WESTERN GEOLOGIC RESOURCES, INC.

2169 E. FRANCISCO BOULEVARD, SUITE B
SAN RAFAEL, CALIFORNIA 94901
415/457-7595 FAX: 415/457-8521

ADDITIONAL SUBSURFACE INVESTIGATION

at

Abandoned Chevron Asphalt Plant
1520 Powell Street
Emeryville, California

Prepared for

Chevron USA
2410 Camino Ramon
San Ramon, California

March 1990

ADDITIONAL SUBSURFACE INVESTIGATION

at

Abandoned Chevron Asphalt Plant
1520 Powell Street
Emeryville, California

Prepared for

Chevron USA
2410 Camino Ramon
San Ramon, California

Prepared by

Western Geologic Resources, Inc.
2169 East Francisco Boulevard, Suite B
San Rafael, California 94901

March 1990

Christopher S. Alger
Project Geologist

Kathleen A. Isaacson
Senior Geologist

Thomas J. Echols
Senior Geologist
CRG No. 4564

REGISTERED GEOLOGIST
THOMAS J. ECHOLS
No. 4564
Exp. 6-30-90
STATE OF CALIFORNIA

CONTENTS

		Page No.
	Executive Summary	i
1	Introduction	1
2	Background	3
	2.1 Site Setting	3
	2.2 Previous Investigations	3
3	Subsurface Investigation	7
	3.1 Soil Borings and Hydrogeology	7
	3.2 Monitor Well Installation and Development	8
	3.3 Groundwater Sampling	9
4	Well Elevation Survey and Groundwater Flow	10
5	Analytic Results	11
	5.1 Soil	11
	5.2 Groundwater	11

FIGURES

1. Site Location Map
2. Site Map with Boring and Monitor Well Locations

TABLES

1. Analytic Results of Soil Samples: Fuel Hydrocarbons, Halocarbons and Aromatic Hydrocarbons
2. Analytic Results of Groundwater Samples: Fuel Hydrocarbons, Halocarbons, Metals and Aromatic Hydrocarbons

APPENDICES

A. Standard Operating Procedures
B. Boring Logs and Well Construction Details
C. Chain-of-Custody Forms
D. Laboratory Analytical Reports and Quality Assurance/Quality Control Reports

EXECUTIVE SUMMARY

An additional subsurface investigation was conducted by Western Geologic Resources, Inc. (WGR) in February and March 1990 at the former Chevron Asphalt Plant located at 1520 Powell Street, Emeryville, California, to determine if petroleum hydrocarbons and halocarbons are present in the shallow soil and groundwater off-site and replace on-site monitor wells destroyed during prior soil excavation. Three exploratory borings, B-1 through B-3, were drilled on-site beyond the perimeter of the excavation backfill, with borings B-2 and B-3 completed as groundwater monitor wells MW-13 and MW-14, respectively, on 2 February 1990. Off-site exploratory boring B-4 was drilled in the estimated-cross-gradient direction from the site and completed as groundwater monitor well MW-15 on 2 February 1990. These three wells were developed on 5 February 1990. Four off-site exploratory borings, B-16 through B-19, were drilled in the estimated-downgradient direction from the site and completed as groundwater monitor wells MW-16 through MW-19, respectively, from 21 to 23 March 1990. Depths to first water ranged from 6.0 ft to 10.5 ft below grade. The wells were developed on 22 to 26 March 1990. Groundwater samples were collected from all wells on 21 to 26 March 1990.

Analytical Results: Soil

Total petroleum hydrocarbons (TPH), characterized as both gasoline and diesel, were detected in soil samples collected from on-site borings B-2, B-3, and off-site boring B-17. Concentrations ranged from 10 parts-per-million (ppm) gasoline in boring B-3 at a depth of 5.5 feet to 870 ppm diesel in boring B-2 at a depth of 3.5 feet. Benzene, toluene, ethylbenzene, and xylenes and halocarbons were not detected in any soil samples analyzed.

