**HYDRO
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ENVIRONMENTAL
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of

CLOSURE REQUEST REPORT

Former Mobil Service Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

Prepared for:

Ms. Tara Lynch
Mobil Oil Corporation
3225 Gallows Road, Room 2M211
Fairfax, VA 22037

Prepared by:

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.
2394 Mariner Square Drive, Suite 2
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HETI Job No. 8-019.2

March 8, 1996

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March 12, 1996

8-019.2

Ms. Amy Leech
Alameda County Department of
Environmental Health
Hazardous Materials Division
1131 Harbor Bay Parkway
Alameda, CA 94502

Re: Former Mobil S/S No. 10-L1X, 15884 Hesperian Boulevard, San Lorenzo, CA

Dear Ms. Leech:

Enclosed please find one copy of Hydro-Environmental Technologies, Inc.'s (HETI's) Closure Request Report for the above-referenced site. No further activities will be conducted at the site until a response is received from ACDEH.

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

Sincerely,
HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

FRANCES MARONI

Frances H. Maroni
Project Manager

enclosure

cc: Ms. Tara Lynch - Mobil Oil Corporation, Fairfax, VA (w/o enclosure)

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1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of this report is to present a summary of results of field activities conducted by Hydro-Environmental Technologies, Inc. (HETI) and other consultants at Former Mobil Oil Service Station No. 10-L1X located at 15884 Hesperian Boulevard, San Lorenzo, California (Figures 1 and 2). Underground storage tank (UST) excavation and removal as well as drilling of soil borings and installation of monitoring wells has occurred and monitoring and sampling has been performed at the site since August 1986. Based upon the results of the soil and water sampling, a request for closure is being submitted.

1.2 Site Location and Background

The following narrative is a summary of activities to date at the site:

The site was previously a Mobil gasoline service station located at the northern corner of the intersection of Hesperian Boulevard and Post Office Street in San Lorenzo, California. It is presently a paved parking lot for a shopping mall. Figure 2 shows the vicinity of the site, and Figure 3 shows the layout of the site and the location of existing monitoring wells.

In March 1986, three gasoline underground storage tanks (USTs) and one used oil UST were removed from the site and four fiberglass USTs were installed. In July 1986, Kaprealian Engineering, Inc. (KEI) installed four two-inch diameter monitoring wells (MW-1 through MW-4) on-site. In December 1987, in preparation to abandon the site, the four fiberglass USTs were removed and the tank pit was over-excavated.

From January to March 1988 approximately 620 cubic yards of soil were excavated. During over-excavation, well MW-2 was destroyed. In August 1988 KEI installed one two-inch diameter monitoring well designated MW-2.

In October 1991, HETI conducted further subsurface investigation. After HETI's initial site inspection to locate the wells, the following conditions were observed: monitoring well MW-2 was found in good condition, the casing to MW-3 was broken off and debris had filled the well, and wells MW-1 and MW-4 could not be located and their existence/condition is unknown.

In January 1992, HETI installed three monitoring wells on-site (MW-5, MW-6 and MW-7) and properly destroyed monitoring well MW-3. Results of that phase of the investigation were presented in HETI's *Phase I Report* dated May 7, 1992.

In August 1993, HETI installed one additional downgradient monitoring well (MW-8), off-site on the southwestern side of Hesperian Boulevard. Results of that phase of the investigation were presented in HETI's *Phase II Subsurface Investigation and Quarterly Monitoring Report* dated September 16, 1993. All monitoring well and soil sample locations are shown on the Site Plan (Figure 3).

A revised sampling program was approved by the Alameda County Department of Environmental Health (ACDEH) and was implemented at the site. All wells, MW-2 and MW-5 through MW-8, were sampled on a biannual basis. The wells were last sampled in ~~February~~ August 1995.

1.3 Investigative Methods.

Standard protocols for soil sampling, ground water monitoring well design, installation, and development, and ground water monitoring and sampling have been included in selected reports by the previous consultant.

HETI's standard protocols for drilling, soil sampling, ground water monitoring well design, installation, and development, and ground water monitoring and sampling are included in Appendix A. The laboratory quality assurance/quality control from Sequoia Analytical was reviewed and appeared appropriate for the investigations.

2.0 EXTENT OF SOIL AND GROUND WATER IMPACT

In March 1986, soil samples collected from beneath the gasoline UST ends during tank removal (#1 through #6 and #103) were analyzed for total petroleum hydrocarbons as gasoline (TPHg). TPHg was detected above the laboratory method detection limit (MDL) in all the soil samples collected. Concentrations ranged from 7.0 milligrams per kilogram mg/kg (#103) to 1,100 mg/kg (#3). Also, a soil sample designated #8 collected from the used oil tank pit during removal of the used oil tank was analyzed for waste oil (W.O.) using EPA Method 3510 (modified). W.O. was detected in a concentration of 360 mg/kg.

In July 1986 no soil samples were collected from the borings during installation of monitoring wells MW-1 through MW-4. In August 1988 well MW-2 was reinstalled and soil samples collected from depths of 5 and 10 feet below ground surface (bgs) were analyzed for TPHg and benzene, toluene, ethylbenzene and xylenes (BTEX). Neither TPHg nor BTEX compounds were detected above the laboratory MDLs in both soil samples.

In January 1992 soil samples were collected at various depths ranging from 5.0 feet bgs to 16.0 feet bgs from borings B-5 through B-8 and analyzed for TPHg and BTEX. The soil samples collected from boring B-5 was also analyzed for total petroleum hydrocarbons as diesel (TPHd), total oil and grease (TOG), halogenated volatile organics (HVO) and the five LUFT metals: organic lead (O-Pb), cadmium (Cd), chromium (Cr), nickel (Ni) and zinc (Zn). Neither TPHg nor BTEX compounds were detected above the laboratory MDLs in any of the soil samples collected. Additionally, neither TPHd nor HVO were detected above the laboratory MDLs in the soil samples collected from boring B-5. Soil sample locations and results are shown on Figure 4.

Concentrations of the five LUFT metals detected in soil samples collected from the 1992 soil borings ranged from ND (O-Pb) to 58 μg/kg (Zn). The concentrations of metals detected in soil samples collected at the site appear to be native background levels. U.S. Geological Survey Professional Paper Number 1270 presents background concentrations of metals in native soils across the U.S. Background levels of chromium, nickel and zinc in native San Francisco Bay Area soils are typically greater than 100 ppm, 30 ppm and 120 ppm, respectively. The maximum concentrations of chromium and zinc detected in the soil samples collected are within the expected native concentrations. Native concentrations were not presented for cadmium, though the concentrations detected in the soil samples were at or below the laboratory MDL. Soil sample analytical results are presented as Table 1.

Monitoring and sampling was performed on the wells from August 1986 through Aug ~~February~~ 1995. Quarterly monitoring and sampling was performed on wells MW-2 and MW-5 through MW-8 from February 1992 through August 1994. Biannual monitoring and sampling was performed on wells MW-2 and MW-5 through MW-8 from August 1994 through February 1995. The most recent ground water sample results are presented graphically on Figure 5, Hydrocarbon Concentrations in Ground Water. Ground water elevations and sample analytical results are presented as Table 2.

Ground water samples collected from well MW-5 have been analyzed for TPHd, TOG, HVO, semi-volatile organics (SVO),polychlorinated biphenyls (PCB) and the five LUFT metals. All sample analytical results have been below the laboratory MDLs except for zinc which was at the laboratory MDL.

In the past, TPHg was detected in concentrations exceeding the laboratory MDL of 50 μg/l in samples collected from wells MW-1, MW-2 and MW-5 through MW-7. Since August 1993, TPHg has not been detected above the laboratory MDL in any of the samples collected from any of the accessible wells except well MW-7. The TPHg concentration in well MW-7 has been below 100 μg/l since November 1992.

Although benzene was detected in a concentration exceeding the maximum contaminant level (MCL) of 1 microgram per liter (μg/l) in samples collected in the past, concentrations of benzene above the MCL have not been detected in samples collected since May 1994. Currently, benzene is not detected above the laboratory method detection limit of 0.5 μg/l in samples collected from any of the wells.

3.0 LOCAL AND REGIONAL HYDROGEOLOGY

3.1 Hydrogeology

Hydrogeologically, the site is located within the San Lorenzo Cone, which drains to the San Francisco Bay. The San Lorenzo Cone is a portion of the East Bay Plain ground water basin. The site is underlain by older alluvium of the Bay Plain, under which lies fractured basement rock. The older alluvium consist of gravels, sands and clays. The underlying alluvium contains aquifers associated with the San Lorenzo Cone and other east bay plain aquifers (Alameda County Flood Control and Water Conservation District, 1984). Ground water quality does not appear to be impacted by upgradient or nearby sources. → ? Chevron site next door?

Ground water elevations were calculated and ground water contours were drawn from February 1992 through February 1995 on a quarterly basis. Shallow ground water is present approximately 10 feet bgs, and flows at a gradient of 0.0026 to the southwest. The latest ground water contour map is included as Figure 6.

3.2 Beneficial uses

The East Bay Plain ground water has beneficial uses which are derived primarily from deeper aquifers greater than 400 feet bgs within the alluvial fans. The current uses include municipal and domestic, industrial process and service, and agricultural water supplies. Shallow aquifers above 50 feet bgs are used for irrigation purposes within the City of San Lorenzo. However, these shallow aquifers are of low yield and generally low water quality. Many older homes have unreported irrigation wells. Except for monitoring wells associated with the site and city related wells, no other wells were reported in available records within the one-half mile radius of the site. → Chevron site has MWs.

4.0 REMEDIAL ACTIVITIES

Remedial activity at the site has consisted of removal of the former underground storage tanks and disposal under manifest and excavation and offsite disposal of over 620 cubic yards of soil. —— ? Manifests ? KEI reported that soil was aerated on site & returned to UST pit.

Dissolved concentrations of hydrocarbons in ground water have substantially declined over time due to natural biodegradation.

5.0 SUMMARY AND EVALUATION OF RESULTS

Results of field activities and laboratory analysis of samples collected during previous investigations and quarterly and biannual monitoring and sampling are discussed below.

- Three gasoline USTs and one used oil UST were excavated and removed and four fiberglass USTs were installed at the site in March 1986. In December 1987 the four fiberglass USTs were removed along with approximately 620 cubic yards of soil. The USTs were all disposed of under manifest.

  confirmation
  Soil results?

- Soils beneath the site, encountered during site investigations, appear to be alluvial sediments comprised of medium dense silty sand from ground surface to approximately 6 feet bgs, underlain by dense clayey sand and silty and sandy clay from 6 feet bgs to 22 feet bgs. Below 22 feet bgs, the sediments consisted of stiff silty clay to 25 feet bgs, the total depth explored.

  which one? '86

- TPHg was detected above the laboratory MDL in all the soil samples collected from beneath the gasoline UST ends during tank removal. Concentrations ranged from 7.0 mg/kg (#103) to 1,100 mg/kg (#3). Also, W.O. was detected in a concentration of 360 mg/kg in soil sample #8, collected from the used oil tank pit.

