GeoStrategies Inc.

WORK PLAN
FOR ADDITIONAL ONSITE SUBSURFACE INVESTIGATION

at

ARCO Station 6002
6235 Seminary Avenue
Oakland, California

794501-1

Report prepared for

ARCO Products Company
P.O. Box 5811
San Mateo, California 94402

by

GeoStrategies Inc.

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STATE OF CALIFORNIA

May 18, 1994

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GeoStrategies Inc.

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at ARCO Station 6002
6235 Seminary Avenue
Oakland, California.

1. INTRODUCTION

At the request of ARCO Products Company (ARCO), GeoStrategies Inc. (GSI) has prepared this Work Plan for additional onsite subsurface investigation at the subject site. This work was requested by Ms. Juliet Shin of the Alameda County Health Care Services Agency (ACHCSA) in a letter dated April 14, 1994. The purpose of this proposed work is to further evaluate the extent of petroleum hydrocarbons in soil and groundwater beneath the subject site and to evaluate the gradient and flow direction of the shallow groundwater beneath the site.

The work to be performed includes: (1) obtaining a drilling permit from the Alameda County Flood Control and Water Conservation District (ACFCWCD) Zone 7, preparing a site safety plan, and scheduling drilling; (2) drilling four soil borings (B-5 through B-8), collecting soil samples from the borings for description and possible laboratory analyses, and installing groundwater monitoring wells MW-2 through MW-5 in the borings; (3) submitting selected soil samples for laboratory analyses; (4) developing groundwater monitoring wells MW-2 through MW-5; (5) surveying wells MW-2 through MW-5 and previously installed MW-1; (6) monitoring, purging and sampling wells MW-1 through MW-5, and submitting groundwater samples for laboratory analyses; and (7) preparing a report which presents field procedures, results, and conclusions of the investigation.

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2. SITE DESCRIPTION AND BACKGROUND

2.1. General

ARCO Station 6002 is an operating service station and AM/PM mini-market located on the southern corner of the intersection of Seminary and Sunnymere Avenues in Oakland, California, as shown on the Vicinity Map, Figure 1. The site is located in a residential area, immediately east of Highway 580, on a gently sloping, asphalt and concrete covered lot at an elevation of approximately 250 feet above mean sea level (msl). Four 10,000 gallon gasoline USTs are located in the eastern portion of the site. Two service islands are located in the northern portion of the site. The approximate locations of the USTs and other pertinent site features are shown on the Site Plan, Figure 2.

2.2. Geology and Hydrogeology

The site is located along the eastern margin of San Francisco Bay on the East Bay Plane, approximately ½ mile west of the Hayward Fault Zone. The subsurface soil in the vicinity of the site have been mapped as late Pleistocene alluvium composed of weakly consolidated, slightly weathered, poorly sorted, irregularly interbedded clay, silt, sand, and gravel deposited mainly in stream channels and on alluvial fans (Helley et.al., 1979).

During drilling of borings B-1 through B-4 by RESNA Industries Inc. (RESNA), groundwater was first-encountered at the site at depths of approximately 9½ to 11 feet below ground surface and stabilized at depths of 7 to 9 feet. Based on topography, groundwater in the area is inferred to flow to the west, toward San Francisco Bay (U.S. Geological Survey, 1980).

3. PREVIOUS ENVIRONMENTAL WORK

3.1. Initial Onsite Environmental Investigation

In January 1994, four exploratory soil borings (B-1 through B-4) were drilled at the site in the vicinity of the USTs, and groundwater monitoring well MW-1 was installed in boring B-2 and vapor extraction wells VW-1 and VW-2 were installed in borings B-3 and B-4, respectively, by RESNA. The soil

boring and well locations are shown on Figure 2. The results of this investigation were described in the RESNA Initial Onsite Subsurface Investigation Report, dated March 31, 1994.

The soil encountered at the site consisted primarily of silty clay and sandy silt to silty sand and sandy gravel. Groundwater was encountered in borings B-1 through B-4 at depths between 9½ and 11 feet and stabilized at depths of 7 to 9 feet below ground surface. Logs of borings B-1 through B-4 and RESNA's Geologic Cross Sections A-A' and B-B', showing a graphic interpretation of the soil stratigraphy beneath the site, are included in Appendix A. The locations of the cross sections are shown on Figure 2.

Laboratory data for soil samples collected from borings B-1 through B-4 indicated that the greatest concentrations of gasoline hydrocarbons (420 parts per million [ppm] of total petroleum hydrocarbons as gasoline [TPH-G]) were in boring B-2 located in the inferred downgradient direction of the USTs at a depth of approximately 10½ feet. The vertical extent of gasoline hydrocarbons in soil has been delineated to less than 1.0 ppm of TPH-G at depths of 13½ feet in B-2 and 15½ feet in B-4, in the downgradient direction of the USTs. Soil in the upgradient direction of the USTs (B-3) do not appear to have been impacted by gasoline hydrocarbons. The results of laboratory analyses of soil samples are summarized in Table 1.