Analytical Results: Groundwater

Total purgeable petroleum hydrocarbons (TPPH) and aromatic hydrocarbons were detected in groundwater samples collected from wells MW-13 and MW-14 with maximum concentrations of 480 parts-per-billion (ppb) TPPH and 5 ppb total xylenes. Halocarbons were detected in groundwater

samples collected from wells MW-16 through MW-19 with maximum concentrations of up to 41 ppb trichloroethene (TCE), 53 ppb tetrachloroethene (PCE), and up to 10 ppb 1,2-dichloroethene (1,2-DCE) in the groundwater sample collected from well MW-19. Soluble metals were detected in groundwater samples collected from wells MW-16 through MW-19 with maximum concentrations of 150 ppb Pb, 340 ppb Cd, 20,000 ppb Cr and 5900 ppb Zn.

Groundwater Flow

The estimated direction of groundwater flow has not been determined due to a pending resurveying effort for the site. Once an accurate datum has been established, depth to water measurements will be taken for all wells and the groundwater flow will be determined.

1 INTRODUCTION

This report presents the results of the off-site phase of the subsurface investigation conducted by Western Geologic Resources, Inc. (WGR) in February and March 1990 at the former Chevron Asphalt Plant, located at 1520 Powell Street, California (Figure 1). This phase of the investigation was designed to further define the extent of petroleum hydrocarbons and halocarbons in the shallow soil and groundwater to the south, downgradient from the site, and replace on-site monitor wells destroyed during recent on-site soil excavation.

The scope of work for the investigation included the following:

1) Drill five exploratory borings (B-4 and B-16 through B-19) off-site, in the estimated downgradient direction of groundwater flow, within the Landregan and Powell Streets right-of-way and collect soil samples at approximately 5 ft intervals;

2) Drill three exploratory borings (B-1, B-2 and B-3) on-site, located beyond the soil excavation boundary, with one of the three extended through the first water bearing zone via a conductor casing.

3) Analyze selected soil samples for total petroleum hydrocarbons (TPH) by EPA Method 8015, and for aromatic hydrocarbons including benzene, toluene, ethylbenzene and total xylenes (BTEX) and halocarbons by EPA Method 8240;

4) Complete seven of the eight borings as 2- or 4-in diameter groundwater monitor wells;

5) Develop the new monitor wells MW-13 through MW-19, purge and sample all wells on- and off-site and analyze the groundwater samples for TPPH by EPA Method 8015, for BTEX by EPA Method 8020, for halocarbons by EPA Method 8010, for oil and

grease by California Standard Method 503E, and for cadmium (Cd), chromium (Cr) and zinc (Zn) by EPA Method 6010, and lead (Pb) by EPA Method 239.2; and

6) Review all field and laboratory data and prepare a report of this investigation.

2 BACKGROUND

2.1 SITE SETTING

The site is an abandoned fueling terminal and asphalt testing laboratory. It is located at 1520 Powell Street in Emeryville, California (Figure 1). The site is located less than 1 mile east of San Francisco Bay in a heavily industrialized area. The elevation of the site is approximately 10 feet above mean sea level (msl) and the local topography slopes gently to the west, toward San Francisco Bay. Groundwater has been found between 1 and 5 feet below grade at the site and appears to be under a tidal influence, but the degree of influence has yet to be determined. The aboveground fuel storage tanks have been removed and the asphalt laboratory and other associated buildings are abandoned (Figure 2).

2.2 PREVIOUS INVESTIGATIONS

March 1985 - Nine on-site groundwater monitoring wells were installed by Harding Lawson Associates (HLA). Low concentrations of hydrocarbons were found in groundwater samples (ref: Chevron Memorandum 21 June 1985).

October 1987 - The above-ground fuel storage tanks and associated piping were removed.

July 1988 - Three additional on-site wells were installed by HLA. Trichloroethene (TCE) and fuel hydrocarbons were found in soil. Fuel hydrocarbons and other regulated compounds were found in the groundwater. Soil borings were also installed at 18 locations. All composites and individual soil samples were analyzed for gasoline, kerosene, diesel and other hydrocarbons. Soil samples from two borings were also analyzed for purgeable priority pollutants. Samples were all below detection for gasoline, kerosene, and diesel hydrocarbons. Other hydrocarbons were

reported at concentrations from below the detection limit to 7,500 parts-per-million (ppm). The samples from borings 17 and 18 contained TCE at 1.4 ppm and 1.5 ppm, respectively (ref: Preliminary Findings--Hazardous Materials Site Assessment, 1520 Powell Street, Emeryville, California; Harding Lawson Associates, 1 September 1988).

August/
September 1988 - The loading dock and barrel storage area were removed to allow for additional subsurface investigation.