- No soil samples were collected from the borings during installation of monitoring wells MW-1 through MW-4. Well MW-2 was reinstalled and soil samples were collected from the boring. Neither TPHg nor BTEX compounds were detected above the laboratory MDLs in both soil samples collected during reinstallation.

- Neither TPHg nor BTEX compounds were detected above the laboratory MDLs in any of the soil samples collected from borings B-5 through B-8. Additionally, neither TPHd nor HVO were detected above the laboratory MDLs in the soil samples collected from boring B-5.

- Organic lead was not detected above the MDL in the soil sample collected from boring B-5. The maximum concentrations of chromium and zinc detected in the soil samples collected from boring B-5 were within the expected native concentrations. The cadmium concentrations detected were at or below the laboratory MDL.

- Ground water samples collected from well MW-5 have been below the laboratory MDLs for TPHd, TOG, HVO, SVO, PCB and the five LUFT metals, except for zinc which was at the laboratory MDL.

- Ground water sample results for TPHg from all the accessible on-site and off-site wells, except well MW-7 did not indicate concentrations exceeding the MDL since August 1993. TPHg sample results from on-site well MW-7 have been below 100 μg/l since November 1992.

- Currently, benzene is not detected in concentrations exceeding the laboratory MDL in any of the ground water samples collected from the five accessible wells.

- In conclusion, the results of the investigations and quarterly and biannual monitoring and sampling indicate that the previous source of hydrocarbons which had been impacting soil and to a lesser extent, shallow ground water has been removed. Any remaining TPHg concentrations in the soil are not impacting ground water above MCLs or other EPA suggested levels. All hydrocarbon bearing soil has been removed or has biodegraded to levels which do not appear to be mobile. Following recent Regional Water Quality Control Board guidelines, this former station is a candidate for closure as a low risk site.

6.0 REQUEST FOR CLOSURE

The evaluation of the site investigations and quarterly and biannual monitoring and sampling indicates that the hydrocarbon source in the soil has been removed and will not further impact ground water at the site. Based upon the above evaluation, HETI requests closure for the site and proposes the following tasks to complete closure of the site.

6.1 Well Destruction

After approval of the request for closure, permit applications for well destruction will be submitted to Zone 7. After the permit application and this portion of the workplan have been approved, the existing monitoring, wells will be destroyed. Two monitoring wells (MW-1 and MW-4) will be located using a locator service.

The wells will be destroyed by pressure grouting through the casing and filter pack materials. The casing and borehole will be backfilled with neat cement or other approved material from total depth to surface. This method of well destruction meets Zone 7 Water Agency's standards of well destruction and Regional Water Quality Control Board guidelines.

6.2 Coordination of Water and Debris Disposal

Well destruction may produce small amounts of water and debris which will require off-site disposal. Rinseate water will be stored on-site in 55-gallon drums with tight fitting lids. Debris will be stored on plastic and prepared for disposal. HETI will coordinate with a separate contractor for the removal of these wastes.

6.3 Preparation of Well Destruction Report.

A final report will be prepared documenting well destruction and disposal of associated debris.

4.0 CERTIFICATION

This report was prepared under the supervision of a registered geologist. All statements, conclusions and recommendations are based solely upon confirmation boring evaluation and review of available reports by Hydro-Environmental Technologies, Inc.

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

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

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

Prepared by:

FRANCES MARONI

Frances Maroni
Project Manager

Reviewed by:

Gary Pischke, R.G., C.E.G.
Senior Geologist

REGISTERED GEOLOGIST
GARY PISCHKE
No. 1501
CERTIFIED
ENGINEERING
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STATE OF CALIFORNIA

TABLES

TABLE 1

SOIL SAMPLE ANALYTICAL RESULTS

Former Mobil Service Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, CA

Sample No.	Sampling Depth	Sampling Date	W.O. (mg/kg)	TPHd (mg/kg)	TPHg (mg/kg)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)
1	14.0	3/25/86	---	---	75	---	---	---	---
2	14.0	3/25/86	---	---	160	---	---	---	---
3	15.0	3/25/86	---	---	1,100	---	---	---	---
4	16.0	3/25/86	---	---	210	---	---	---	---
5	14.0	3/25/86	---	---	39	---	---	---	---
6	14.0	3/25/86	---	---	37	---	---	---	---
103	14.0	3/25/86	---	---	7.0	---	---	---	---
8	10.0	3/25/86	360	---	---	---	---	---	---
MW-2-5'	5.0	8/8/88	---	---	ND<1.0	ND<0.05	ND<0.1	ND<0.1	ND<0.1
MW-2-10'	10.0	8/8/88	---	---	ND<1.0	ND<0.05	ND<0.1	ND<0.1	ND<0.1
B-5-5'	5.0	1/27/92	---	ND<1.0	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-5-10'	10.0	1/27/92	---	ND<1.0	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-5-15'	15.0	1/27/92	---	ND<1.0	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-6-4.5'	4.5	1/27/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-6-9.5'	9.5	1/27/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-6-14.5'	14.5	1/27/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-7-6'	6.0	1/28/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-7-11'	11.0	1/28/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-8-6'	6.0	1/28/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005

TABLE 1

SOIL SAMPLE ANALYTICAL RESULTS

Former Mobil Service Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, CA

Sample No.	Sampling Depth	Sampling Date	W.O. (mg/kg)	TPHd (mg/kg)	TPHg (mg/kg)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)
B-8-11'	11.0	1/28/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005
B-8-16'	16.0	1/28/92	---	---	ND<1.0	ND<0.005	ND<0.005	ND<0.005	ND<0.005

Sample No.	Depth (feet)	Sampling Date	TOG (mg/kg)	HVO (µg/kg)	O-Pb (µg/kg)	Cd (µg/kg)	Cr (µg/kg)	Ni (µg/kg)	Zn (µg/kg)
B-5-5'	5.0	1/27/92	4.2	ND<0.005	ND<.050	ND<0.50	31	38	58
B-5-10'	10.0	1/27/92	4.8	ND<0.005	ND<.050	ND<0.50	43	43	58
B-5-15'	15.0	1/27/92	4.8	ND<0.005	ND<.050	0.53	29	36	48

<u>Notes:</u>

Sample No. : Sample designation.
Depth : Depth at which soil sample was collected.
Date : Date sample was collected.
W.O. : Waste oil using EPA Method 3510 (modified).
TPHd : Total petroleum hydrocarbons as gasoline using EPA Method 8015 (modified).
TPHg : Total petroleum hydrocarbons as gasoline using EPA Method 8015 (modified).
BTEX : Benzene, Toluene, Ethylbenzene and total Xylenes using EPA Method 8020 (modified).
mg/kg: Millograms per kilogram.
ND : Not detected in concentrations exceeding the indicated laboratory method detection limit
TOG : Total oil and grease by EPA Method 413.2 (I.R.)
HVO : Halogenated volatile organics by EPA Method 8010
O-Pb : Organic lead by California LUFT Manual, 12/87
Cd, Cr,
Ni, Zn : Cadmium, Chromium, Nickel and Zinc by EPA Method 6000 series

Table 2

GROUND WATER ELEVATIONS AND SAMPLE ANALYTICAL RESULTS

Former Mobil Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

MW-No.	Date	TOC (feet)	DTW (feet)	GWE (feet)	TPHd (µg/L)	TPHg (µg/L)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)
MW-1	8/18/86	87.60	---	---	---	ND<50	ND<1.0	ND<1.0	---	ND<1.0
	12/23/86	87.60	13.5	74.10	---	77	32	4.7	---	2.0
	4/25/87	87.60	13.1	74.50	---	ND<50	ND<1.0	ND<1.0	---	ND<1.0
	9/2/87	87.60	---	---	---	ND<50	ND<1.0	ND<1.0	---	ND<1.0
	8/25/88	87.60	---	---	---	---	---	---	---	---
MW-2	8/18/86	87.64	---	---	---	58,000	4,300	390	---	1,800
	12/23/86	87.64	12.92	74.72	---	4,100	970	96	---	750
	4/25/87	87.64	12.35	75.29	---	660	2.2	ND<1.0	---	9.2
	9/2/87	87.64	---	---	---	710,000	980	3,000	---	33,000
	8/25/88 (1)	87.64	14.70	72.94	---	2,300	63	3.3	ND<0.5	240
	11/1/88	87.64	15.29	72.35	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	2/12/92	31.81	12.74	19.07	---	190	4.4	ND<0.3	4.7	3.8
	5/4/92	31.81	11.36	20.45	---	480	9.1	1.4	4.4	2.3
	8/20/92	31.81	13.80	18.01	---	ND<50	0.99	ND<0.5	ND<0.5	ND<0.5
	11/27/92	31.81	14.30	17.51	---	56	3.2	ND<0.5	0.87	2.1
	2/24/93	31.81	9.73	22.08	---	330	14	ND<0.5	ND<0.5	ND<0.5
	5/19/93	31.81	11.82	19.99	---	100	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	8/19/93	31.81	12.27	19.54	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	11/19/93	31.81	12.91	18.90	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	2/18/94 (2)	31.81	10.30	21.51	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	5/24/94	31.81	11.25	20.56	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	8/24/94	31.81	12.77	19.04	---	---	---	---	---	---
	2/17/95	31.81	9.99	21.82	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-3	8/18/86	87.77	---	---	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5
	12/23/86	87.77	13.75	74.02	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5

Table 2

GROUND WATER ELEVATIONS AND SAMPLE ANALYTICAL RESULTS

Former Mobil Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

MW-No.	Date	TOC (feet)	DTW (feet)	GWE (feet)	TPHd (µg/L)	TPHg (µg/L)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)
MW-3	4/25/87	87.77	13.35	74.42	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5
	9/2/87	87.77	---	---	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5
	8/25/88	87.77	---	---	---	---	---	---	---	---
MW-4	8/18/86	87.82	---	---	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5
	12/23/86	87.82	13.48	74.34	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5
	4/25/87	87.82	13.09	74.73	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5
	9/2/87	87.82	---	---	---	ND<50	ND<0.5	ND<0.5	---	ND<0.5
	8/25/88	87.82	---	---	---	---	---	---	---	---
MW-5	2/12/92	32.92	13.59	19.33	ND<50	0.3	ND<0.3	ND<0.3	ND<0.3	ND<0.3
	5/4/92	32.92	12.25	20.67	ND<50	ND<30	ND<0.3	ND<0.3	ND<0.3	ND<0.3
	8/20/92	32.92	14.62	18.30	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	11/27/92	32.92	15.14	17.78	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	2/24/93	32.92	10.57	22.35	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	5/19/93	32.92	11.66	21.26	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	8/19/93	32.92	13.01	19.91	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	11/19/93	32.92	13.69	19.23	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	2/18/94 (2)	32.92	11.10	21.82	---	---	---	---	---	---
	5/24/94	32.92	12.03	20.89	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	8/24/94	32.92	13.59	19.33	---	---	---	---	---	---
	2/17/95	32.92	10.87	22.05	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-6	2/12/92	32.68	13.57	19.11	---	2,700	14	3.5	27	39
	5/4/92	32.68	12.23	20.45	---	ND<30	ND<0.3	ND<0.3	ND<0.3	ND<0.3
	8/20/92	32.68	14.64	18.04	---	ND<50	ND<0.5	ND<0.5	ND<0.5	3.8

