	24	160	<50	320
		(07/26/90)	<0.5	<0.5	<0.5	<0.5	<50	<50	<50
		10/18/90	8.3	<0.5	2.6	1.5	<50	<50	NA
OB-3	11.5	11/06/89	420	8	6	64	4,000	NA	NA
		04/26/90	160	19	5	8.6	1,000	3,200	<50
		(07/26/90)	<0.5	<0.5	<0.5	0.9	68	1,200	<50
		10/18/90	260	69	35	490	3,200	2,100	<50
OB-4	10.0	11/06/89	500	11	10	24	4,000	NA	NA
		04/26/90	360	10	10	18	460	3,900	<50
		(07/26/90)	23	3.7	1.6	5.9	200	1,600	<50
		10/18/90	600	540	83	840	4,300	330	<50
DWAL			1.0	680	100	1,750			

DWAL = Drinking water action levels, State of California Department of Health Services (April, 1989).

* <0.5 indicates that concentrations are below the reporting limit of 0.5 µg/l.

** "Heavy" petroleum hydrocarbons such as waste oil, mineral spirits, jet fuel, or fuel oil.

(07/26/90) Sample not analyzed for BTEX and TPH(g) within 14-day holding time.

NA = Compounds not analyzed

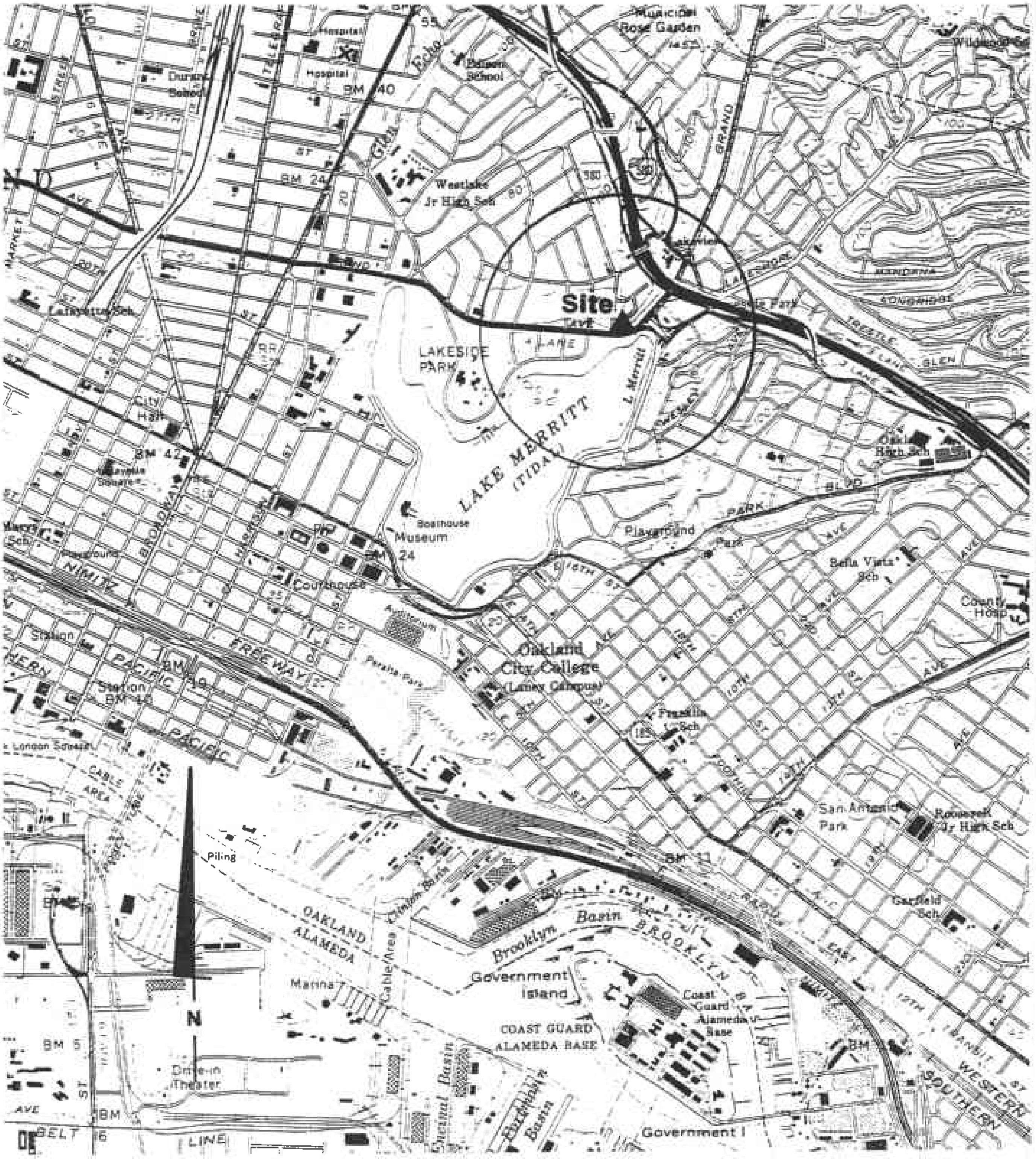
Table 3. Schedule for Sampling, Measurement, and Analysis
Optional Groundwater Treatment System
500 Grand Avenue
Oakland, California