September 1988 - WGR drilled 42 soil borings on-site, near the old barrel storage area, and off-site to determine the vertical and horizontal extent of fuel hydrocarbons in shallow soil at and adjacent to the facility (ref: Soil Sampling Report--Chevron Asphalt Plant, 1520 Powell Street, Emeryville, California: Western Geologic Resources, Inc., 27 February 1989).

Laboratory analysis of soil samples collected from the borings indicated fuel hydrocarbon concentrations ranging from below the detection limit to 2,700 ppm.

December 1988 - Groundwater Technology, Inc. (GTI) drilled 33 additional soil borings to further investigate the vertical and horizontal extent of fuel hydrocarbons and halocarbons in the unsaturated zone and to perform a preliminary feasibility study for bioreclamation. The sampling depths ranged from 1.5 feet to 10 feet below grade. Samples were collected in the saturated zone to determine bacteria population size and moisture/dry weight analysis (ref: Subsurface Soil Investigation--1520 Powell Street, Emeryville, California: Groundwater Technology Inc., December 1988).

Twenty-seven soil samples were analyzed for fuel hydrocarbons (gasoline, diesel and "waste oil"), 31 were analyzed for halocarbons, 2 were analyzed for purgeable priority pollutants (fuels, halocarbons plus other regulated purgeable compounds), 5 were tested for moisture/dry weight analysis and 9 were tested for bacterial

population count. Gasoline was detected in one of the samples analyzed for fuel hydrocarbons, while diesel compounds were detected in 9 of these samples and "waste oil" was identified in 3 of these samples. The term "waste oil" refers to heavier hydrocarbons or degraded gasolines, diesel fuels or fuel oils. Halocarbons were detected in three of the 27 samples analyzed for these compounds.

April/
September 1989 - Approximately 10,400 cubic yards (cy) of soils containing hydrocarbons were excavated to a depth averaging 6 feet. The approximate limits of the excavation are indicated on Figure 2. The lateral extent of the excavation was determined in the field using a photoionization detector (PID). For most of the subject area, soils were excavated until the PID did not detect any concentrations of hydrocarbons. Existing buildings and property lines determined the boundaries for the excavation in some locations. The excavation was lined with 10-mil Visqueen plastic sheeting, backfilled with 1-1/2 inch (in) diameter clean crushed rock, and covered with graded subbase material. The backfill was then wetted and compacted. Monitor wells MW-4, MW-5, and MW-6 were abandoned and excavated during this phase (ref: Preliminary Site Remediation Report--Chevron Asphalt Plant and Terminal, 1520 Powell Street, Emeryville, California: Western Geologic Resources, Inc., August 1989.)

Approximately 256 cy of additional soil containing halocarbons were excavated and removed from four separate locations. Three of these were under the southwest office/lab building and one was just outside that building. Soil containing halocarbons outside the building was excavated to an average depth of 6 feet, at which point field analysis of the soil using a portable gas chromatograph did not show detectable concentrations of halocarbons. The area was subsequently backfilled in the same manner as the larger excavation. The soils containing halocarbons under the building were excavated to approximately 14 inches below the surface. The excavation was lined with two layers of 10-mil Visqueen plastic sheeting, and backfilled with six inches of 1-1/2 in diameter clean

crushed rock, and overlain by two inches of sand. A six-inch steel-reinforced concrete slab was poured to match the existing concrete floor.

3 SUBSURFACE INVESTIGATION

3.1 SOIL BORINGS AND HYDROGEOLOGY

Four exploratory soil borings, B-1 through B-4, were drilled from 1 to 2 February 1990 under the supervision of WGR geologist Christopher Alger by Exploration Geoservices, Inc. of San Jose, California, using a Mobile B-56 truck-mounted hollow-stem auger drill rig. Four additional exploratory soil borings, B-16 to B-19 were drilled and sampled from 21 to 23 March by WGR geologists Michael Edmonson and David Reichard with a Giddings trailer-mounted hollow-stem auger drill rig. Off-site boring and monitor well locations as shown on Figure 3, were selected based on the estimated southern direction of groundwater flow. In addition, borings B-2 and B-3 were located to replace monitor wells destroyed during recent soil excavations (Figure 2).