Table 2

GROUND WATER ELEVATIONS AND SAMPLE ANALYTICAL RESULTS

Former Mobil Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

MW-No.	Date	TOC (feet)	DTW (feet)	GWE (feet)	TPHd (µg/L)	TPHg (µg/L)	B (µg/L)	T (µg/L)	E (µg/L)	X (µg/L)
MW-6	11/27/92	32.68	15.14	17.54	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	2/24/93	32.68	10.62	22.06	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	5/19/93	32.68	11.66	21.02	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	8/19/93	32.68	13.06	19.62	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	11/19/93	32.68	13.73	18.95	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	2/18/94 (2)	32.68	11.20	21.48	---	---	---	---	---	---
	5/24/94	32.68	12.11	20.57	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	8/24/94	32.68	13.60	19.08	---	---	---	---	---	---
	2/17/95	32.68	10.85	21.83	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
MW-7	2/12/92	33.08	13.90	19.18	---	ND<30	ND<0.3	ND<0.3	ND<0.3	ND<0.3
	5/4/92	33.08	12.60	20.48	---	640	4.5	ND<0.6	11	14
	8/20/92	33.08	14.96	18.12	---	220	1.2	ND<0.5	3.8	4.3
	11/27/92	33.08	15.49	17.59	---	82	1.6	ND<0.5	4.3	3.6
	2/24/93	33.08	10.97	22.11	---	82	1.5	ND<0.5	6.0	4.0
	5/19/93	33.08	12.09	20.99	---	67	0.85	ND<0.5	6.4	3.8
	8/19/93	33.08	13.48	19.60	---	88	1.7	ND<0.5	9.0	4.8
	11/19/93	33.08	14.10	18.98	---	50	ND<0.5	ND<0.5	1.5	ND<0.5
	2/18/94 (2)	33.08	11.55	21.53	---	61	1.2	ND<0.5	8.0	3.2
	5/24/94	33.08	12.48	20.60	---	83	0.95	ND<0.5	10	4.0
	8/24/94	33.08	13.98	19.10	---	77	0.57	ND<0.5	6.9	2.8
	2/17/95	33.08	11.25	21.83	---	71	ND<0.5	ND<0.5	4.3	2.2
MW-8	8/19/93	31.31	12.21	19.10	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	11/19/93	31.31	12.84	18.47	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	2/18/94 (2)	31.31	10.41	20.90	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5
	5/24/94	31.31	11.21	20.10	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5

Table 2

GROUND WATER ELEVATIONS AND SAMPLE ANALYTICAL RESULTS

Former Mobil Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

MW-No.	Date	TOC (feet)	DTW (feet)	GWE (feet)	TPHd (μg/L)	TPHg (μg/L)	B (μg/L)	T (μg/L)	E (μg/L)	X (μg/L)
MW-8	8/24/94	31.31	12.71	18.60	---	---	---	---	---	---
	2/17/95	31.31	9.94	21.37	---	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5

MW-No.	Date	TOG (mg/L)	HVO (μg/L)	SVO (μg/L)	PCB (μg/L)	Cd (mg/L)	Cr (mg/L)	Ni (mg/L)	Zn (mg/L)	O-Pb (mg/L)
MW-5	2/12/92	ND<1.0	ND<0.5-5.0	---	---	ND<0.010	ND<0.010	ND<0.050	ND<0.010	ND<0.050
	5/4/92	ND<1.0	ND<0.5-5.0	---	---	ND<0.010	ND<0.010	ND<0.050	ND<0.010	ND<0.050
	8/20/92	ND<1.0	ND<0.5-5.0	ND<2-10	ND<0.5-2.0	ND<0.010	ND<0.010	ND<0.050	0.012	ND<0.050

<u>Notes:</u>

MW No. :	Monitoring well number.
Date :	Ground water sample collection date.
TOC :	Elevation at the north side of the top of the well casing referenced to approximate mean sea level.
DTW :	Depth to water.
GWE :	Ground water elevation.
TPHd :	Total petroleum hydrocarbons as diesel by EPA Method 8015 .
TPHg :	Total petroleum hydrocarbons as gasoline by EPA Method 8015.
BTEX :	Benzene, Toluene, Ethylbenzene and total Xylenes by EPA Method 8020.
TOG :	Total oil and grease by EPA Method 413.2 (I.R.).
HVO :	Halogenated volatile organics by EPA Method 8010.
SVO:	Semi-volatile organics by EPA Method 8270 GC/MS.
PCB:	Polychlorinated biphenyls by EPA Method 8080.

Table 2

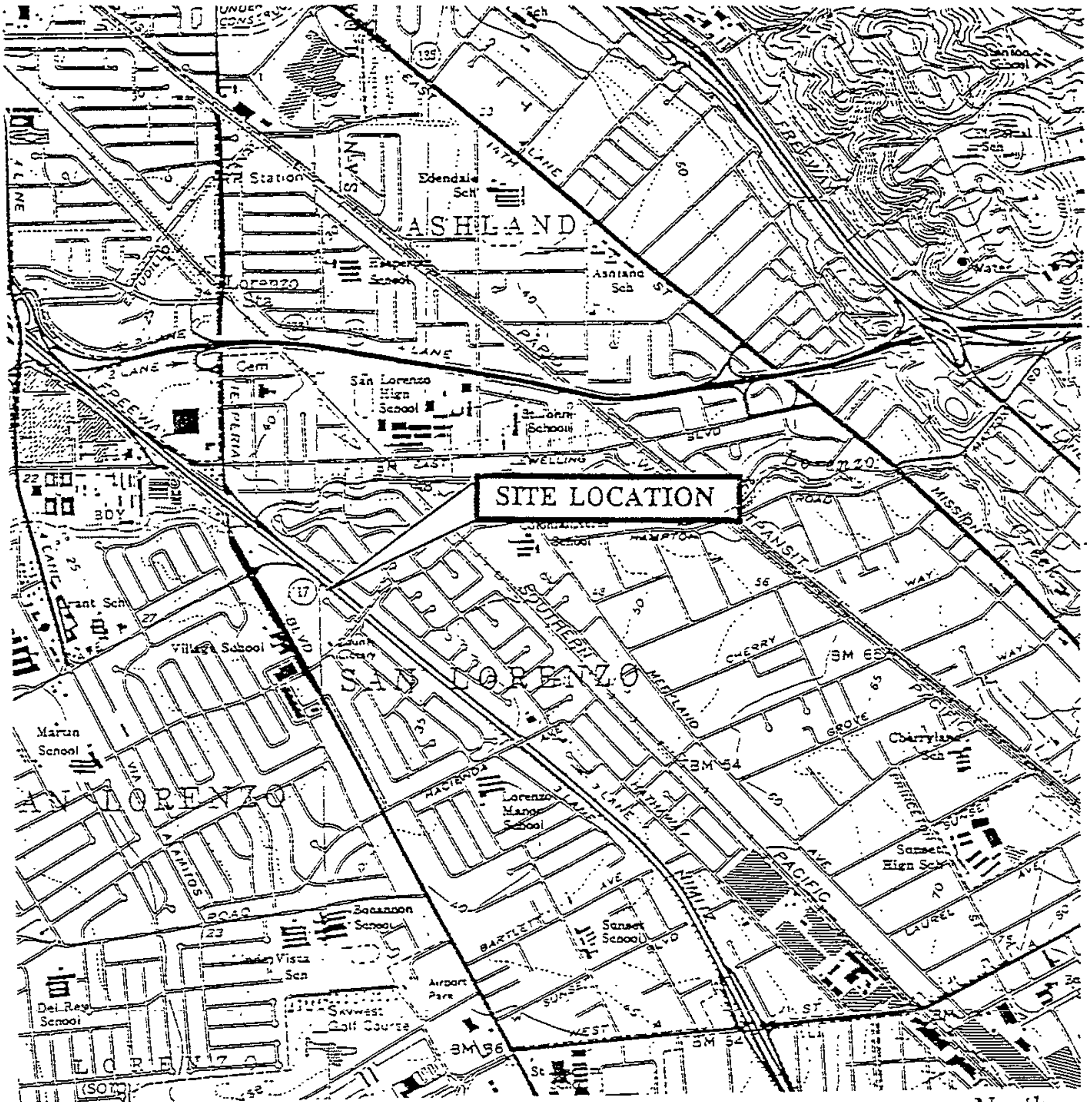
GROUND WATER ELEVATIONS AND SAMPLE ANALYTICAL RESULTS

Former Mobil Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

Notes (con't) :

Cd, Cr, Ni, Zn :	Cadmium, chromium, nickel and zinc by EPA Method 6000.
O-Pb	Organic lead by California LUFT Manual (revised).
µg/L :	Micrograms per liter.
mg/L :	Milligrams per liter.
---	Not measured, not analyzed or not known to HETI.
ND :	Not detected in concentrations exceeding the indicated laboratory method detection limit.
(1) :	Monitoring well MW-2 destroyed during tank excavation; well replaced on 8/8/88.
(2) :	Wells gauged on 2/24/94.