	Sampling Station		
Measurement/Analysis	Influent	Effluent	Intermediate
Type of sample	G	G	G
Flow rate*	D/W/M	D/W/M	--
pH	D/W/M	D/W/M	--
Temperature	D/W/M	D/W/M	--
Electrical conductivity	D/W/M	D/W/M	--
EPA 8020 for: Benzene Toluene Total xylenes Ethylbenzene	D/W/M	D/W/M	W/M
EPA 8015 for: total petroleum hydrocarbons (as gasoline)	D/W/M	D/W/M	W/M
SMWWA 2450D for: Total suspended solids	D/W/M	D/W/M	--
SMWWA 5220A for: Chemical oxygen demand, filtered	D/W/M	D/W/M	--
EPA 524.2 for: Volatile organics; Drinking water quality	--	S	--
EPA 200 Series for: Priority pollutant Metals	--	S	--

NOTES

G = Grab sample.
D/W = 2 hours after system start-up, every 24 hours thereafter for 4 days, and weekly thereafter.
D/W/M = 2 hours after system start-up, every 24 hours thereafter for 4 days; weekly thereafter for 3 weeks, monthly thereafter for 3 months, and quarterly thereafter.
S = 2 hours after system start up
SMWWA = Standard Method Water and Wastewater Analyses, 17th edition.
* == A flow totalizer will record cumulative effluent discharge volume.

105649



Ref: USGS, 7.5 Minute Topographic Map, Oakland West, California, Photo revised 1980.

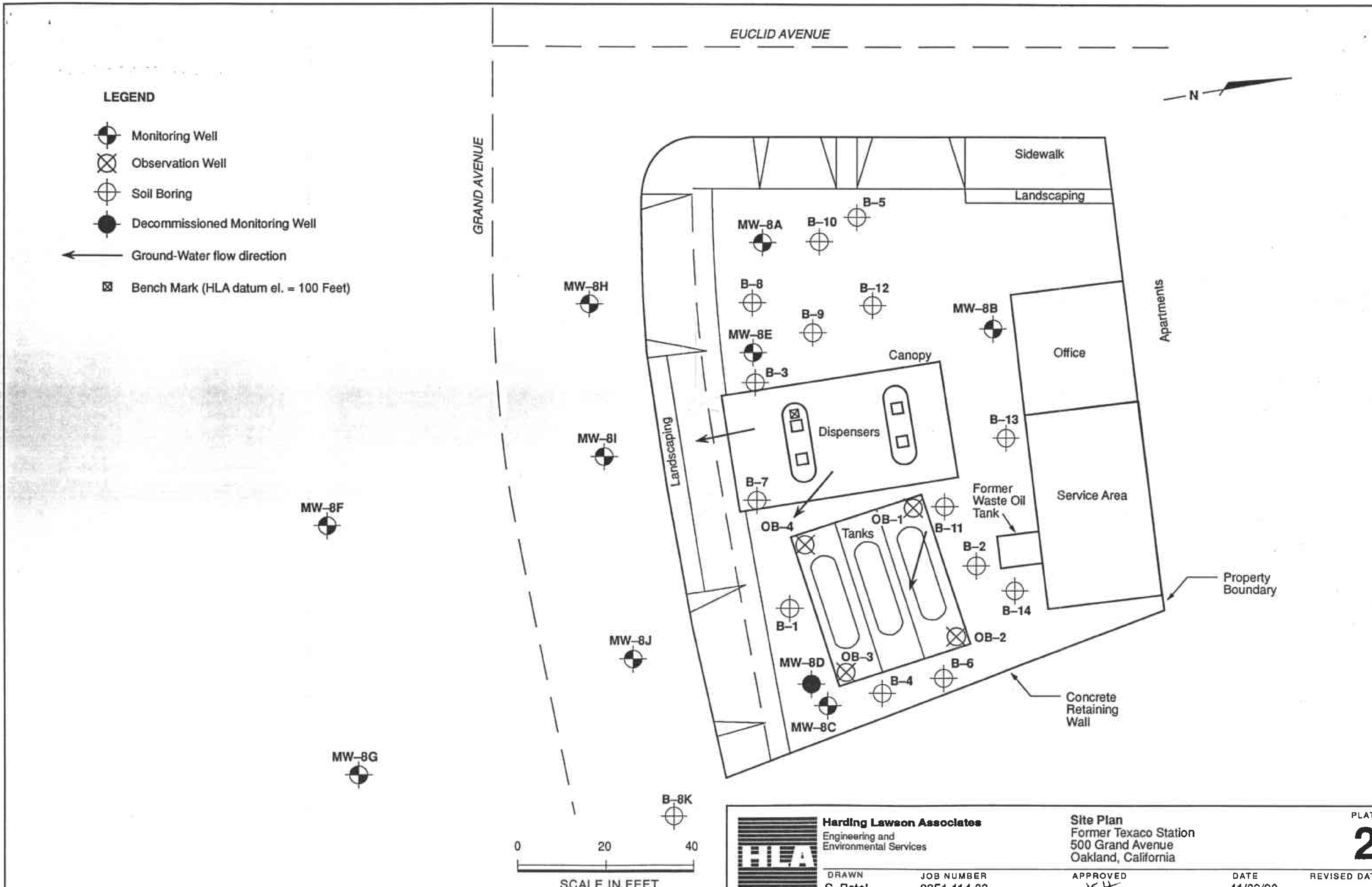
0 2000 4000
SCALE IN FEET

Harding Lawson Associates
Engineers and Geoscientists

Regional Map
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE 1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
YC	2251,114.03	QK	5/89		