Laboratory analyses results for groundwater samples collected from groundwater monitoring well MW-1 and vapor extraction wells VW-1 and VW-2 (grab samples) indicated TPH-G ranging from 11,000 parts per billion [ppb] to 19,000 ppb and benzene concentrations ranging from 620 ppb to 1,300 ppb. The results of laboratory analyses of groundwater samples are summarized in Table 2.

4. PROPOSED WORK

GSI proposes project steps 1 through 7 listed below to further evaluate the extent of petroleum hydrocarbons in soil and groundwater at the subject site, and to evaluate the gradient and flow direction of the shallow groundwater beneath the site.

Step 1 Obtain a well drilling permit from the ACFCWCD, Zone 7; prepare a site specific health and safety plan; and schedule underground locating services, drillers, equipment, and personnel.

Step 2 Drill four onsite soil borings (B-5 through B-8) to the depth of approximately 25 feet below ground surface in the locations shown on Figure 2, and install groundwater monitoring wells MW-2 through MW-5 in these borings. Soil samples for soil description will be collected continuously in boring B-7 and every 5 feet and at the changes in soil stratigraphy in other borings . The soil samples will be classified using the United Soil Classification System (USCS), placed in a cooler with ice, and retained for possible laboratory analyses.

The groundwater monitoring wells will be constructed using 4-inch inner-diameter schedule 40 polyvinyl chloride (PVC) blank casing, and 0.020-inch machine slotted schedule 40 PVC screen. The well annulus will be filled with No. 3 sand to approximately 1 foot above the well screen, and overlain with approximately 1-foot of bentonite. The bentonite will then be hydrated and the annulus will be grouted up to a depth of approximately 1 foot below ground surface. A traffic rated well box will be installed over the well.

Step 3 Submit selected soil samples from borings B-5 through B-8 under Chain-of-Custody Records to a State-certified laboratory for analyses of TPH-G and gasoline constituents benzene, toluene, ethylbenzene and total xylenes (BTEX) using EPA Methods 5030/8015/8020.

Step 4 Develop groundwater monitoring wells MW-2 through MW-5 to remove fine-grained sediments and allow better communication between the water bearing-strata and the wells.

Step 5 Survey the site wells MW-1 through MW-5, VW-1 and VW-2, and other pertinent site features for the location, and groundwater monitoring wells MW-1 through MW-5 for the wellhead elevation to a U.S. Coast and Geodetic Survey Datum.

Step 6 Measure depth-to-water in groundwater monitoring wells MW-1 through MW-5, inspect the wells for the presence of floating product, purge the wells and collect groundwater samples for laboratory analyses. Submit groundwater samples collected from MW-1 through MW-5 under Chain-of-Custody Records to the State-certified laboratory for analyses of TPH-G and BTEX using EPA Methods 5030/8015/8020.

Step 7 Prepare a report including results of investigation, field methods, interpretations and conclusions.

5. SCHEDULE OF OPERATIONS

A preliminary time schedule to perform the steps described above is shown on Figure 3, Preliminary Time Schedule. This time schedule is an estimate and is subject to change should the circumstances dictate. Time is estimated in weeks after gaining regulatory approval of the Work Plan and any changes which must be incorporated into this Work Plan due to regulatory request. GSI can initiate work at the site within 1 week after receiving authorization to proceed, provided that site access can be received. **If ARCO has not received regulatory approval of this work plan within 60 days, they will proceed as stated in Title 23, Article 11, Chapter 16, Sections 2722 (b)(5) and 2726 (c).**

6. DISTRIBUTION

On behalf of ARCO, GSI has forwarded a copy of this report to:

Ms. Juliet Shin
Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Mr. Richard Hiett
Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612

If you have any questions or comments, please call us at (510) 551-8777.

7. REFERENCES

Helley et.al., 1979, Flatland Deposits - Their Geology and Engineering Properties and Their Importance to Comprehensive Planning, Selected Examples from the San Francisco Bay Region, California: U.S. Geological Survey Professional Paper 943, 88p.

RESNA Industries Inc., March 31, 1994. Initial Onsite Subsurface Investigation Report. Report # 130063.01

U.S. Geological Survey 1980. 7.5-Minute Quadrangle, Oakland East, California.