FIGURES



North

Source: U.S.Geological Survey
7.5 Minute Quadrangle Maps
Entitled: "San Leandro, California"
and "Hayward, California"
Revised 1980

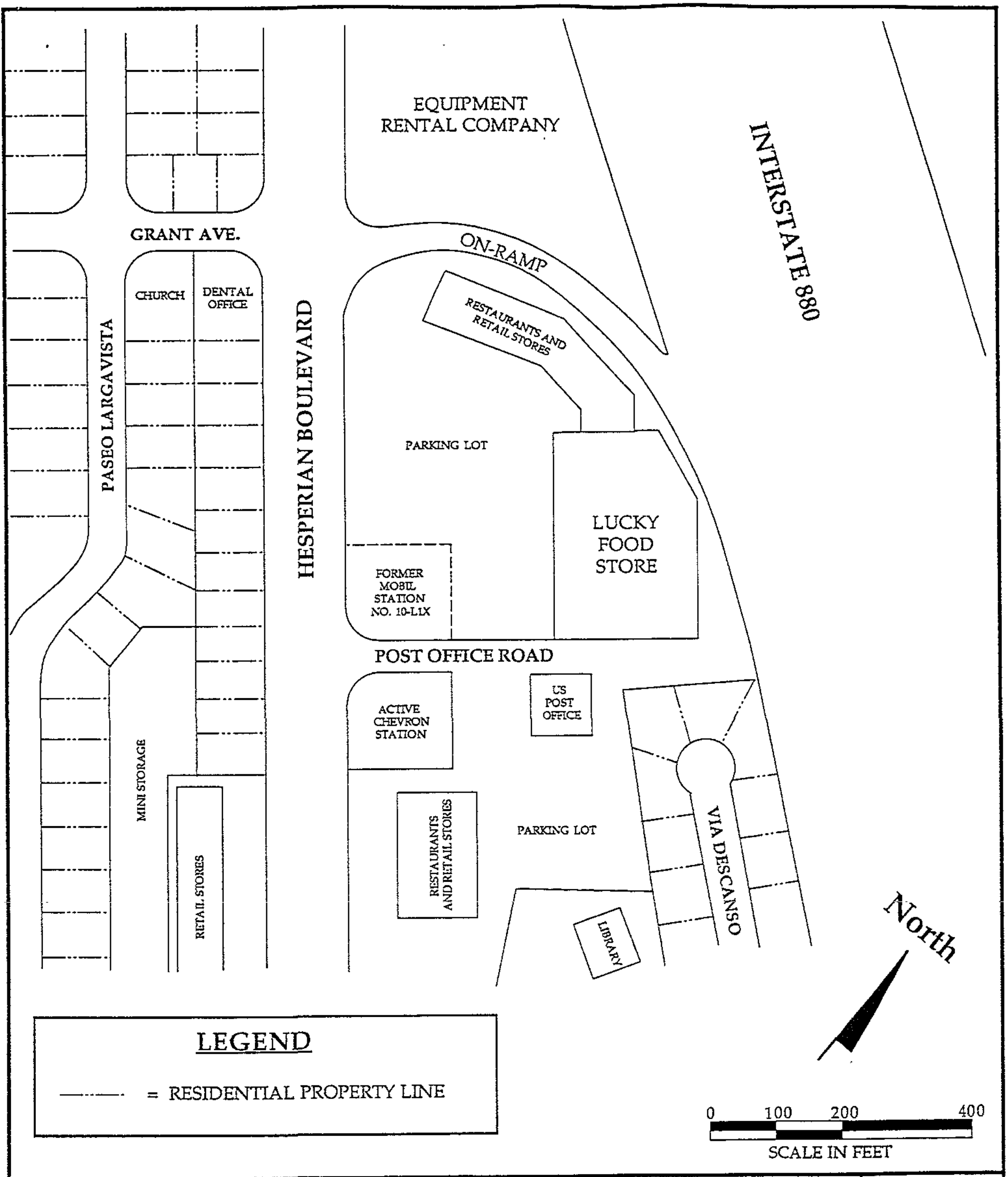
Scale 1:24,000

HYDRO
ENVIRONMENTAL
TECHNOLOGIES, INC.

SITE LOCATION MAP

Former Mobil Service Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

Job No.
8-019
Figure
1



LEGEND

— · — · — = RESIDENTIAL PROPERTY LINE

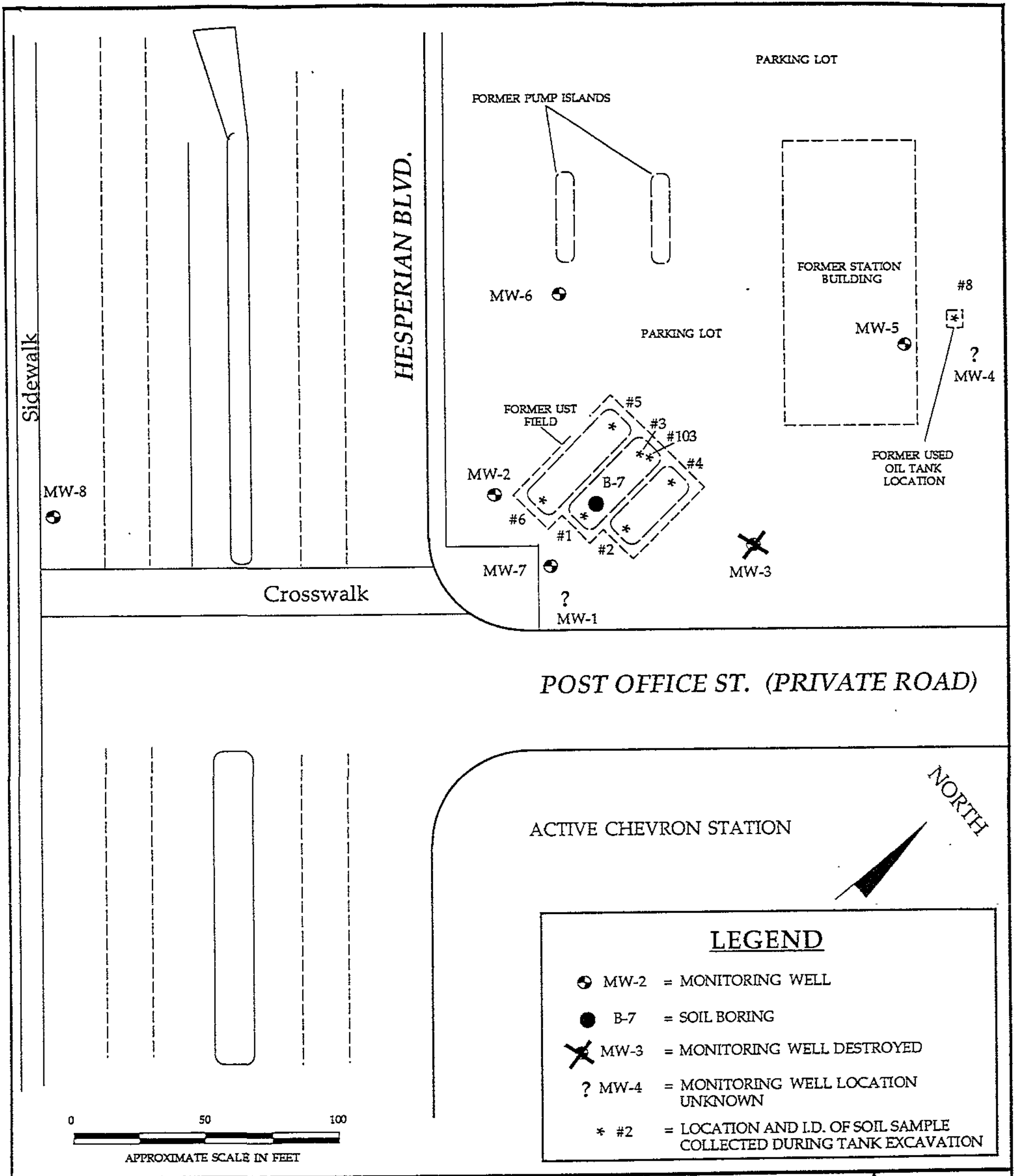
HYDRO
ENVIRONMENTAL
TECHNOLOGIES, INC.

SITE VICINITY MAP

Former Mobil Service Station No. 10-L1X
15884 Hesperian Boulevard
San Lorenzo, California

Figure
2

8-019.2 3/96



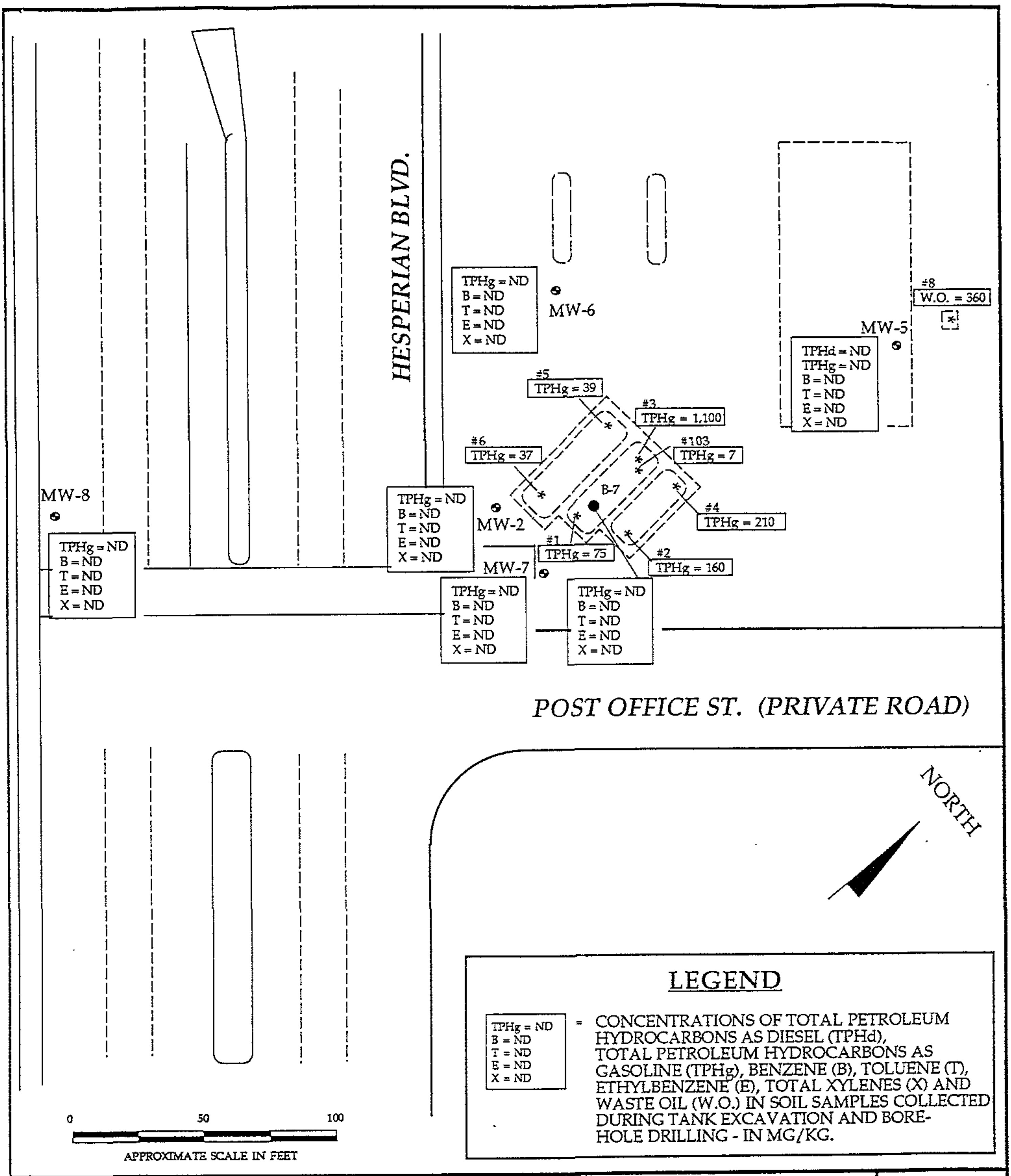
HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