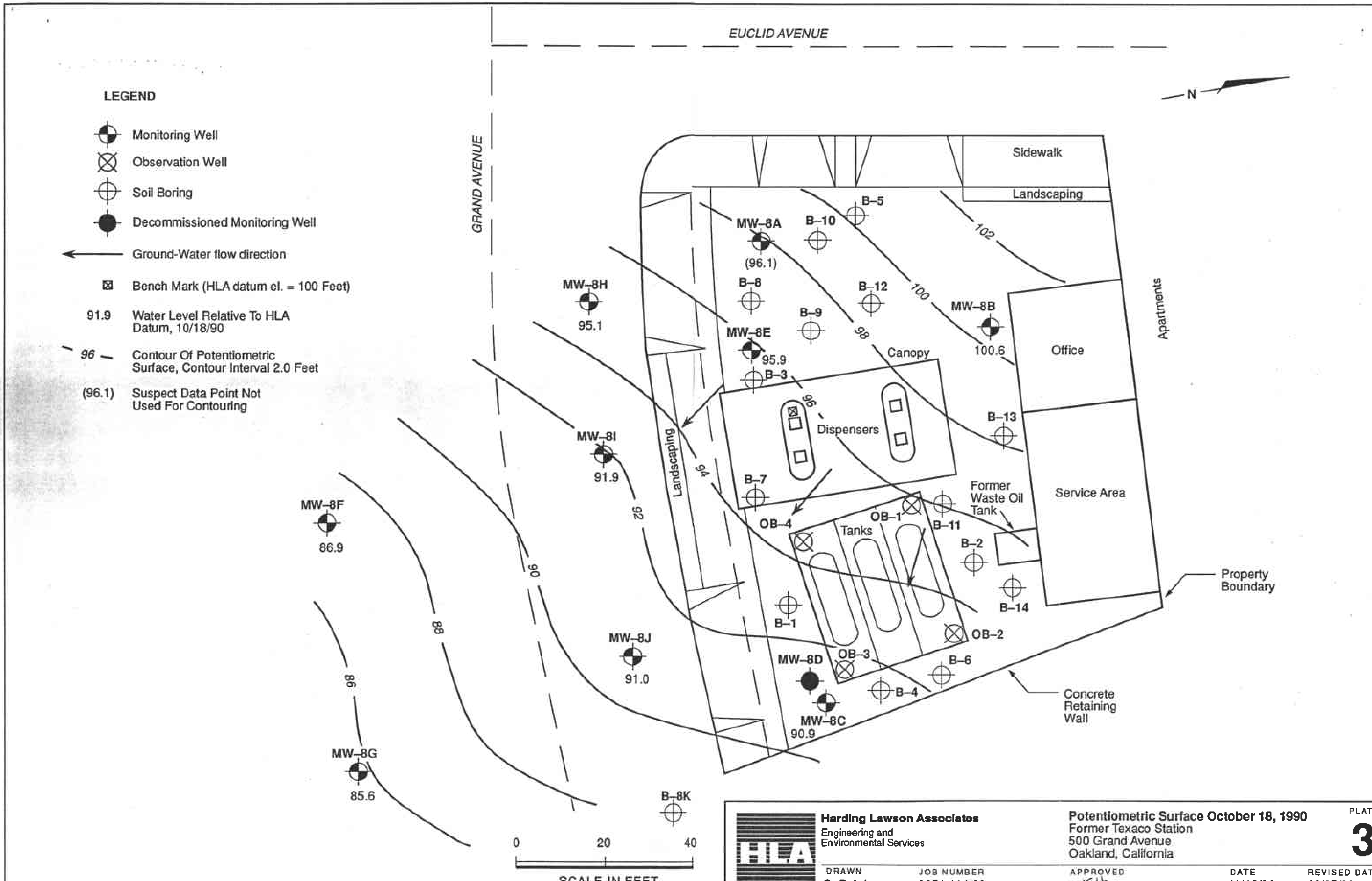


Harding Lawson Associates
Engineering and
Environmental Services

Site Plan
Former Texaco Station
500 Grand Avenue
Oakland, California

PLATE
2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSH	11/09/90	

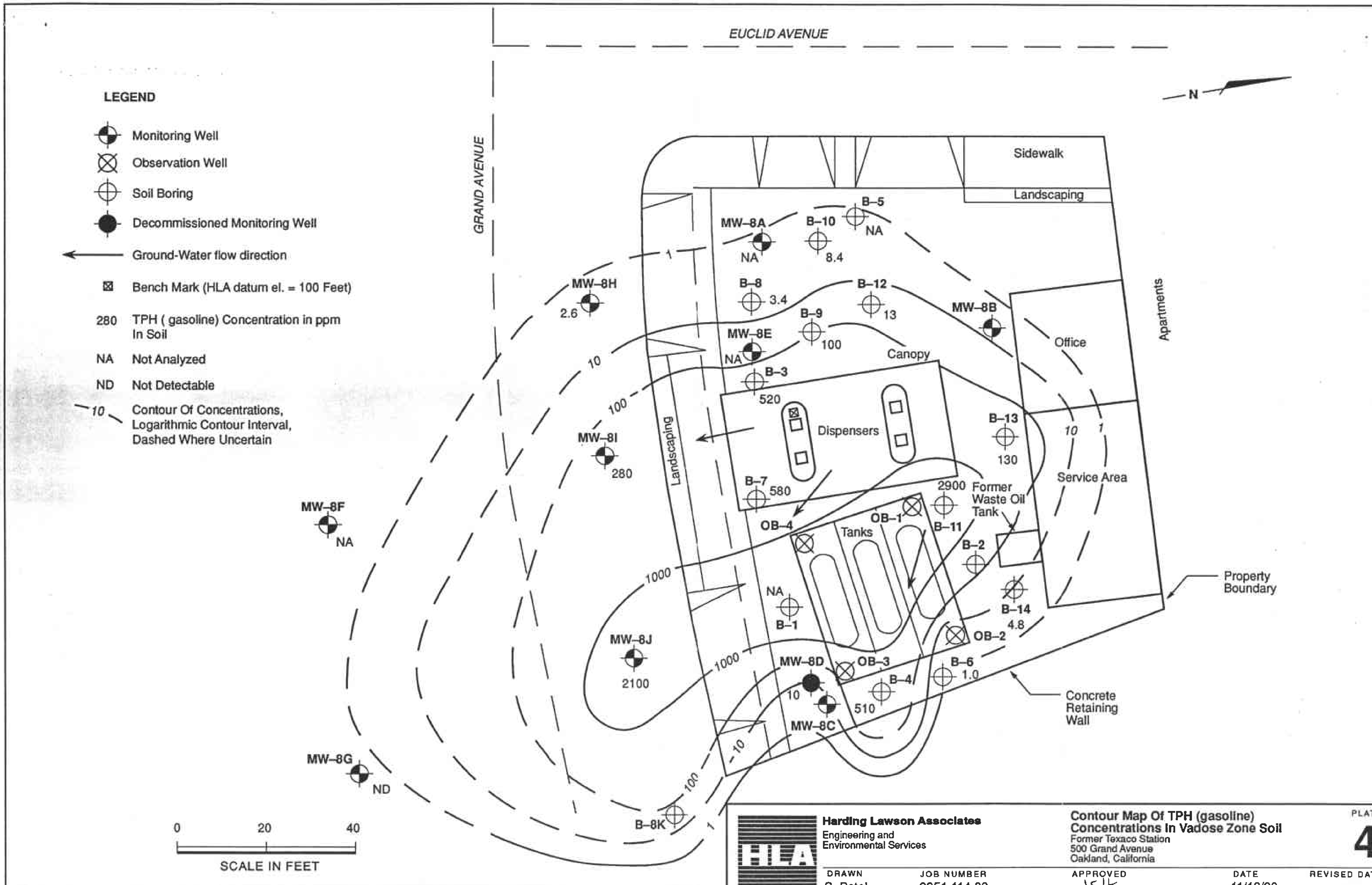


Harding Lawson Associates
Engineering and Environmental Services

Potentiometric Surface October 18, 1990