Borings B-1 and B-2 were drilled on-site west of the excavation area beyond the site fence, adjacent to the property boundary with the Southern Pacific Railway. Boring B-1 was cased through the first water bearing zone in an attempt to determine the thickness of the known aquitard which underlays the site. Boring B-3 was drilled north of the center of the site beyond the excavation boundary. Boring B-4 was drilled off-site in the western edge of Landregan Street, north of Powell Street and boring B-16 was drilled in the eastern edge of Landregan Street north of Haroff Street. Borings B-17, B-18, and B-19 were drilled in the southern edge of old Powell Street, beneath the Powell Street Bridge. Prior to beginning drilling of off-site borings, the proper encroachment permits were obtained from the City of Emeryville Public Works Department.

Soil samples were collected at intervals ranging from 1 ft to 5 ft in depth according to the WGR standard operating procedure for soil sampling (SOP-2) included in Appendix A. Twelve soil samples were sent under chain-of-custody to Superior Analytical Laboratory, Inc. of San Francisco, California. In addition, twenty-six soil samples were sent under chain-of-custody to GTEL Environmental Laboratories, Inc. (GTEL) of Concord, California.

Boring logs are included in Appendix B. The stratigraphy encountered during drilling was fairly consistent, with minimal variation between borings. Asphalt pavement and baserock material were encountered to a depth of about 1 ft in borings B-4 and B-16 through B-19; no pavement overlaid boring B-3, but sand and gravel fill was encountered to a depth of about 3 ft. Borings B-1 and B-2 encountered silty fill to a depth of approximately 3 ft. Soils encountered during drilling in the unsaturated zone were characterized by low-estimated permeability silty and gravelly clay. The unsaturated/saturated zone interface was often characterized by low-estimated permeability silty and clayey gravel.

Shallow groundwater was encountered at depths ranging from 6.0 ft to 10.5 ft below grade. Groundwater was not encountered in boring B-3. The saturated zone appeared to vary in thickness from about 3 ft in boring B-4 to about 19 ft in boring B-1. Soils encountered during drilling in the saturated zone were characterized by low- to moderate-estimated permeability sandy to clayey gravel of relatively high clay and silt content interbedded with clayey silts/silty clays of low-estimated permeability. An unsaturated zone of low-estimated permeability silty clay was encountered in boring B-1 from 19 ft to 29 ft below grade, that was underlain with moist, moderate-estimated permeability clayey sands and silts to 30.5 ft below grade. Liquid hydrocarbons were encountered in borings B-1 and B-2.

3.2 MONITOR WELL INSTALLATION AND DEVELOPMENT

The WGR standard operating procedure for monitor well installation and development (SOP-3) is included in Appendix A. Borings B-2, B-3, and B-4 were completed as 4-in diameter groundwater monitor wells MW-13, MW-14, and MW-15, respectively, on 1 through 2 February 1990. Borings B-16 through B-19 were completed as 2-in diameter groundwater monitor wells MW-16 through MW-19, respectively, on 21 through 23 March 1990. Well construction details are included on the boring logs for monitor wells MW-13 through MW-19 in Appendix B.

The screened interval and sandpack of wells MW-13 through MW-19 were chosen to conform with the estimated permeability of the soil, static water level, and thickness of the saturated zone. Well-screen lengths varied from 3.5 ft to 8.0 ft. The top of the screened intervals varied between 4 ft and 8

ft below grade, and were extended up to 5 ft above the static water level to allow for seasonal groundwater level fluctuations.

Monitor wells MW-13, MW-14 and MW-15 were developed on 5 February 1990; and MW-16, MW-17, MW-18, and MW-19 were developed on 22, 23, and 26 March 1990, by WGR environmental technicians until relatively clear silt- and sand-free water was produced. Development was performed using surge block techniques.

3.3 GROUNDWATER SAMPLING

After purging monitor wells MW-13, MW-14 and MW-15 on 21 March 1990, and MW-16 through MW-19 on 26 March 1990, groundwater samples were collected by WGR environmental technicians using steam-cleaned bailers according to the WGR standard operating procedure for groundwater sampling (SOP-4) included in Appendix A. Groundwater purged during the development and sampling processes was temporarily stored on-site in 55-gallon drums pending laboratory analyses. The groundwater samples were sent under chain-of-custody for analysis to GTEL.