SITE PLAN

Former Mobil Service Station No. 10-L1X
15884 Hesperian Blvd.
San Lorenzo, California

Figure
3

8-019.2 3/96



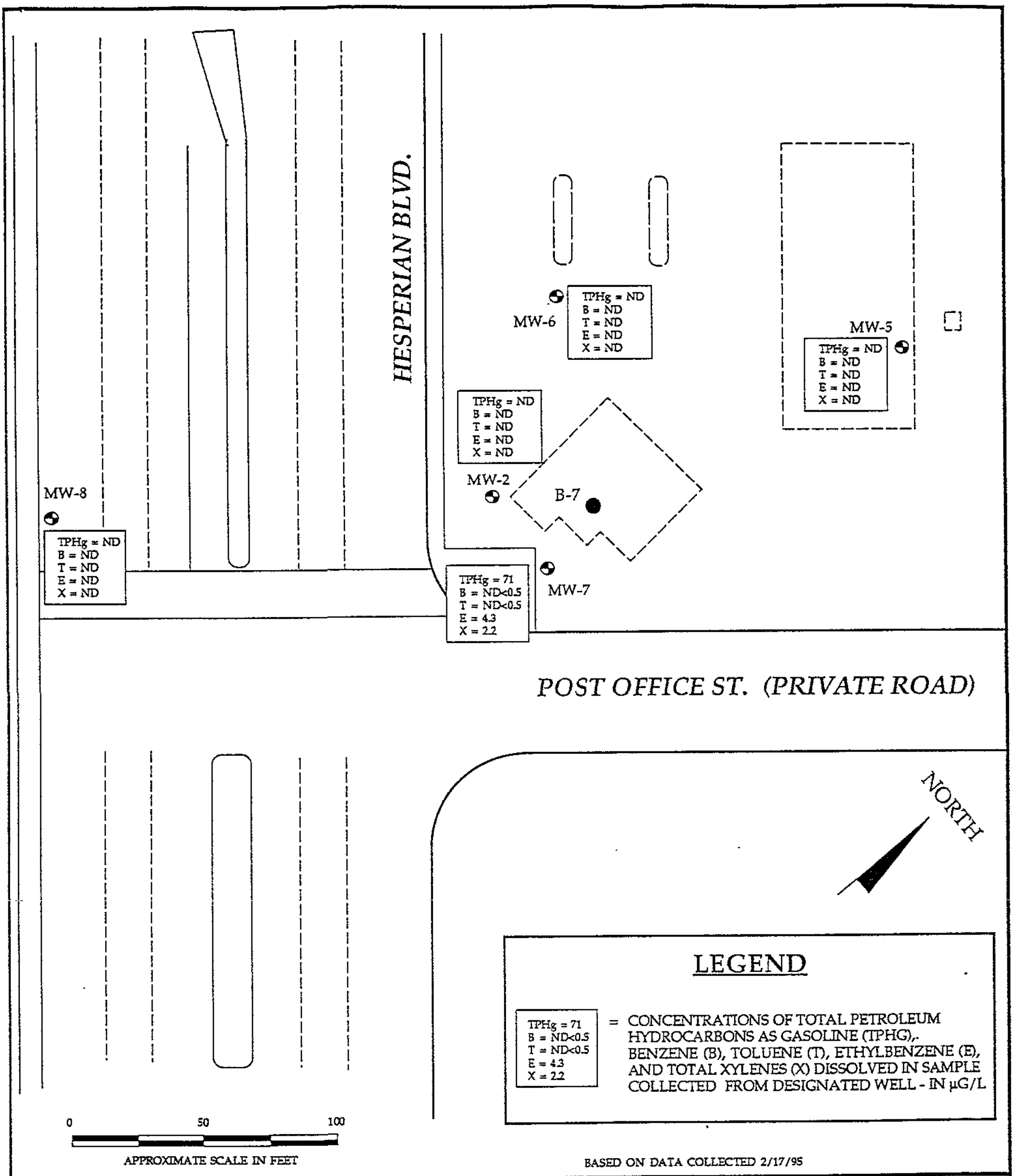
= CONCENTRATIONS OF TOTAL PETROLEUM HYDROCARBONS AS DIESEL (TPHd), TOTAL PETROLEUM HYDROCARBONS AS GASOLINE (TPHg), BENZENE (B), TOLUENE (T), ETHYLBENZENE (E), TOTAL XYLENES (X) AND WASTE OIL (W.O.) IN SOIL SAMPLES COLLECTED DURING TANK EXCAVATION AND BORE-HOLE DRILLING - IN MG/KG.

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.

HYDROCARBON CONCENTRATION IN SOIL
Former Mobil Service Station No. 10-L1X
15884 Hesperian Blvd.
San Lorenzo, California

Figure
4

8-019.2 3/96



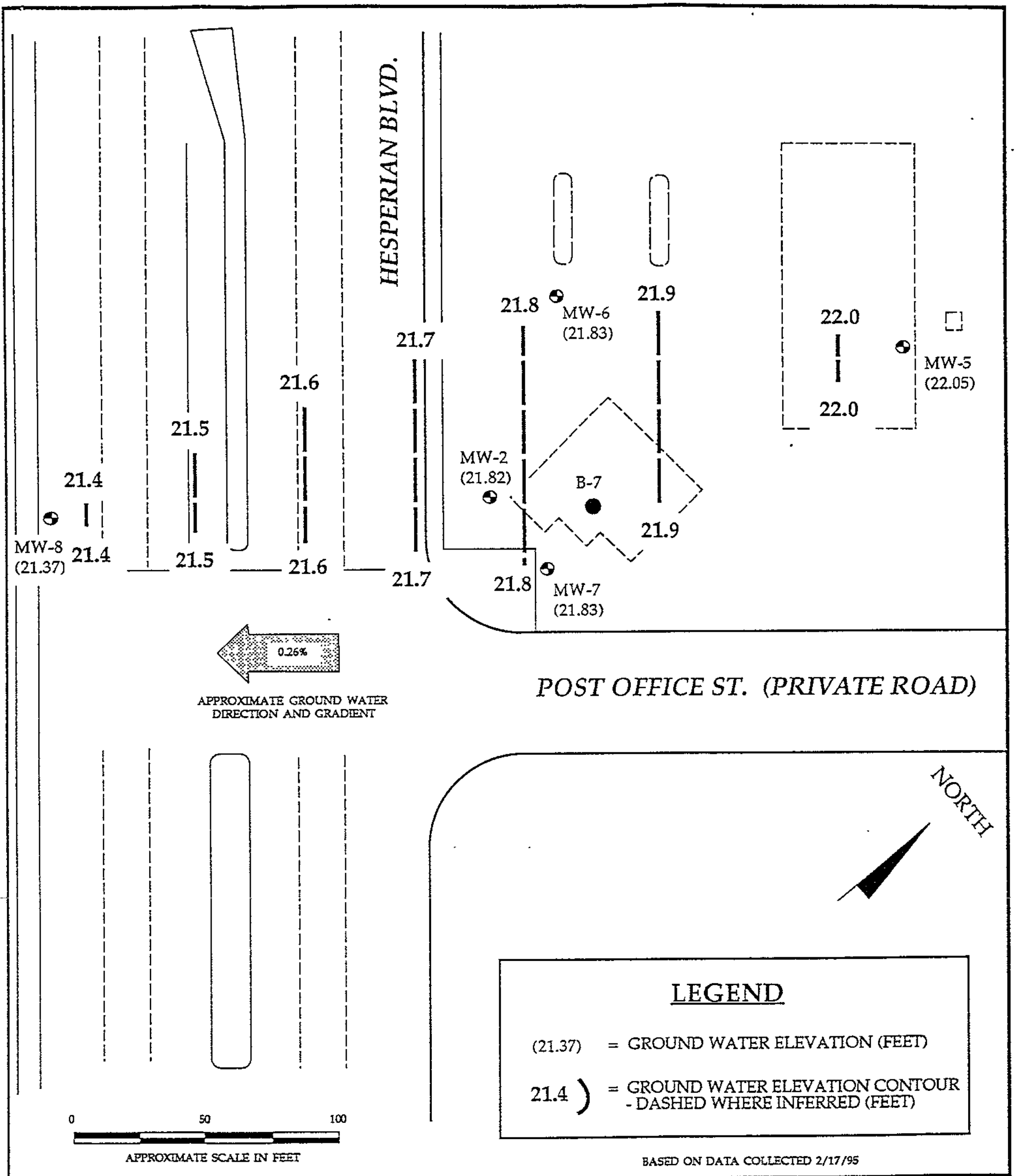
BASED ON DATA COLLECTED 2/17/95

**HYDRO-
ENVIRONMENTAL
TECHNOLOGIES, INC.**

HYDROCARBON CONCENTRATIONS
IN GROUND WATER
Former Mobil Service Station No. 10-L1X
15884 Hesperian Blvd.
San Lorenzo, California

Figure
5

8-019.2 3/96



BASED ON DATA COLLECTED 2/17/95

HYDRO-
ENVIRONMENTAL
TECHNOLOGIES, INC.

GROUND WATER CONTOUR MAP

Former Mobil Service Station No. 10-L1X
15884 Hesperian Blvd.
San Lorenzo, California

Figure
6

8-019.2 3/96

APPENDIX A

HYDRO-ENVIRONMENTAL TECHNOLOGIES, INC.
CALIFORNIA

DRILLING
WELL CONSTRUCTION
AND
SAMPLING PROTOCOLS

November 1992

DRILLING, WELL CONSTRUCTION, AND SAMPLING PROTOCOLS

Drilling Protocol

Prior to any drilling activities, Hydro-Environmental Technologies, Inc. (HETI) will verify that necessary drilling permits have been secured.

Prior to drilling, underground and above ground utilities will be located using Underground Service Alert (USA) and site reconnaissance. To the extent possible, drilling will be conducted so that disruptions of normal business activities at the project site are minimized. HETI shall obtain and review available public data on subsurface geology and, if warranted, the location of wells within a quarter mile of the project site will be identified. Drilling equipment will be inspected for suitability and integrity prior to performing work.

Subsurface investigations are typically performed to assess the lateral and vertical extent of petroleum hydrocarbons or other contaminants which may be present in soils and groundwater. Drilling methods will be selected to optimize field data requirements and to be compatible with known or suspected subsurface geologic conditions.