Former Texaco Station
500 Grand Avenue
Oakland, California

PLATE **3**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSH	11/12/90	12/05/90



Harding Lawson Associates
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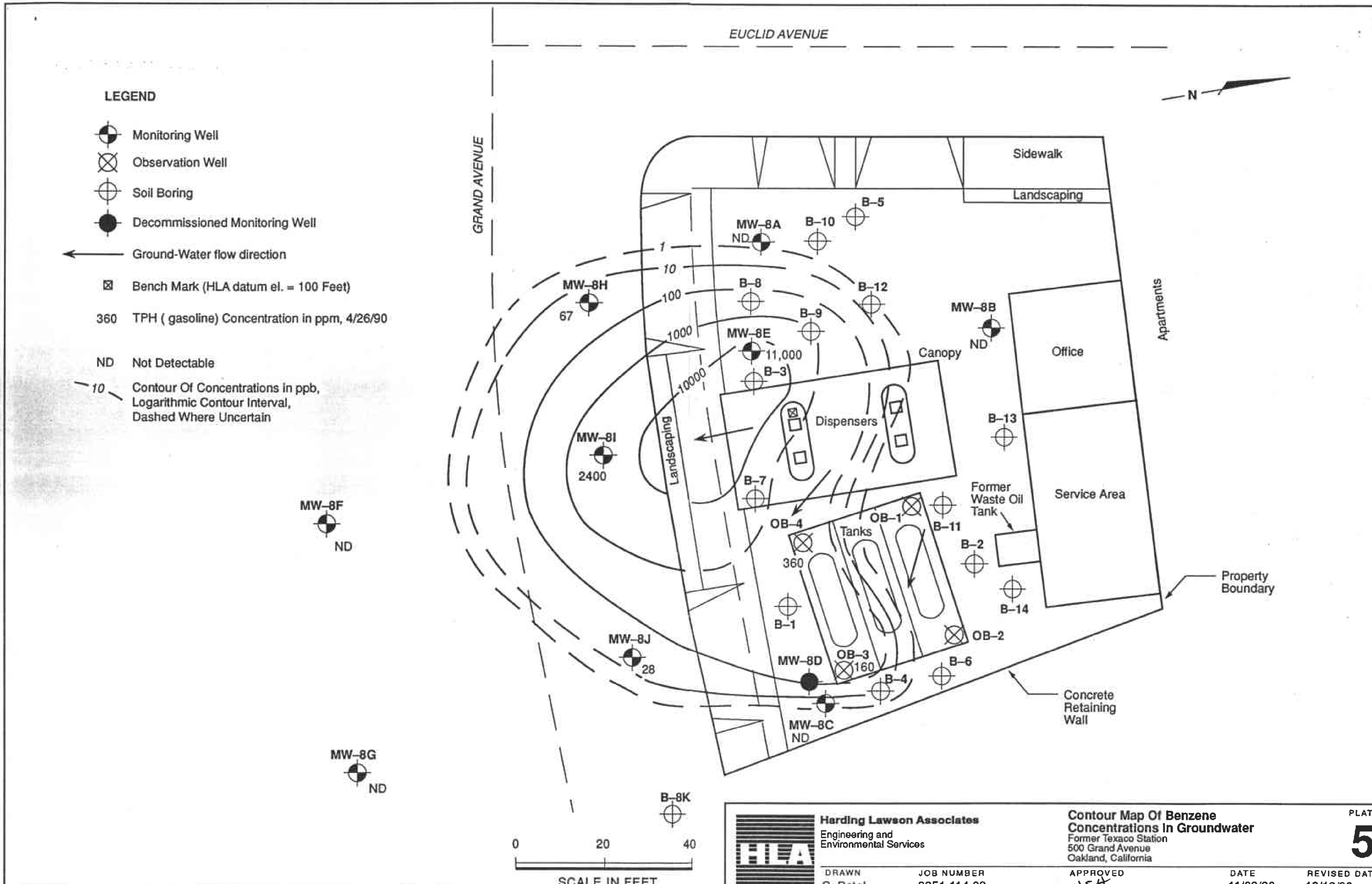
Contour Map Of TPH (gasoline) Concentrations In Vadose Zone Soil
Former Texaco Station
500 Grand Avenue
Oakland, California