TABLE 1

LABORATORY ANALYSES RESULTS FOR SOIL SAMPLES
ARCO Station 6002
Oakland, California

BORING NO	SAMPLE DEPTH (FEET)	TPH-G (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)
January 1994						
S-5-B1	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-8.5-B1	8.5	3.8*	<0.0050	<0.0050	<0.0050	<0.0050
S-5.5-B2	5.5	3.8	0.031	0.022	0.013	<0.060
S-7.5-B2	7.5	7.2	0.030	0.042	0.027	0.16
S-10.5-B2	10.5	420**	<0.0050	<0.0050	5.5	14
S-13.5-B2	13.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-18-B2	18	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-20.5-B2	20.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-23.5-B2	23.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-27-B2	27	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-32.5-B2	32.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-36-B2	36	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-5-B3	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-10-B3	10	<1.0	0.014	0.013	0.0060	0.026
S-14.5-B3	14.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-5-B4	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
S-10-B4	10	3.9	0.014	<0.0050	<0.0050	0.041
S-15.5-B4	15.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
Soil Stockpile						
01140SP-(A-D)	---	3.1	<0.0050	<0.0050	<0.0005	<0.0050

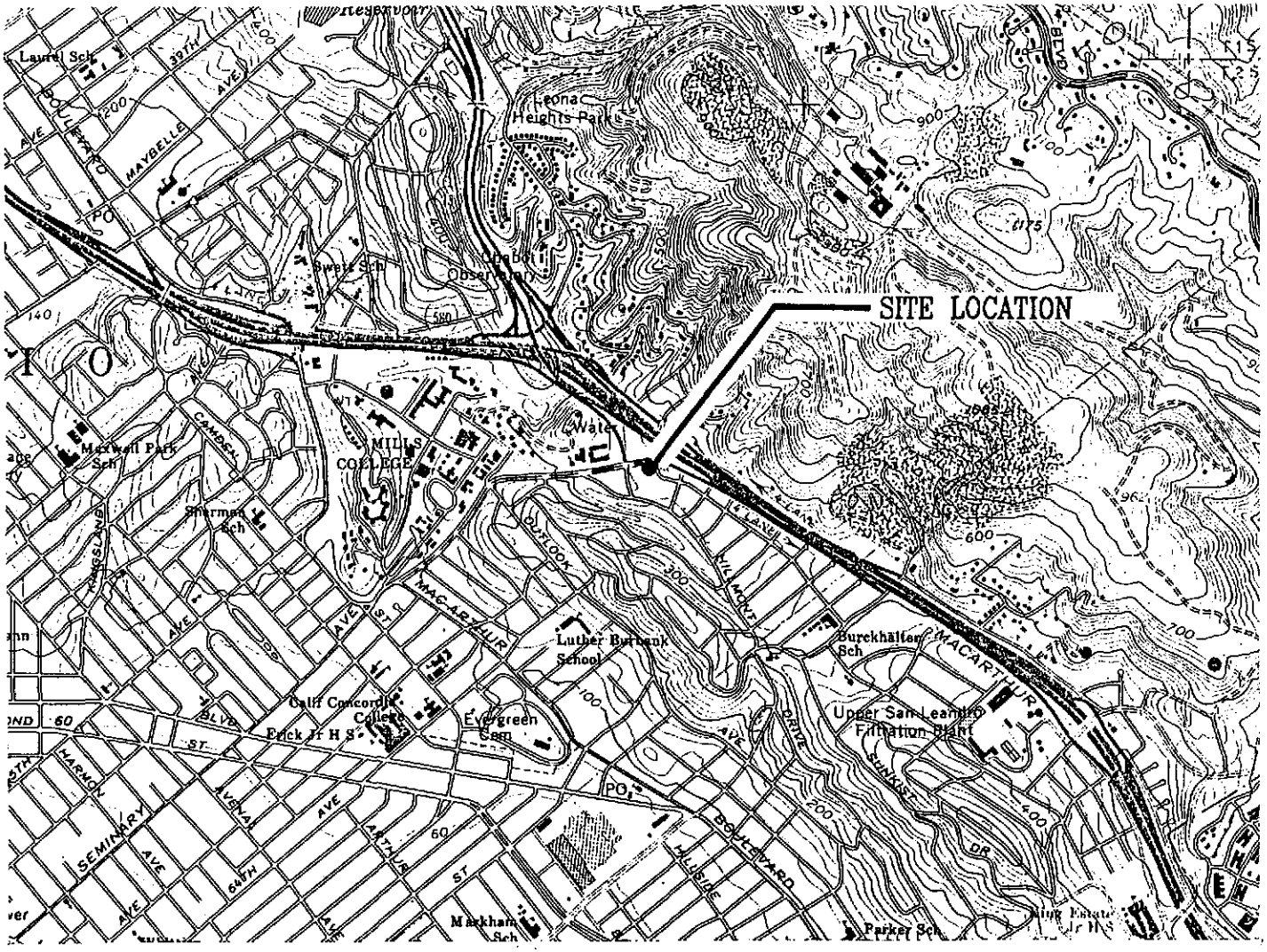
TPH-G = Total Petroleum Hydrocarbons calculated as Gasoline.
PPM = Parts Per Million.
< = less than detection limit.
* = Laboratory reported the chromatogram pattern to indicate a "non-gas mix >C8."
** = Laboratory reported the chromatogram pattern to indicate "weathered gas."