Shallow soil borings will be drilled dry using a truck-mounted hollow-stem auger drilling rig, unless site conditions favor a different drilling method. Drilling and sampling methods will be consistent with ASTM Method D-1452-80. The auger size will be a minimum of 3-inches nominal outside diameter (O.D.) for borings not to be completed as wells. The auger size will be a minimum of 8-inches nominal O.D. for borings to be completed as wells. No drilling fluids will be used during this drilling method. All augers and drill rods will initially be thoroughly steam cleaned before arriving on-site, to prevent the introduction of contaminants from off-site, and augers and drill rods which are used will be steam cleaned between borings away from boring locations. Working components of the drilling rig (subs, collars and all parts of the rig chassis near the borehole) will also be steam cleaned. Cleaned augers, rods and other tools, if required, will be stored and covered when not in use. Decontamination of drilling equipment will consist of steam cleaning, and/or trisodium phosphate wash. Cleaning operations will be observed and supervised by a representative of HETI. The drilling rig will also be inspected by a representative of HETI to ensure that no fluids (hydraulic or lubricant) are leaking from the equipment.

Soil Sampling Protocol

Soil samples are typically collected at 5-foot intervals, from the ground surface to the total depth of the boring, with a California Modified split-spoon sampler driven 18 to 24 inches ahead of the lead auger by a 140-pound hammer falling a minimum of 30 inches. The sampler will be lined with clean brass or stainless steel tubes. The number of blows necessary to drive the sampler will be recorded on the boring log and well construction diagram (Plate A-1) to help evaluate the consistency of the materials encountered. Additional soil samples may be collected based on significant lithologic changes and/or potential chemical content. All equipment that contacts soil samples will be thoroughly cleaned prior to arrival at the project site and between each individual sample collection point on-site. New and used split-spoon samplers will be steam cleaned or washed with a trisodium phosphate or Alconox solution, rinsed with tap water, air dried or wiped dry with a clean towel. Soil removed from the top two liners (typically each 4 to 6 inches in length) and the end cone will be used for visual logging purposes and disposed with cuttings produced during the drilling operations. The bottom liner, if suitable, will be preserved for laboratory analysis. Soil samples from each sampling interval will be lithologically described, consistent with the Unified Soil Classification System, by a HETI geologist. The exact depth of all borings to the nearest 1/2-

foot will be determined in the field. Exploratory boring logs shall be prepared under the direction of a Registered Geologist or Professional Engineer.

Head-space analysis will be performed in the field to check for the presence of volatile organic compounds. Head-space analysis will be performed using an organic vapor meter (either flame-ionization or photo-ionization). The method used will be consistent with the method described by Fitzgerald (1989). Organic vapor concentrations will be recorded on the HETI Soil Boring Log (Figure 1). The selection of soil samples for chemical analysis are typically based on the following criteria:

a. Soil discoloration
b. Soil odors
c. Visual confirmation of chemical in soil
d. Depth with respect to underground tanks
e. Depth with respect to groundwater
f. Organic vapor meter reading

The soil sampler and liners will be cleaned with a trisodium-phosphate or Alconox solution, rinsed with clean tap water and air dried or wiped dry with a clean towel prior to each sampling event. Soil samples (full liners) selected for chemical analyses will be covered with aluminum foil or teflon tape and the ends will be sealed with plastic end caps. The end caps will then be taped to ensure a more secure seal. The samples will then be labeled and entered onto a Chain-of-Custody document, and placed in a cooler on blue ice (hard shell) for transport to a state certified analytical laboratory.

Where copper and zinc contamination are the subject of the investigation, stainless steel liners will be used in lieu of brass liners. Stainless steel liners will also be used when the client, additional sampling protocol or regulatory agencies require.

Soil borings will be backfilled (sealed) to the ground surface using either a neat cement or cement-bentonite grout mixture in accordance with appropriate local regulations.

Pending the outcome of the results of the laboratory analyses, excess drill cuttings will remain on-site and, when deemed necessary, covered with a plastic tarp or drummed. Confirmed uncontaminated soils may be appropriately disposed of on-site by the client. Soils found to contain concentrations of contaminants above applicable local or state limits will be placed in appropriately labeled 55-gallon D.O.T. drums or in a hazardous materials drop bin and left on-site for proper disposal by the client. At the clients request, HETI will act as the client's agent by assisting in the disposal of the contained material. In no case will HETI personel sign a Hazardous Waste Manifest.

Well Construction

Monitoring wells shall be installed using a truck-mounted hollow-stem auger drilling rig or an air or mud-rotary drilling rig. Typically, the hollow stem rig will be used for the installation of wells up to 100 feet deep, if subsurface conditions prove favorable. Wells greater than 100 feet in depth will typically be drilled using air or mud-rotary equipment. Mud-rotary equipment will typically be used when alternate methods have failed or proven ineffective.

Monitoring well casing and screen shall be constructed of a minimum of Schedule 40, flush joint, threaded, polyvinylchloride (PVC) pipe. The well screen will be factory mill-slotted. The screen length shall be determined in the field and shall be placed with the intent of setting the screened interval adjacent to the aquifer material. The screen length shall also be set with the intent of placing the top of the screened interval a minimum of 2 feet above the static water level. All screens and casings used will be in a contaminant-free condition when placed in the ground. No thread lubrication shall be used, other than teflon tape or distilled water, during the connection of individual lengths of screened and solid well casing. Screen shall not be placed in a borehole that creates hydraulic interconnection of two or more distinctly separate aquifer units. Screen slot size will be chosen to be compatible with the encountered aquifer materials. The screen slot size will be chosen to retain a high percentage of the filter pack or natural formation. The remainder of the well casing, above the screened interval, shall be of solid riser casing. A sand pack shall be placed in the remaining anular space surrounding the well casing to a minimum of 1 foot above the screened interval. Sand pack shall not be placed such that it interconnects two or more distinctly separate aquifer units. Sand pack shall be chosen to be compatible with both the aquifer materials and the screen slot size. Sand pack shall consist of clean, washed, kiln dried silica sand. A minimum 1-foot thick bentonite pellet or bentonite slurry seal shall be placed above the sand pack. All bentonite shall be hydrated by either formation water or steam-distilled water. The remaining annular space above the bentonite seal shall be grouted with a neat cement or bentonite-neat cement mixture and shall be placed from the top of the bentonite pellet seal to within 6 inches of the top of the well. If used, the bentonite content of the mixture shall not exceed 5 percent by weight. Sand pack, bentonite, and cement seal levels will be confirmed during construction by measuring the remaining anular space with a calibrated weighted tape. If shallow water table conditions prevail, the screen interval will be placed such that the screen height above the static water level is reduced and a maximum possible surface seal can be achieved. A field boring log and well construction diagram (Plate A-1) shall be prepared by a representative of HETI for each well completed. Monitoring and extraction wells shall be constructed with Class-A cement/bentonite grout or bentonite pellets tremied into position as a base for the well casing if necessary. The well casing will be set within the aquifer according to the proposed function of the well and the chemistry of the potential contaminants.

In the event a monitoring well is required to be installed in an aquifer unit underlying an existing, shallower aquifer, the well will be completed in the lower aquifer such that only water from the lower aquifer is drawn into the well. The upper aquifer will be sealed by installing a steel conductor casing which extends to the base of the shallow aquifer. The steel casing will be tremied into position with an annular neat cement or cement-bentonite grout seal placed between the outside wall of the casing and the wall of the borehole. The cement grout will be allowed a minimum of 72 hours to set prior to advancing the boring beyond the sealed conductor casing and into the next aquifer. After 72 hours, the boring will be advanced below the seal and completed as a well as described above but within the steel conductor casing.

The tops of all well casings will be sealed and placed in a vandal resistant, traffic rated box to prevent entry of surface contamination, unauthorized entry and tampering.

Monitoring wells will be surveyed to obtain north-end casing elevations to the nearest ± 0.01 foot. Water level measurements will be recorded with an interface probe to the nearest ± 0.01 foot and referenced to either a project datum or mean sea level (MSL). A project site datum is typically chosen such that it will remain in the event the project site undergoes a physical change as a result of construction or other cultural disturbance. Where required, the wells will be surveyed by a licensed land surveyor relative to the nearest bench mark and relative to mean sea level. Typically, the establishment of a known, on-site reference by a licensed survey, is enough to allow for the remaining well top elevations to be determined using a survey level and rod. Unless directed otherwise by local regulatory agencies, the well top elevations will be established in this manner.

Well Development

After installation, all monitoring wells shall be developed to remove fine grained sediments from the well and to stabilize sand, gravel and disturbed aquifer materials in the annular area around the screened interval. Well development will be accomplished by air-lift pump, suction-lift pump, submersible pump, bladder pump, surge block, bailer or any combination of the above. All well development equipment will be decontaminated prior to development using a steam cleaner and/or trisodium-phosphate solution wash, clean water rinse, and steam distilled water rinse. Well development will continue until each well is relatively free of turbidity. The adequacy of well development will be assessed by a HETI geologist. Where appropriate, indicator parameters (pH, specific conductance, temperature, and turbidity) will be monitored during well development. Field instrument calibrations will be performed prior to use according to manufacturers specifications.

Well Head Completion and Site Clean-up

Monitoring wells shall be completed below grade unless special conditions exist that require above grade design. Monitoring well casing (including the well locking seal and cap) will be completed approximately two inches below the vandal resistant traffic rated road box cover. Except in areas where snow plows might be used, the road box cover shall be completed approximately one inch above the existing grade surface to allow for precipitation runoff. All concrete work, both inside and outside the road box, shall be completed with a smooth finish.

Above ground completions will be set inside a 2 to 3 foot tall locking steel protective casing. If traffic conditions dictate, three 4-inch diameter steel pipes will be set in concrete in a triangular pattern to act as bumper posts. The posts will be set 2 feet deep and will be filled with concrete. A four foot square, 3-inch thick concrete pad which slopes away from the well will be set around each well. Both the protective steel well casing and the bumper posts will be painted yellow.

The project site shall be left as clean as possible. All soils and excess concrete produced from each monitoring well will be placed in appropriate areas to be disposed as previously described. All monitoring well locations will either be broomed or washed down such that staining of the existing surface cover is minimized.

GROUNDWATER SAMPLING AND ANALYSIS

Quality Assurance/Quality Control Objectives

The sampling and analysis procedures employed by HETI for groundwater sampling and monitoring follow specific Quality Assurance/Quality Control (QA/QC) guidelines. Quality Assurance (QA) objectives have been established by HETI to develop and implement procedures for obtaining field data and evaluating water quality in an accurate, precise and complete manner so that sampling procedures and field measurements provide information that is comparable and representative of the actual field conditions. Quality Control (QC) is maintained by HETI by using specific field protocols and requiring the analytical laboratory to perform internal and external QC checks. It is the goal of HETI to provide data that are accurate, precise, complete, comparable, and representative. The definitions for accuracy, precision, completeness, comparability, and representativeness are as follows:

1. Accuracy - the degree of agreement of a measurement with an accepted reference or true value.
2. Precision - a measure of agreement among individual measurements under similar conditions. Usually expressed in terms of standard deviation.
3. Completeness - the amount of valid data obtained from a measurement system compared to the amount that was expected to meet the project data goals.
4. Comparability - the confidence with which one data set can be compared with another.
5. Representativeness - the degree to which a sample or group of samples reflect the characteristics of a media at a given sampling point. Also includes the degree to which a sampling point represents the actual parameter variations which are under study.