PLATE **4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSH	11/12/90	



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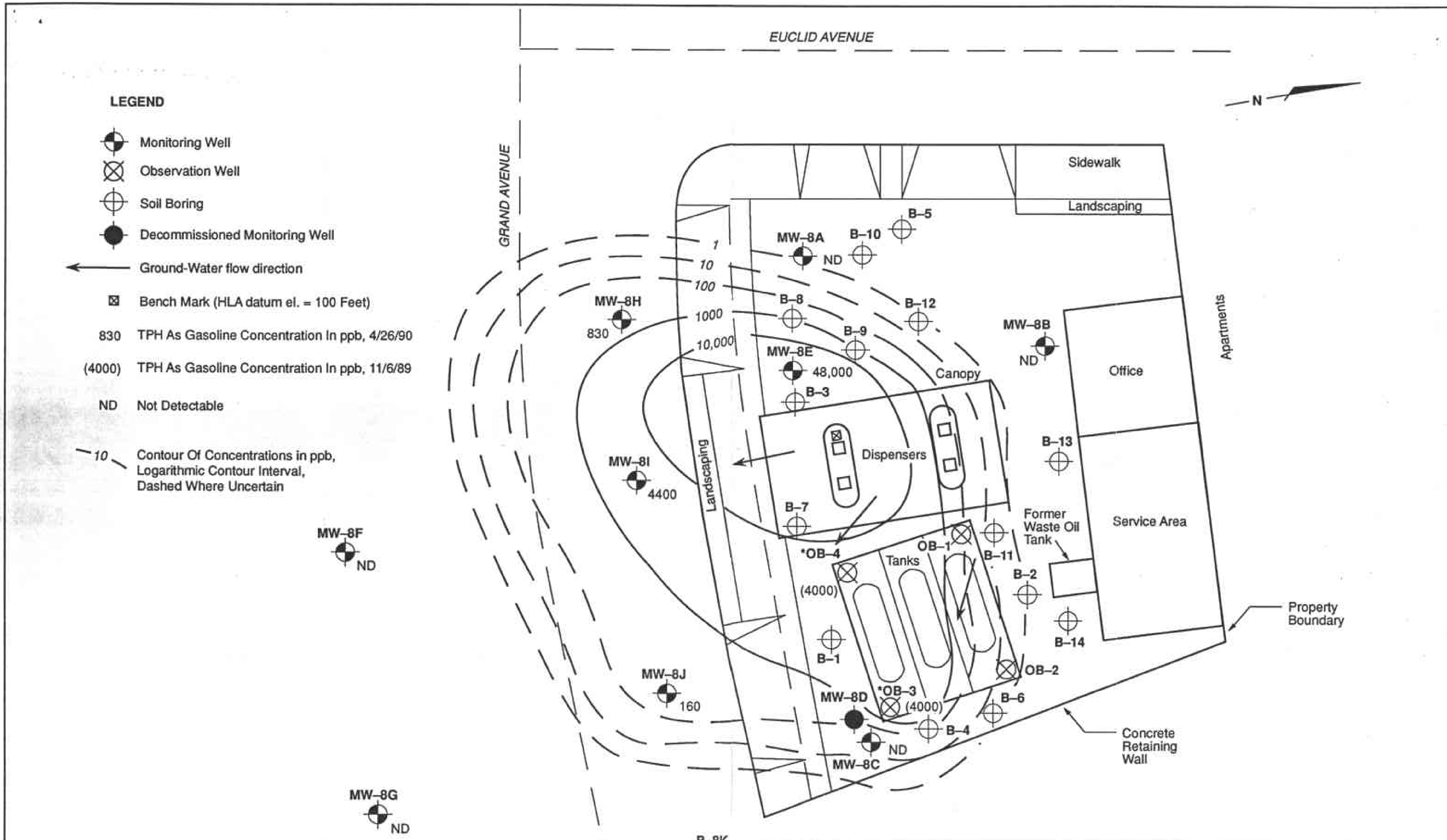
Contour Map Of Benzene Concentrations In Groundwater
Former Texaco Station
500 Grand Avenue
Oakland, California

PLATE **5**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSH	11/09/90	12/12/90