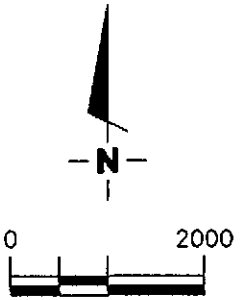
TABLE 2

LABORATORY ANALYSES RESULTS FOR GROUNDWATER SAMPLES
ARCO Station 6002
Oakland, California

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
21-Jan-94	MW-1	18,000	1,300	1,600	250	1,900
21-Jan-94	VW-1*	19,000	1,100	180	720	2,800
21-Jan-94	VW-2*	11,000	620	1,500	330	1,400

TPH-G = Total Petroleum Hydrocarbons calculated as Gasoline.
PPB = Parts Per Billion.
* = Grab samples collected from vapor wells VW-1 and VW-2 as a one-time sampling event only.





Base Map: USGS Topographic Map

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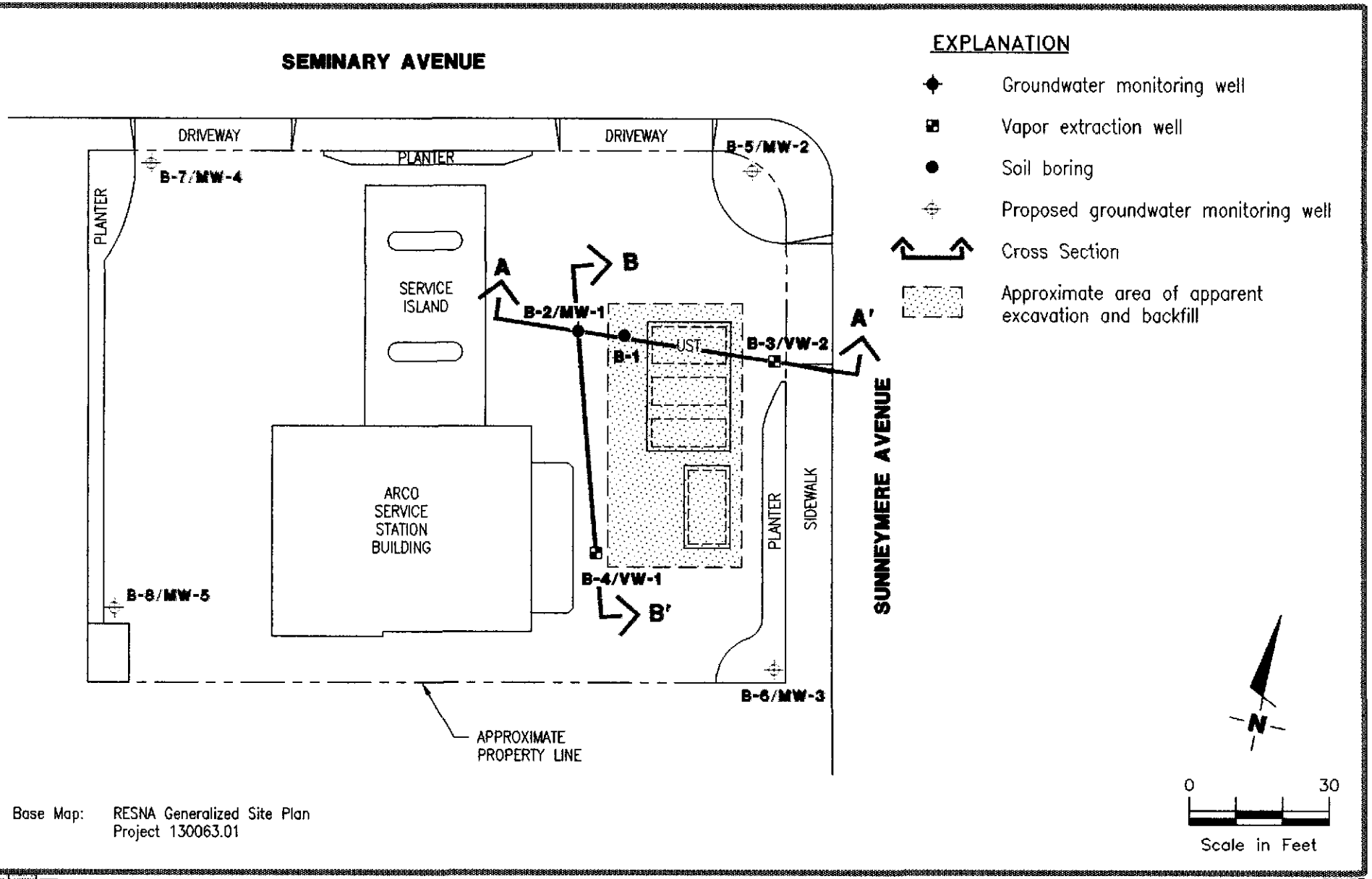
VICINITY MAP
ARCO Service Station #6002
6235 Seminary Avenue
Oakland, California