4 WELL ELEVATION SURVEY AND GROUNDWATER FLOW

No calculation of groundwater flow has been performed due to a pending resurveying effort for the site. Once an accurate datum has been established, and top-of-casing elevations surveyed, then depth-to-water measurements will be taken for all wells and the groundwater flow direction will be determined.

5 ANALYTIC RESULTS

5.1 SOIL

All soil samples were analyzed by EPA Methods 8015 and 8240 for the presence of TPPH, aromatic hydrocarbons, including BTEX, and halocarbons. Analytic results for soil samples are presented in Table 1. Chain-of-custody forms and laboratory analytical reports with quality assurance/quality control documents are included in Appendices C and D, respectively.

TPPH, characterized as gasoline and as diesel, were detected in soil samples from on-site borings B-2, B-3 and off-site boring B-17, at concentrations ranging from 10 ppm (gasoline) in a soil sample collected from boring B-3 at a depth of 5.5 ft to 870 ppm (diesel) in a soil sample collected from boring B-2 at a depth of 3.5 ft. No aromatic hydrocarbons were detected in any soil samples analyzed. Acetone was detected at low concentrations in soil samples from boring B-2. The acetone may have been introduced at the laboratory and the results are being verified.

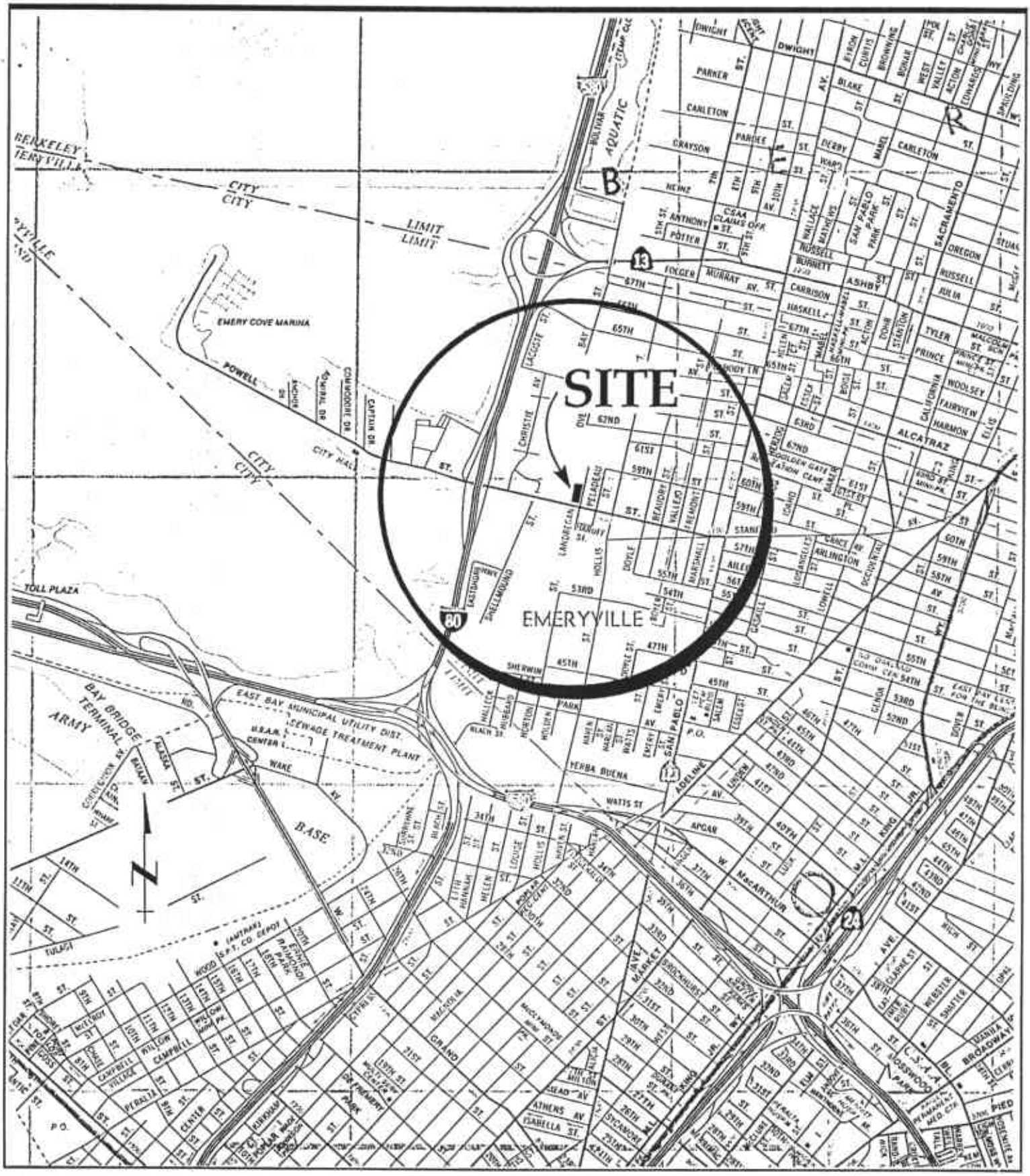
5.2 GROUNDWATER