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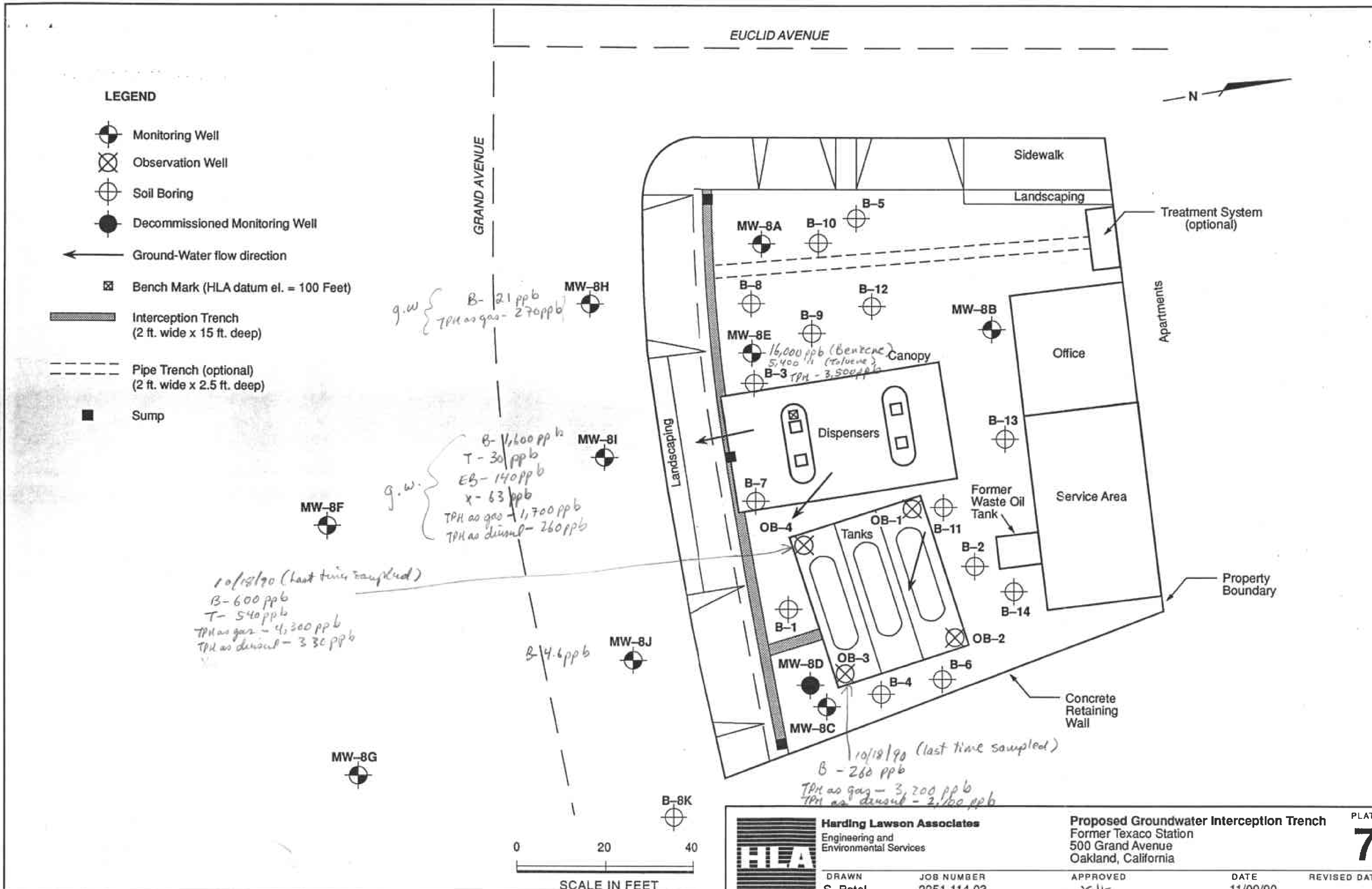
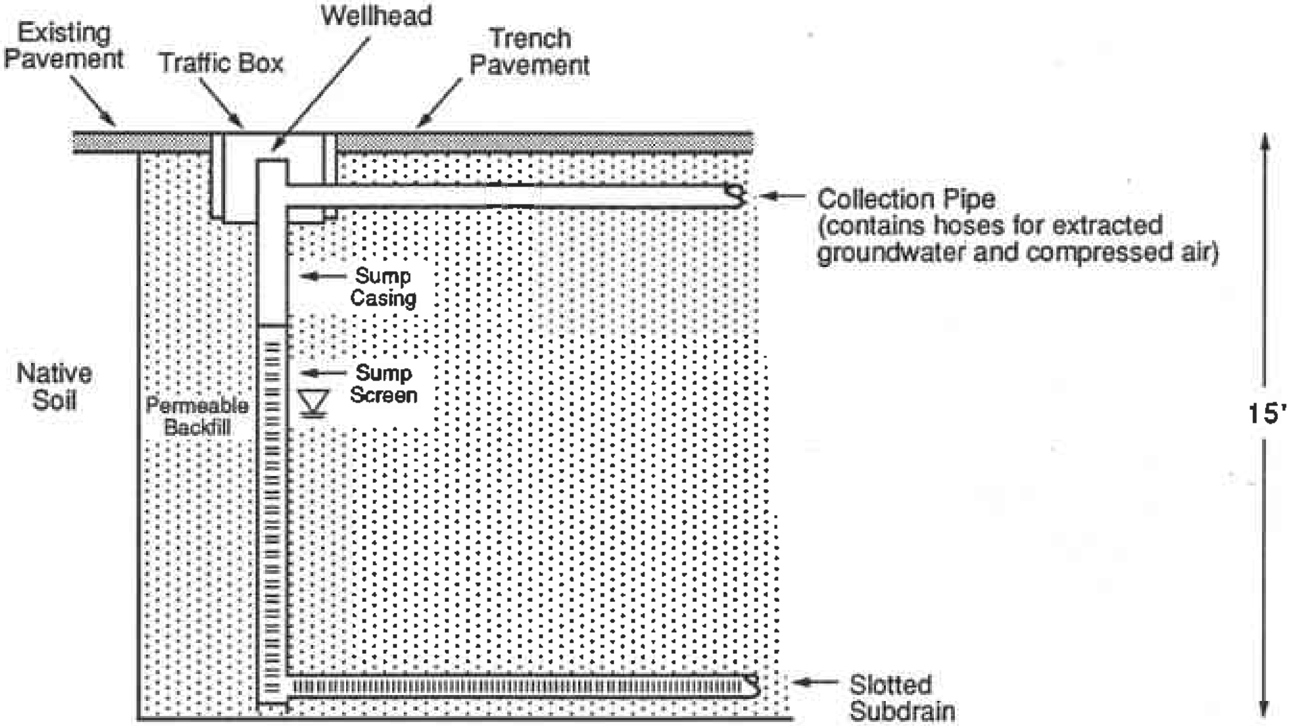
Contour Map Of TPH (gasoline) Concentrations In Groundwater
Former Texaco Station
500 Grand Avenue
Oakland, California