FIGURE
1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
7945		5/94	



Base Map: RESNA Generalized Site Plan
Project 130063.01

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SITE PLAN
ARCO Service Station #6002
6235 Seminary Avenue
Oakland, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
7945		5/94	

PRELIMINARY TIME SCHEDULE

PROJECT STEPS	ESTIMATED TIME IN WEEKS (AFTER ACQUIRING REGULATORY APPROVAL)																								COMMENTS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
(1) OBTAIN DRILLING PERMIT, SCHEDULE DRILLING	■	■																							
(2) DRILL AND INSTALL WELLS			■																						
(3) SUBMIT SOIL SAMPLES FOR ANALYSIS				■	■																				
(4) DEVELOP WELLS				■																					
(5) WELLHEAD SURVEY					■																				
(6) MONITOR AND SAMPLE WELLS					■	■																			
(7) PREPARE REPORT							■	■	■	■	■	■													

NOTES:
1. IF ARCO HAS NOT RECEIVED REGULATORY APPROVAL OF THIS WORK PLAN WITHIN 60 DAYS, THEY WILL PROCEED AS STATED IN TITLE 23, ARTICLE 11, CHAPTER 16, SECTIONS 2722 (b)(5) AND 2726 (c).
2. UPON COMPLETION OF ONSITE INVESTIGATION ARCO WILL EVALUATE NEED FOR ADDITIONAL WORK AT THIS SITE.

LEGEND

■ ESTIMATED SCHEDULE

GeoStrategies Inc.

PRELIMINARY TIME SCHEDULE
ARCO Service Station #6002
6235 Seminary Avenue
Oakland, California

FIGURE 3

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
7945	BS	5/94	

APPENDIX A

BORING LOGS AND CROSS SECTIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION		LTR	DESCRIPTION	MAJOR DIVISION		LTR	DESCRIPTION
COARSE-GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.	FINE-GRAINED SOILS	SILTS AND CLAYS LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		GM	Silty gravels, gravel-sand-silt mixtures.			OL	Organic silts and organic silt-clays of low plasticity
		GC	Clayey gravel, gravel-sand-clay mixtures.		SILTS AND CLAYS LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	SAND AND SANDY SOILS	SW	Well-graded sand or gravelly sands, little or no fines.			CH	Inorganic clays of high plasticity, fat clays.
		SP	Poorly-graded sands or gravelly sands, little or no fines.			OH	Organic clays of medium to high plasticity, organic silts.
		SM	Silty sands, sand-silt mixtures.	HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.
		SC	Clayey sands, sand-clay mixtures.				


Depth through which sampler is driven


Relatively undisturbed sample


No sample recovered


Static water level observed in well/boring


initial water level observed in boring

S-10 Sample number


Sand pack


Bentonite

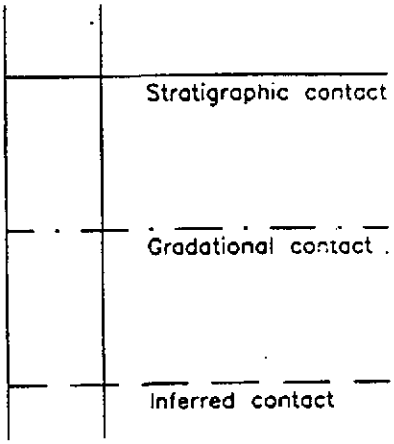

Neat cement


Caved native soil


Blank PVC


Machine-slotted PVC


Pea gravel



P.I.D. Photoionization detector

BLOWS REPRESENT THE NUMBER OF BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES TO DRIVE THE SAMPLER THROUGH EACH 6 INCHES OF AN 18-INCH PENETRATION.

GRADATIONAL AND INFERRED CONTACT LINES SEPARATING UNITS ON THE LOG REPRESENT APPROXIMATE BOUNDARIES ONLY. ACTUAL BOUNDARIES MAY BE GRADUAL. LOGS REPRESENT SUBSURFACE CONDITIONS AT THE BORING LOCATION AT THE TIME OF DRILLING ONLY.