Groundwater samples were analyzed by EPA Methods 8015 and 8020 for the presence of TPPH and BTEX, by EPA Method 601 for halocarbons, by California Standard Method 503E for oil and grease, and by EPA Method 6010 for Cd, Cr and Zn, and EPA Method 239.2 for Pb. Analytic results for groundwater samples are presented in Table 2. Chain-of-custody forms and laboratory analytical reports with quality assurance/quality control documents are included in Appendices C and D, respectively.

TPPH, characterized as gasoline, and certain aromatic hydrocarbons were detected in groundwater samples collected from on-site wells MW-13 and MW-14, with maximum concentrations

of 480 ppb TPPH and 5 ppb total xylenes. No TPPH or aromatic hydrocarbons were detected in groundwater samples from any of the off-site wells.

Halocarbons were detected in groundwater samples from off-site wells MW-16 through MW-19, with maximum concentrations of 41 ppb trichloroethene (TCE), 53 ppb tetrachloroethene (PCE) and 10 ppb 1,2-dichloroethene (1,2-DCE) detected in the groundwater sample collected from well MW-19. Halocarbons were not detected in groundwater samples from on-site wells MW-13, MW-14 and off-site well MW-15. One ppm concentration of oil and grease was detected in groundwater samples collected from wells MW-13 and MW-17. Soluble metals were detected in groundwater samples collected from wells MW-16 through MW-19 with maximum concentrations of 150 ppb Pb, 340 ppb Cd, 20,000 ppb Cr and 5900 ppb Zn.