PLATE
6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSH	11/13/90	


EUCLID AVENUE
GRAND AVENUE
LEGEND
Monitoring Well
Observation Well
Soil Boring
Decommissioned Monitoring Well
Ground-Water flow direction
Bench Mark (HLA datum el. = 100 Feet)
Interception Trench
(2 ft. wide x 15 ft. deep)
Pipe Trench (optional)
(2 ft. wide x 2.5 ft. deep)
Sump
N
Sidewalk
Landscaping
Treatment System
(optional)
Apartments
Office
Service Area
Canopy
Dispensers
Tanks
Former Waste Oil Tank
Property Boundary
Concrete Retaining Wall
Landscaping
MW-8A
MW-8B
MW-8C
MW-8D
MW-8E
MW-8F
MW-8G
MW-8H
MW-8I
MW-8J
B-8K
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
B-13
B-14
OB-1
OB-2
OB-3
OB-4
g.w. B- 21 ppb
TPH as gas- 270ppb
16,000 ppb (Benzene)
5,400 " (Toluene)
TPH - 3,500ppb
g.w. B- 1,600 ppb
T - 30 ppb
EB- 140ppb
X - 63 ppb
TPH as gas - 1,700 ppb
TPH as diesel - 260 ppb
10/18/90 (last time sampled)
B- 600 ppb
T- 540 ppb
TPH as gas - 4,300 ppb
TPH as diesel - 330 ppb
B- 4.6 ppb
10/18/90 (last time sampled)
B - 260 ppb
TPH as gas - 3,200 ppb
TPH as diesel - 2,160 ppb
0
20
40
SCALE IN FEET
Harding Lawson Associates
Engineering and Environmental Services
HLA
Proposed Groundwater Interception Trench
Former Texaco Station
500 Grand Avenue
Oakland, California
PLATE
7
DRAWN
S. Patel
JOB NUMBER
2251,114.03
APPROVED
JSH
DATE
11/09/90
REVISED DATE



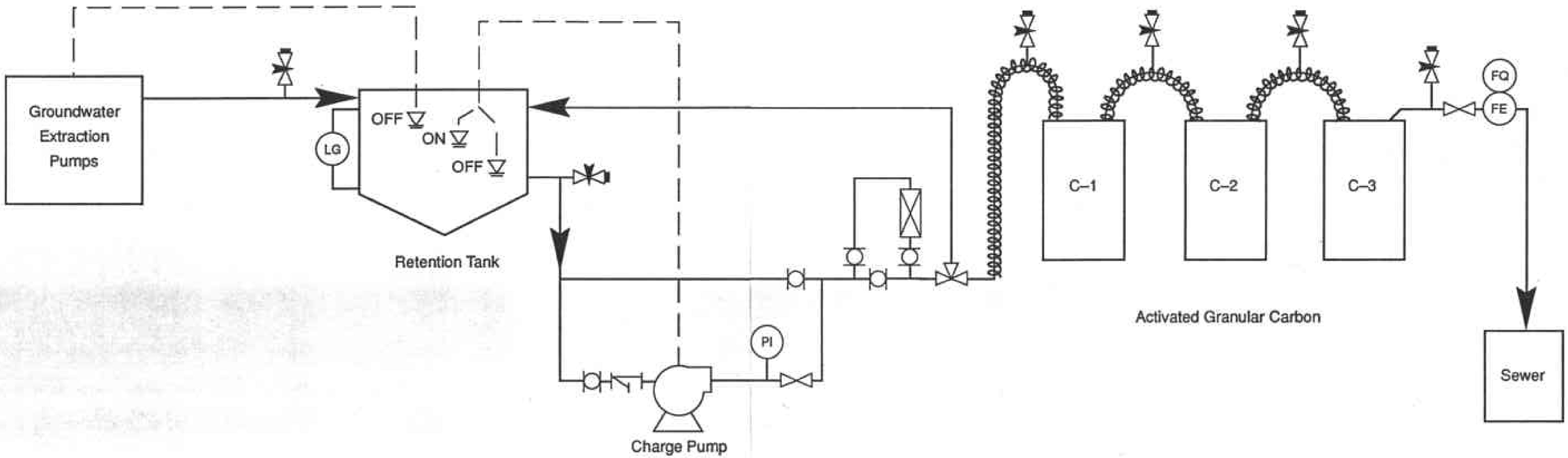
Trench Side View

Harding Lawson Associates
Engineering and Environmental Services

Conceptual Interception Trench Design
Former Texaco Station
500 Grand Avenue
Oakland, California