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UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 6002
6235 Seminary Avenue
Oaklend, California

PLATE 3

Total depth of boring:	15-1/2 feet	Casing diameter:	NA
Diameter of boring:	12 inches	Casing material:	NA
Date drilled:	1-13-94	Slot size:	NA
Drilling Company:	Exploration Geoservices	Sand size:	NA
Driller:	Dave and Howard	Screen Interval:	NA
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin Krueger

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

P.I.D.	Sample No.	Blows	Depth	USCS Code	Description	Well Const.
			2	SP	Asphalt (2 inches). Medium-grained sand, trace cobbles, tan, damp, very dense; probably fill, trace patches silty clay, black, damp, medium plasticity, stiff.	
			4			
90	S-5		6		Hand dug to 5 feet, fill, no pipes or utilities encountered.	
			8	ML	Sandy silt, gray, damp, medium plasticity, stiff; fill.	
250	S-8.5		10	SP-SM	Medium-grained sand with silt, gray, moist to wet, medium dense; probable fill, pieces of wood; fill. Wet, product odor.	
			12			
108	S-14.5		14	CL	Silty clay, trace gravel, brown-orange, damp, medium plasticity, wet around gravel.	
			16		Total Depth = 15-1/2 feet.	
			18			
			20			
			22			
			24			
			26			
			28			
			30			
			32			
			34			
			36			
			38			
			40			

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LOG OF BORING B-1

ARCO Station 6002
6235 Seminary Avenue
Oakland, California

PLATE 4

Total depth of boring:	36-1/2 feet	Casing diameter:	4 inches
Diameter of boring:	12 inches	Casing material:	Sch 40 PVC
Date drilled:	1-13-94	Slot size:	0.020-inch
Drilling Company:	Exploration Geoservices	Sand size:	No. 3 sand
Driller:	Dave and Howard	Screen Interval:	5 feet to 25 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin Krueger

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

P.I.D.	Sample No.	Blows	Depth	USCS Code	Description	Well Const.
			2	GP	Asphalt (2 inches). Sandy gravel, orange, damp, very dense; baserock.	
			4	ML	Clayey silt, trace fine gravel, black, damp, medium plasticity, very stiff.	
4400	S-5.5		6	ML	Sandy silt, with gravel, gray, damp, medium plasticity, stiff.	
>9999	S-7.5		8		Visible product, black, rootholes.	
	S-8.5					
614	S-10.5		10	CL ▽	Silty clay, with gravel, orange, damp, medium plasticity, stiff; visible product. Wet around gravel and in rootholes.	
			12			
1500	S-13.5		14		With gray mottling.	
190	S-16		16			
210	S-18		18		Roots and increasing amounts of gravel and moisture.	
770	S-20.5		20	GM	Silty gravel with sand, gray, moist to wet, dense; wet around roots and in rootholes.	
			22		Wet.	
250	S-23.5		24		Wet around gravel.	
			26	GP	Coarse sandy gravel, gray, sand red, white, and gray, damp, dense; wet around gravel.	
20	S-27		28			
			30	SM	Silty sand with gravel, gray, damp to moist, dense; wet around gravel.	
				GP	Coarse sandy gravel, orange, moist to wet, dense.	
			32	SC	Clayey sand with fine gravel, orange, damp, dense; wet around gravel.	
0	S-32.5		34			
0	S-36		36			
			38		Total Depth = 36-1/2 feet.	
			40			

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LOG OF BORING B-2/MW-1

ARCO Station 6002
6235 Seminary Avenue
Oakland, California

PLATE 5

Total depth of boring:	15-1/2 feet	Casing diameter:	4 inches
Diameter of boring:	12 inches	Casing material:	Sch 40 PVC
Date drilled:	1-14-94	Slot size:	0.1-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" pea gravel
Driller:	Dave and Howard	Screen interval:	6 feet to 14 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin Krueger

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

P.I.D.	Sample No.	Blows	Depth	USCS Code	Description	Well Const.
			0	GP	Asphalt (2 inches).	
					Sandy gravel, orange, damp, dense; baserock	
			2	ML	Sandy silt with fine gravel, brown, damp, medium plasticity, stiff.	
			4		Hand dug to 4 feet, native material encountered.	
95	S-5	5 6 8	6			
			8			
78	S-10	8 10 17	10	▽	Gray, moist, wet around gravel.	
			12	ML	Sandy silt, with gravel, trace clay, orange, moist to wet, medium plasticity, stiff.	
33	S-14.5	6 7 8	14			
			16		Total Depth = 15-1/2 feet.	
			18			
			20			
			22			
			24			
			26			
			28			
			30			
			32			
			34			
			36			
			38			
			40			