NOT TO SCALE

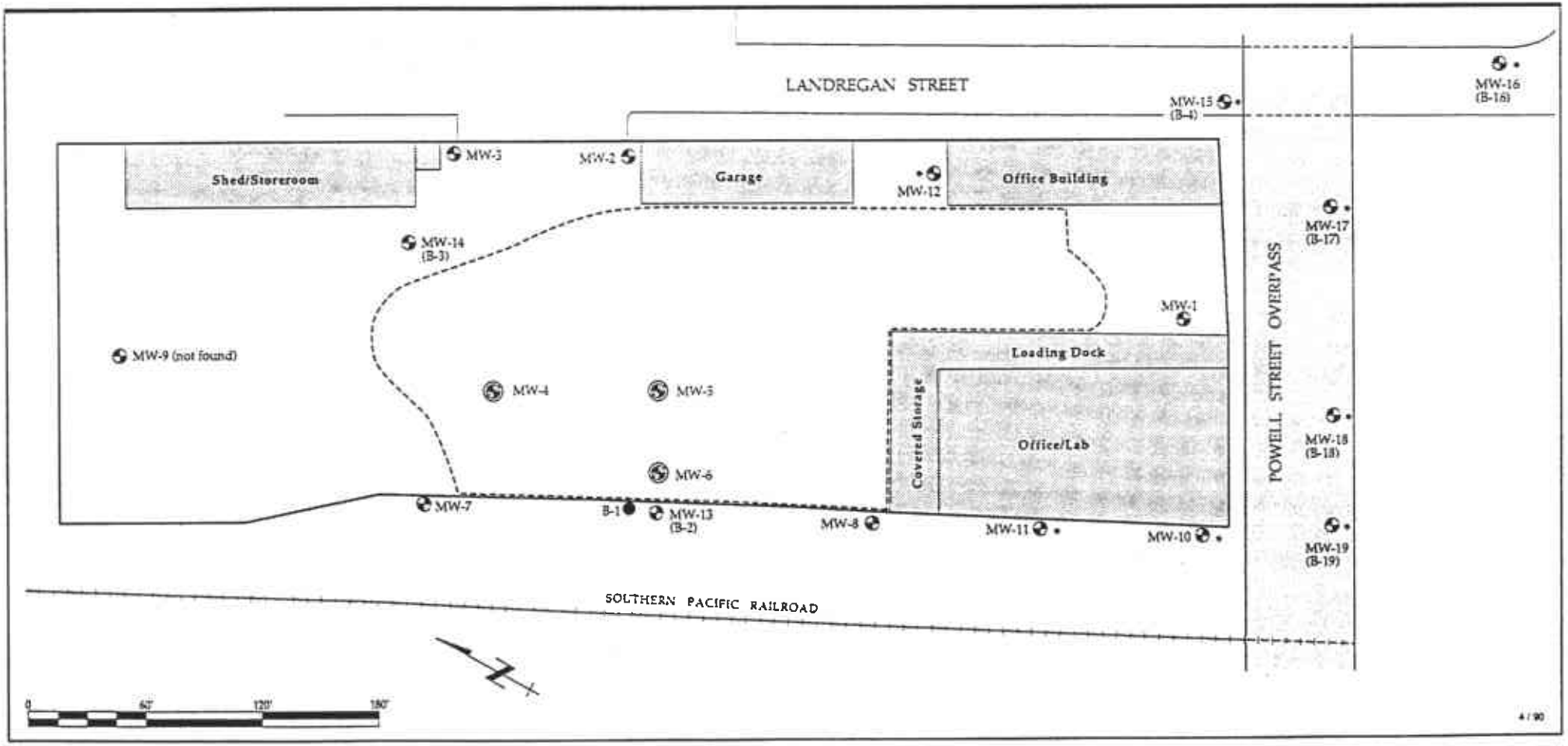
Reference: 1989 CSAA Road Map

Site Location Map
Former Chevron Asphalt Plant and Terminal
Emeryville, California

FIGURE
1

WESTERN GEOLOGIC RESOURCES, INC.

1-045.44



LEGEND

MW-14 (B-3)	Monitor Well (and Soil Boring) Location
B-1	Soil Boring Location
MW-5	Destroyed or Abandoned Monitor Well Location
*	Top of casing elevation unknown
- - - - - - -	Boundary of Excavation

Site Map with Soil Boring and Monitor Well Locations
Former Chevron Asphalt Plant and Terminal
Emeryville, California

FIGURE 2

WESTERN GEOLOGIC RESOURCES, INC.

1-045.45

Table 1. Analytic Results: Soil
Former Chevron Asphalt Plant
Emeryville, California
WGR Project #1-045.45

Well/Sample ID#	Date	Depth	EPA	Benzene	Toluene	E-Benzene	Xylenes	TPH(G)	TPH(D)	O&G
				<----------ppm---------->						<-ppm->
B-1	2 Feb 90	18.0	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	<10	---
B-1	2 Feb 90	23.0	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	<10	---
B-1	2 Feb 90	29.0	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	<10	---
MW-13	2 Feb 90	3.5	8240/8015	<0.01	<0.02	<0.02	<0.02	430	870	---
MW-13	2 Feb 90	5.5	8240/8015	<0.01	<0.02	<0.02	<0.02	130	260	---
MW-13	2 Feb 90	10.5	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	11	---
MW-13	2 Feb 90	13.0	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	<10	---
MW-14	2 Feb 90	5.5	8240/8015	<0.01	<0.02	<0.02	<0.02	10	60	---
MW-14	2 Feb 90	8.5	8240/8015	<0.01	<0.02	<0.02	<0.02	17	120	---
MW-14	2 Feb 90	11.0	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	<10	---
MW-15	2 Feb 90	6.0	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	<10	---
MW-15	2 Feb 90	9.5	8240/8015	<0.01	<0.02	<0.02	<0.02	<10	<10	---
MW-16	23 Mar 90	8.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-16	23 Mar 90	10.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-17	21 Mar 90	4.8	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-17	21 Mar 90	7.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	220	640
MW-17	21 Mar 90	9.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-17	21 Mar 90	12.8	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-18	22 Mar 90	4.8	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-18	22 Mar 90	7.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-18	22 Mar 90	9.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-18	22 Mar 90	11.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-19	22 Mar 90	5.8	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	17
MW-19	22 Mar 90	8.8	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
MW-19	22 Mar 90	10.3	8020/8015	<0.005	<0.005	<0.005	<0.015	<10	<10	<5
TB	26 Mar 90									