PLATE **8**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSK	11/13/90	



LEGEND

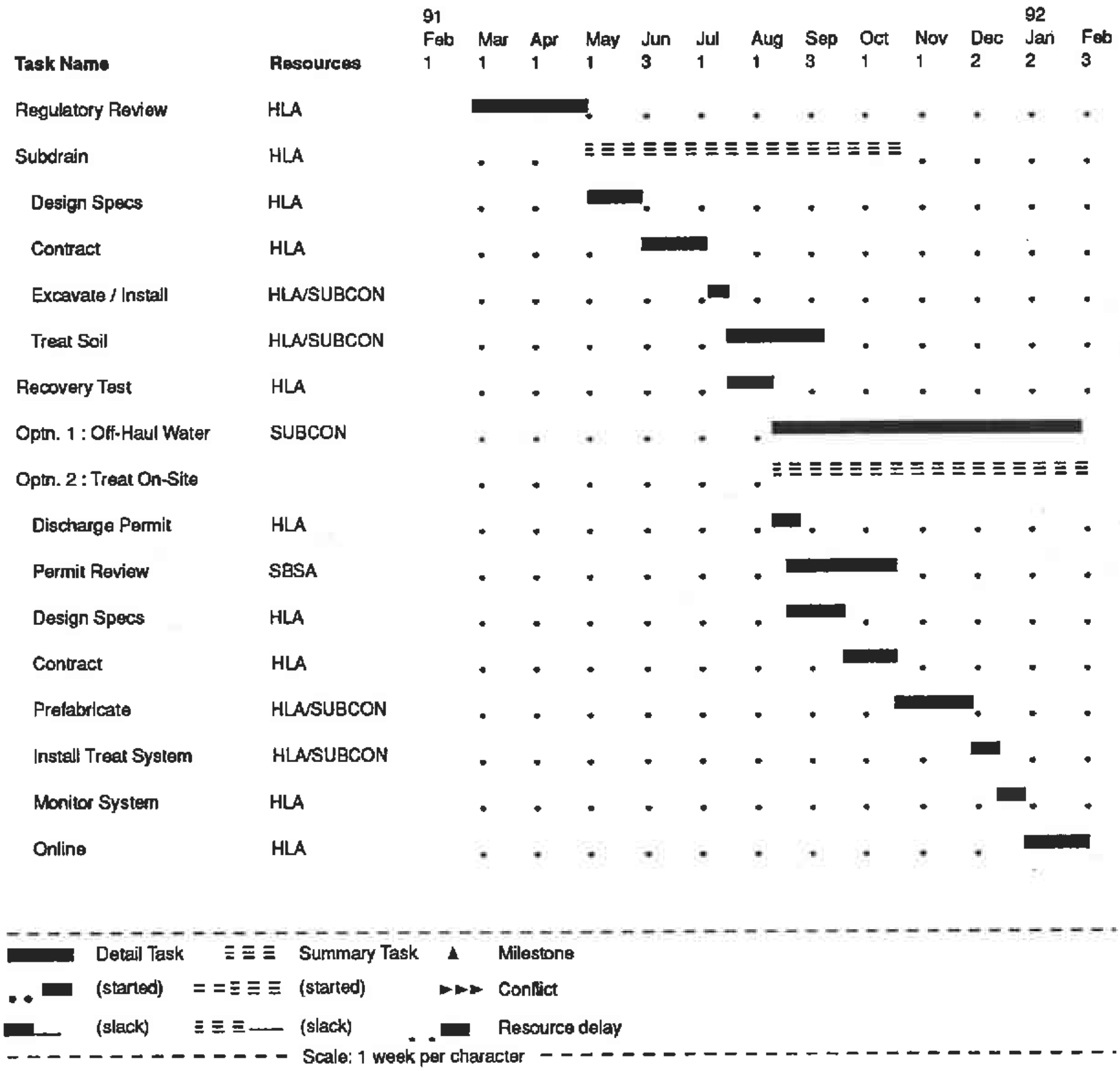
Local Instrument	Control Valve
FE Flow Element	Bag Filter
FQ Flow Totalizer	Gate Valve
LG Level Gauge	Sampling Valve (needle valve)
PI Pressure Indicator	Strainer
Water Discharge Line	Pressure Relief Valve (psig)
Instrument Control Line	Ball valve
Flexible Hose	

Harding Lawson Associates
Engineering and Environmental Services

Conceptual Groundwater Treatment System
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE 9

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSH	11/09/90	12/12/90



Harding Lawson Associates
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Environmental Services

Anticipated Remediation Schedule
Former Texaco Service Station
500 Grand Avenue
Oakland, California

PLATE
10

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
S. Patel	2251,114.03	JSA	11/05/90	12/05/90

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JSH/RS/mlw 031795P/R41

QUALITY CONTROL REVIEWER

Michael A. Sides
Senior Environmental Engineer