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LOG OF BORING B-3/VW-2

ARCO Station 6002
6235 Seminary Avenue
Oakland, California

PLATE 6

Total depth of boring:	16 feet	Casing diameter:	4 inches
Diameter of boring:	12 inches	Casing material:	Sch 40 PVC
Date drilled:	1-14-94	Slot size:	0.1 inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" pea gravel
Driller:	Dave and Howard	Screen Interval:	6 feet to 14 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin Krueger

Signature of Registered Professional: _____

Registration No.: CEG 1463 State: CA

P.I.D.	Sample No.	Blows	Depth	USCS Code	Description	Well Const.
			0	GP	Asphalt (2 inches).	
			2		Sandy gravel, brown, damp, dense; baserock.	
					Hand dug to 3 feet, native material encountered.	
		5	4	ML	Sandy silt with gravel, brown, damp, medium plasticity, stiff.	
8	S-5	6				
		6	6		Gray, moist to wet.	
			8		Brown.	
		15		▽		
39	S-10	18	10		Orange, damp, wet around gravel.	
		12				
			12			
			14			
26	S-15.5	7			With gray mottling in rootholes.	
		11				
		13	16			
					Total Depth = 16 feet.	
			18			
			20			
			22			
			24			
			26			
			28			
			30			
			32			
			34			
			36			
			38			
			40			

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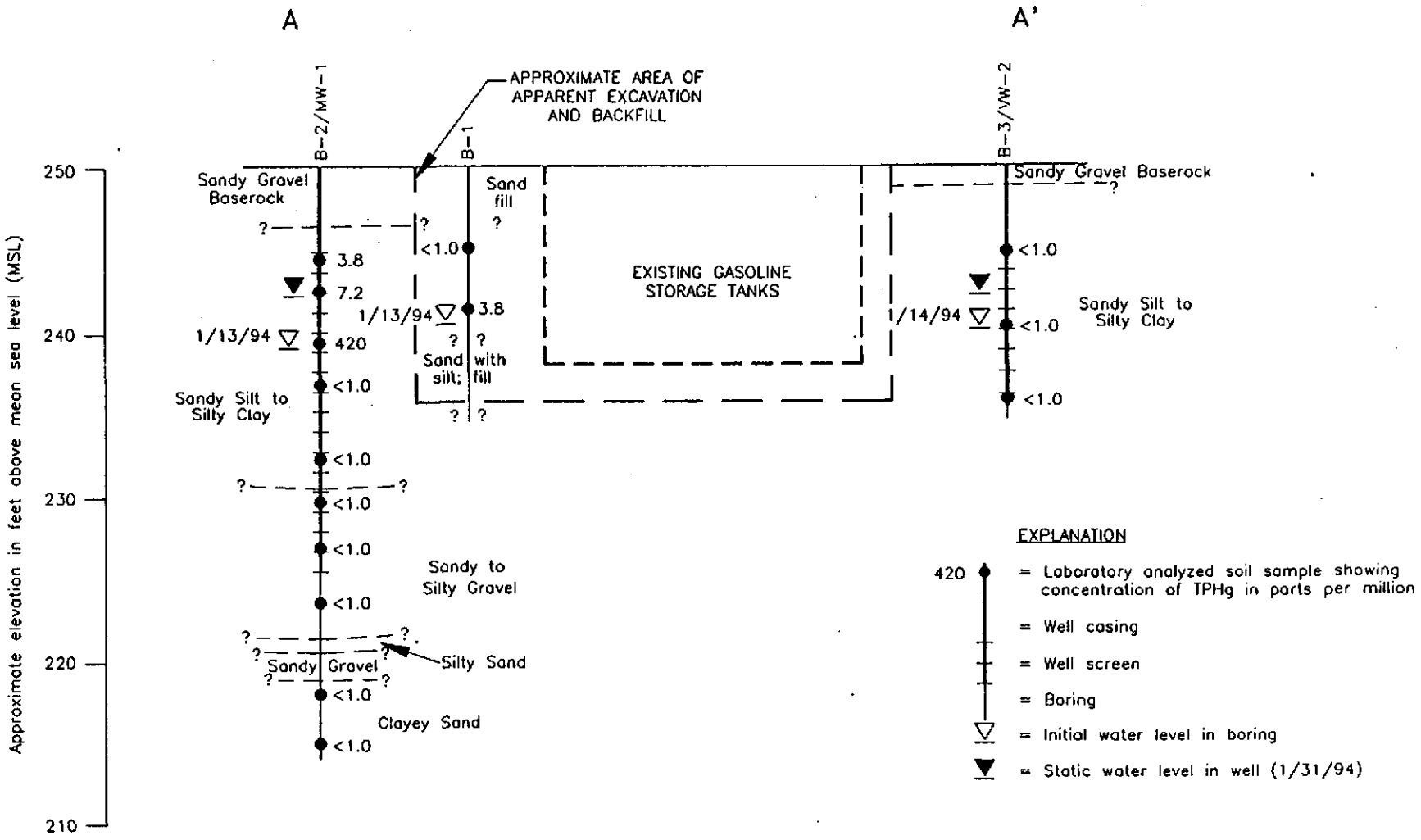
PROJECT: 130063.01