As part of the HETI QA/QC program, applicable federal, state and local reference documents are to be followed. The procedures outlined in these regulations, manuals, handbooks, guidance documents and journals are incorporated into the HETI sampling procedures to assure that: (1) groundwater samples are properly collected, (2) groundwater samples are identified, preserved, and transported in a manner such that they are representative of field conditions, and (3) chemical analyses of samples are accurate and reproducible.

GUIDANCE AND REFERENCE DOCUMENTS USED TO COLLECT GROUNDWATER SAMPLES

U.S.E.P.A. - 339/9-51-002	NEIC Manual for Groundwater/ Subsurface Investigation at Hazardous Waste Sites
U.S.E.P.A. - 503/SW611	Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities (August, 1977)
U.S.E.P.A. - 600/4-79-020	Methods for Chemical Analysis of Water and Wastes (1983)
U.S.E.P.A. - 600/4-82-029	Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)
U.S.E.P.A. - SW-846#, 3rd Edition	Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (November, 1986) and latter additions
40 CFR 136.3e Table II	Required Containers, Preservation Techniques, and Holding Times
Resources Conservation and Recovery Act (OSWER 9950.1)	Groundwater Monitoring Technical Enforcement Guidance Document (September, 1986)
California Regional Water Quality Control Board (Central Valley Region)	A Compilation of Water Quality Goals (September, 1988); Updates (October, 1988)
California Regional Water Quality Control Board (North Coast, San Francisco Bay, and Central Valley)	Regional Board Staff Recommendations for Initial Evaluations and Investigation of Underground Tanks: Tri-Regional Recommendations (June, 1988)
California Regional Water Quality Control Board (Central Valley Region)	Memorandum: Disposal, Treatment, and Refuse of Soils Contaminated with Petroleum Fractions (August, 1986)
State of California Department of Health Services	Hazardous Waste Testing Laboratory Certification List (March, 1987)
State of California Water Resources Board	Leaking Underground Fuel Tank Control (LUFT) Field Manual (May, 1988), and LUFT Field Manual Revision (April, 1989)

State of California Water Resources 85), Control Board	Title 23 (Register #85.#33-8-17-Subchapter 16: Underground Tank Regulations; Article 3, Sections 2632 and 2634; Article 4, Section 2647 (October, 1986)
Santa Clara Valley Water District	Guidelines for Investigating Fuel Leaks (March, 1989)
Santa Clara Valley Water District	Guidelines for Preparing or Reviewing Sampling Plans for Soil and Groundwater Investigation of Fuel Contamination Sites (January, 1989)
Alameda County Water District	Groundwater Protection Program: Guidelines for Groundwater and Soil Investigations at Leaking Underground Fuel Tank Sites (most recent revision)
American Public Health Association	Standard Methods for the Examination of Water and Wastewaters, 16th Edition
Analytical Chemistry (journal)	Principles of Environmental Analysis Volume 55, pages 2212-18, December, 1983
American Petroleum Institute Environmental Affairs Dept., June, 1983	Groundwater Monitoring & Sample Bias
The Bay Area Air Quality Management District	Regulation 8 - Rule 40 & Rule 48

Because groundwater samples collected by HETI are analyzed in the parts per billion (ppb) range for many analytes, care is exercised to prevent contamination of samples. When volatile or semivolatile organic compounds are included for analysis, HETI sampling crew members will adhere to the following precautions in the field:

1. A new pair of clean, disposable, latex (or comparable material) gloves are to be worn for each well to be sampled.
2. When possible, samples will first be collected from wells known or suspected to contain the fewest contaminants, followed by wells in increasing order of degree of contamination.
3. All sample bottles and equipment are to be kept away from fuels and solvents. When possible, gasoline (used in generators and water pumps) is to be shipped to the project site in separate compartments of the same vehicle or in a separate vehicle as that in which sample bottles are shipped.

4. Sampling bailers are to be composed of polyethylene (when dedicated to the well), Teflon or stainless steel. Other materials, such as acrylic, may contain phthalate esters which can interfere with gas chromatography (GC) analyses. Well purging may be performed with PVC bailers.

5. Volatile organic groundwater samples are collected so that air passage through the sample does not occur or is minimal (to prevent volatiles from being stripped from the samples). Sample bottles are filled by slowly running the sample down the side of the bottle until there is a positive convex meniscus over the neck of the bottle. The Teflon side of the septum (in cap) is positioned against the meniscus and the cap is screwed on tightly. The sample is then inverted and lightly tapped while the sampler inspects the contents of the bottle for an air bubble. The absence of an air bubble indicates a successful seal. If a bubble is evident, the cap is removed and more water is added to the sample. The inspection procedure is repeated and if bubbles persist, the vial is discarded in a container designated for used and broken vials and bottles and the sample filling procedure is repeated with another vial.

6. Extra vials shall be available for use in the event of dropped bottles and/or caps. Any bottle which has come in contact with the ground shall be considered contaminated and shall not be used. When replacing septa, or if septa become inverted, care shall be taken to assure that the Teflon seal faces the interior of the bottle.

7. All preservatives shall be provided by the contract analytical laboratory.

Laboratory and field handling procedures of samples may be monitored by including QC samples for analysis with sample lots from a project site. QC samples may include any combination of the following:

1. Trip Blank - Used for purgable organic compounds only; QC samples shall be collected in 40 milliliter (ml) sample vials filled in the analytical laboratory with organic free water. Trip blanks should be sent to the project site, and travel with the samples from the project site. Trip blanks are <u>not</u> opened, and are returned from the project site with the samples from the project site for analysis.

2 Field Blank - Prepared in the field using steam-distilled water. Field blank QC samples shall accompany project site samples to the laboratory and shall be analyzed for the same chemical parameters as those samples taken from the project site.

3. Equipment Blank - Equipment Blank QC samples shall be prepared in the field using field equipment rinsate between two different wells after the equipment has been washed and rinsed. The equipment blank will consist of deionized water retained in the sampling equipment. These QC samples will only be taken when a dedicated bailer is not used for sampling.

4. Duplicates - Duplicate QC samples shall be collected "second samples" from a selected well and project site. Duplicates shall be collected as either split samples or second-run samples (i.e. later date) from the same well.

The number and types of QC samples shall be determined by HETI on a site-specific basis.

GROUNDWATER SAMPLE COLLECTION

This section describes the routine procedures followed by HETI while collecting groundwater samples for chemical analysis. These procedures include decontamination, water level measurements, well purging, physical parameter measurements, sample collection, sample preservation, and sample handling. Critical sampling objectives for HETI are to:

1. Collect groundwater samples which are representative of the sampled matrix.
2. Maintain sample integrity from the time of sample collection to delivery to the analytical laboratory.

Sample analyses, methods, containers, preservation, and holding times are presented in Table A-1.

Decontamination Procedures

All physical parameter measuring and sampling equipment shall be decontaminated prior to measurement and sample collection using a trisodium phosphate or Alconox solution wash, followed by two separate rinses in tap water, followed by one rinse in steam-distilled water. Any sampling equipment surfaces or parts that might absorb specific contaminants, such as plastic pump valves, impellers, etc., are to be cleaned in the same manner.

Sample bottles, bottle caps, and septa used for sampling volatile organics are thoroughly pre-cleaned in either the laboratory or the factory. All appropriate measures shall be taken to assure continued sterility of the containers issued by the contract laboratory prior to usage at the project site.

During field sampling, equipment which has been placed in a well shall be decontaminated by washing with a trisodium-phosphate or Alconox solution followed by two rinses in tap water and one rinse in steam-distilled water.

Water Level Measurements

Prior to purging and sampling any wells, the static-water level shall be measured by use of an electronic sounder and/or calibrated portable oil-water interface probe. Both static water level and separate phase product thickness shall be measured and noted to the nearest ±0.01 foot. Interface probe results shall be confirmed by sampling the top of the water column with a clear bailer and measuring any floating product thickness to the nearest ±0.01 foot with an engineers scale tape. In all cases a clear bailer sample will be taken from each well to check for color, sheen and undetected floating product. If floating product of any measureable thickness is observed, no sampling will be performed for that well. If visible product sheen is observed, sampling shall proceed under normal protocols.

The line used to lower the bailer shall be discarded after each use to preclude the possibility of cross contamination. Field observations (e.g., well integrity, product odor, turbidity, water color, odors, etc.) shall be recorded on the HETI Purge/Sample Sheet (Plate A-2). Before and after the use of the electric sounder, interface probe, non-dedicated bailer, or any other down well equipment, each will be decontaminated by washing in a trisodium phosphate or Alconox solution, followed by a double rinse with tap water, followed by a rinse with steam-distilled water.

Well Purging

Before sampling commences, well casing storage water and interstitial water in the artificial sand pack shall be purged from the well using: (1) a positive displacement bladder pump constructed of inert non-wetting Teflon and stainless steel; (2) a pneumatic-airlift pumping system; (3) a centrifugal pumping system; or (4) a PVC, Teflon or stainless steel bailer. Methods of purging will be assessed based on the well size, location, depth, accessibility, and known chemical conditions. Individual well purge volumes are calculated from the casing volumes. In general, a minimum of 3 to 5 casing volumes will be purged. Wells which dewater or demonstrate slow recharge capacities (i.e., low yield wells which only recover to 70 percent of initial water column height after 1 hour) during purging activities may be sampled after fewer than 3 to 5 purging cycles. If a low yield well is to be sampled, sampling shall not take place until at least 70 percent of the previously measured water column has been replaced by recharge. Monitoring wells shall be purged according to the protocol flowchart presented in Plate A-3. Water removed from the wells will either be disposed or stored in 55-gallon DOT drums for future disposal according to proceedures outlined for contaminated soil cuttings in the Soil Sampling Protocol section above. Where appropriate, physical parameters (pH, specific conductance, and temperature) will be monitored by HETI field crew during well purging operations. If necessary, purging may continue until all three physical parameters have stabilized. Stability shall be defined as a change of less than 0.2 pH units, less than 10 percent in micro mhos, and less than 1.0 degree Centigrade. The pH meters shall be read to the nearest ± 0.1 pH units. Specific conductance meters shall be read to the nearest ± 10 micro-mhos per centimeter. Both types of meters shall be calibrated daily to manufacturer's specifications. Temperature shall be read to the nearest ± 0.1 degree centigrade. Field data collected while developing, purging and sampling the wells will be entered onto the HETI Purge/Sample Sheet (Plate A-2). Copies of the Purge/Sample Sheets will be reviewed for accuracy and completeness for each well sampled.