LOG OF BORING B-4/VW-1

ARCO Station 6002
6235 Seminary Avenue
Oakland, California

PLATE 7



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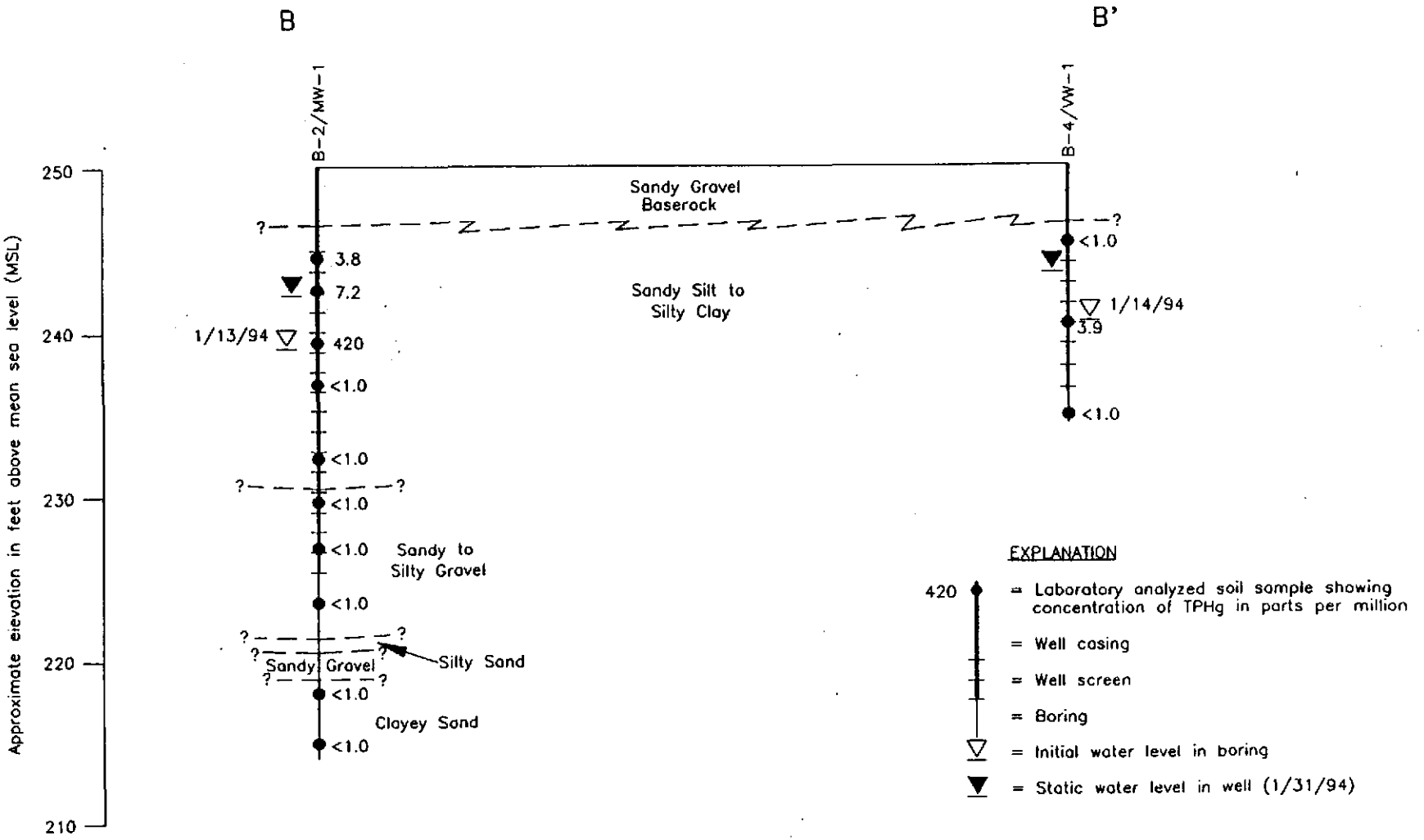
GEOLOGIC CROSS SECTION A-A'
ARCO Station 6002
6235 Seminary Avenue
Oakland, California

PLATE
8



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Working to Restore Nature

PROJECT 130063.01

GEOLOGIC CROSS SECTION B-B'
ARCO Station 6002
6235 Seminary Avenue
Oakland, California

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