DOCUMENTATION

Sample Container Labels

Each sample container shall be labeled immediately after the sample is collected and sealed. The label shall include:

- Company Name (HETI)
- Source (i.e., well number or code)
- Sampler's identification
- Project number
- Date and time of collection
- Type of preservation (if any) used

Field Sampling Data Sheets

In the field, the HETI sampling crew will record the following information on the Purge/Sample Sheet (Plate A-2) for each well sampled:

- Project number
- Client
- Location
- Source (i.e., well number or code)
- Time and date of development, purging and sampling
- Well accessibility and integrity
- Pertinent well data (e.g., total depth, product thickness, static water level)
- Physical parameters when appropriate (e.g., specific conductance, pH, temperature) - may be more than one reading
- Gallons and well casing volumes purged

Chain-of-Custody

A chain-of-custody record shall be completed and will accompany every shipment of samples to the analytical laboratory in order to establish documentation tracing sample possession from the time of collection until delivery to the laboratory. The record will contain the following information:

- Sample or station number or code (ID)
- Signature of the collector, sampler, or recorder
- Date and time of collection
- Place of collection (project address and name of business)
- Sample type (soil or water)
- Type of analysis requested
- Signatures of persons involved in chain of possession (in chronological order)
- Dates and times of individual possession (inclusive)
- Laboratory comments regarding the sample receptacle conditions

Samples will always be accompanied by a Chain-of-Custody record. When transferring the samples, the individuals relinquishing and receiving the samples will sign, date and note the time on the Chain-of-Custody record.

Sample Collection, Handling, Storage and Transport

All water samples will be collected in an order such that those parameters most sensitive to volatilization will be sampled first. A general order of collection for some common groundwater parameters is as follows:

- Volatile Organic Compounds (VOC's)
- Total Organic Halogens (TOH)
- Total Organic Carbon (TOC)
- Extractable Organics
- Total Metals
- Dissolved Metals
- Phenols
- Sulfate and Chloride
- Nitrate and Ammonia
- Turbidity

All samples from the same well shall be collected immediately after purging or when the well recovers to 70 percent of the original water column height. All samples from one sampling set from a single well should be collected on the same day.

All chemical sample handling and storage will be conducted under the direction of HETI's consulting analytical chemist. All laboratory chemical testing will be accomplished by a state approved analytical laboratory.

All water samples will be held at 4°C by packing them in a water-tight container inside an ice chest and covering with hard shelled "blue ice™". In no event shall the time between sample collection and delivery to the contract laboratory be greater than 72 hours. Preservatives will not be added to any sample by the sampling crew, unless instructed by the consulting analytical chemist. If added in the field, preservatives shall be supplied by the contract analytical laboratory. No one will open the samples other than laboratory personnel who will perform the specified chemical analyses.

If it is necessary for samples or sample ice chests to leave the immediate control of the sampling crew prior to delivery to the laboratory or laboratory courier, such as shipment by a common carrier (e.g., UPS™), a custody seal will be placed on each sample container and/or sample chest. Custody seals will be placed to ensure that the samples have not been tampered with during shipment and will contain the samplers signature, the date and time the seal was emplaced.

TABLE A-1

SAMPLE ANALYSIS METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Parameter	Analytical Method	Reporting Units	Container*	Preservation†	Maximum Holding Time
Total Petroleum Hydrocarbons (low to med. b.p. i.e. gasoline)	EPA 8015 (DHS modified)	ppb ug/l	40ml glass vial, Teflon lined septum	4°C HCl to pH<2**	14 days
Benzene Toluene Ethylbenzene Xylenes (BTEX)	EPA 8020	ppb ug/l	40ml glass vial, Teflon lined septum	4°C HCl to pH<2**	7 days(w/o preservative) 14 days (w/preservative)
Oil & Grease	SM 503A&E	ppb ug/l	1L glass jar, Teflon lined cap	4°C H2SO4 to pH<2	28 days
Total Petroleum Hydrocarbons (high. b.p. i.e. diesel)	EPA 8015 (DHS modified)	ppb ug/l	1L glass jar, Teflon lined cap	4°C	14 days
Halogenated Volatile Organics (chlorinated solvents)	EPA 8010	ppb ug/l	40ml glass vial, Teflon lined septum	4°C	14 days
Non-Chlorinated Solvents	EPA 8020	ppb ug/l	as above	4°C	14 days
Volatile Organics (GC/MS)	EPA 8240	ppb ug/l	as above	4°C	14 days
Semi-Volatile Organics (GC/MS)	EPA 8270	ppb ug/l	as above	4°C	14 days
Metals	ICP-EPA 200.7 or A.A.EPA-	ppb ug/l	100 ml	4°C HNO3 to pH<2	6 months

* Containers listed are for water - soil containers are to be brass or stainless steel tubes with plastic end caps.

† Applies only to liquid samples.

** May vary depending on lab requirements.

SITE/LOCATION	BEGUN	BORING DIAMETER	ANGLE/BEARING	BORING NO
DRILLING CONTRACTOR	COMPLETED	FIRST ENCOUNTERED WATER DEPTH		
OPERATOR	LOGGED BY	STATIC WATER DEPTH/DATE		
DRILL MAKE & MODEL	SAMPLING METHOD			BOTTOM OF BORING
WELL MATERIAL SLOT SIZE FILTER PACK	BORING SEAL			WELL NO.

BLOWS/ FOOT	FIELD HEAD-SPACE*	DEPTH	SAMPLE	WATER LEVEL	WELL CONSTR.	GRAPHIC LOG	MATERIAL CLASSIFICATION & PHYSICAL DESCRIPTION
		1					
		2					
		3					
		4					
		5					
		6					
		7					
		8					
		9					
		10					
		11					
		12					
		13					
		14					
		15					
		16					
		17					
		18					
		19					
		20					
		21					
		22					
		23					
		24					
		25					
		26					
		27					
		28					
	*PID	29					
	(ppm)	30					

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TECHNOLOGIES, INC.

DATE:

APPROVED BY:

SOIL BORING LOG MW-4
AND
WELL CONSTRUCTION MW-4

PLATE
A-1

JOB NO.

PURGED/SAMPLED BY: ______________________ DATE: ________________

GAUGING DATA:

Depth to bottom: ________ ft.

Depth to water: ________ ft.

Saturated Thickness: __________ ft.

Conversion

diam.	gals/ft.
2 in.	x 0.16
4 in.	x 0.65
6 in.	x 1.44

Well casing volume _________ gallons

volumes to purge x_________ vols.

*Total volume to purge = ________ gallons

* unless chemical parameters stabilize earlier

PURGING DATA:

Purge method: PVC bailer/ Submersible pump/ Suction lift pump/ ______________
(circle one)

Time	Volume (gallons)	Temp. (°F)	Conductivity (mS/cm)	pH

Color: ______________ Turbidity: __________________

Recharge: ____________ SPP________ft.

SAMPLING DATA:

Sampling method: Dedicated bailer /______________

Sample for: (circle)

TPHg/BTEX	METALS	TOG	8010	
TPHd	O-Pb	TEL	8020	
TPH mo	Total Pb	EDB	8240	
601	602	Nitrates	8260	8270

Other: ____________________

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MONITORING WELL PURGE/SAMPLE SHEET

WELL # ________

LOCATION ______________________

PLATE

A-2

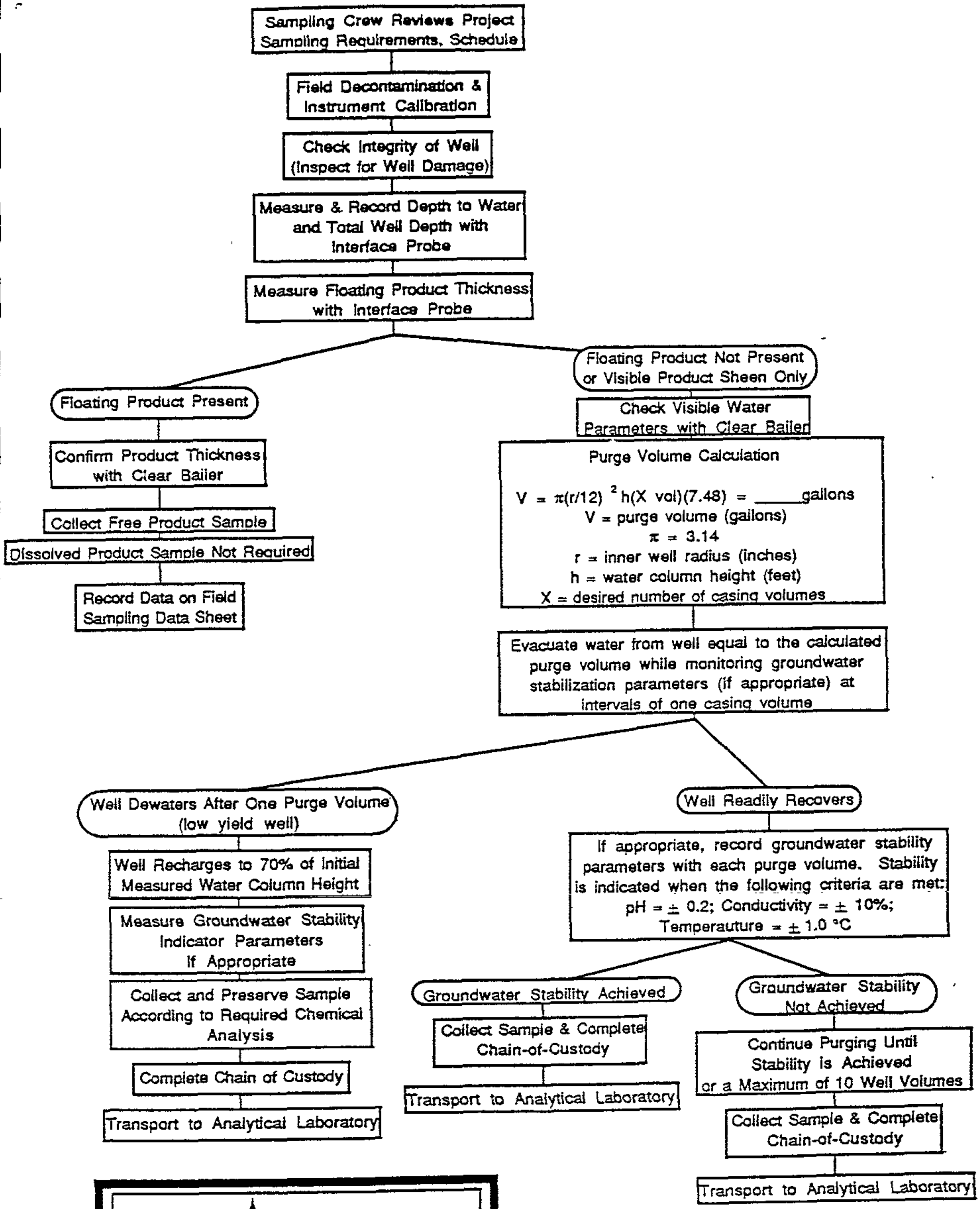

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PLATE A-3
WATER SAMPLING
FLOWCHART