045T4AP0.WP

Table 1. Analytic Results: Soil (continued)
Former Chevron Asphalt Plant
Emeryville, California
WGR Project #1-045.45

Well/Sample ID#	Date	Depth	EPA Method	Acetone	1,2-DCE	1,1-DCE	Chloroform	1,2-DCA	1,1,1-TCA	TCE	PCE
				<--------			ppm				-------->
B-1	2 Feb 90	18.0	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
B-1	2 Feb 90	23.0	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
B-1	2 Feb 90	29.0	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-13	2 Feb 90	3.5	8240	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-13	2 Feb 90	5.5	8240	0.10	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-13	2 Feb 90	10.5	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-13	2 Feb 90	13.0	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-14	2 Feb 90	5.5	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-14	2 Feb 90	8.5	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-14	2 Feb 90	11.0	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-15	2 Feb 90	6.0	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-15	2 Feb 90	9.5	8240	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW-16	23 Mar 90	8.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-16	23 Mar 90	10.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-17	21 Mar 90	4.8	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-17	21 Mar 90	7.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-17	21 Mar 90	9.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-17	21 Mar 90	12.8	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-18	21 Mar 90	4.8	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-18	21 Mar 90	7.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-18	21 Mar 90	9.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-18	21 Mar 90	11.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-19	22 Mar 90	5.8	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-19	22 Mar 90	8.8	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
MW-19	22 Mar 90	10.3	8010	---	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5
TB	26 Mar 90										

Table 1. Analytic Results: Soil (continued)
Former Chevron Asphalt Plant
Emeryville, California
WGR Project #1-045.45

NOTES:

ppm = parts-per-million
ppb = parts-per-billion
E-Benzene = Ethylbenzene
TPH(G) = Total Petroleum Hydrocarbons as Gasoline
TPH (D) = Total Petroleum Hydrocarbons as Diesel
O&G = Oil and Grease
1,2-DCE = cis- and trans-1,2-Dichloroethene
1,1-DCE = 1,1-Dichloroethene
1,2-DCA = 1,2-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
TCE = Trichloroethene
PCE = Tetrachloroethene

Table 2. Analytic Results: Groundwater
Former Chevron Asphalt Plant
Emeryville, California
WGR Project #1-045.45

Well/Sample ID#	Date	Benzene	Toluene	E-Benzene	Xylenes	TPPH(G)	O&G	Total Cadmium	Total Chromium	Total Lead	Total Zinc
		<----------ppb---------->					<-ppm->	<----------ppb---------->			
MW-13	21 Mar 90	<0.3	<0.3	1	5	480	1	<50	<100	<5	<100
MW-14	22 Mar 90	<0.3	<0.3	0.4	2	170	<1	<50	<100	5	<100
MW-15	21 Mar 90	<0.3	<0.3	<0.3	<0.6	<50	<1	<50	<100	<5	<100
MW-16	26 Mar 90	<0.3	<0.3	<0.3	<0.6	<50	<1	<50	6600	45	540
MW-17	26 Mar 90	<0.3	<0.3	<0.3	<0.6	<50	1	56	7900	150	1020
MW-18	26 Mar 90	<0.3	<0.3	<0.3	<0.6	<50	<1	340	20,000	140	5900
MW-19	26 Mar 90	<0.3	<0.3	<0.3	<0.6	<50	<1	<50	1600	30	420
TB	21 Mar 90	<0.3	<0.3	<0.3	<0.6	<50					
TB	26 Mar 90	<0.3	<0.3	<0.3	<0.6	<50	<1				

045T3AP0.WP

TABLE 2. Analytic Results: Groundwater (continued)
Former Chevron Asphalt Plant
Emeryville, California
WGR Project #1-045.45

Well ID#	Date Sampled	1,2-DCE	1,1-DCA	Chloroform	1,2-DCA	1,1,1-TCA	TCE	PCE
		<--------			ppb			-------->
MW-13	21 Mar 90	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-14	22 Mar 90	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-15	21 Mar 90	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-16	26 Mar 90	0.8	<0.5	2.0	1.0	<0.5	27	8
MW-17	26 Mar 90	5.2	0.7	1.1	0.6	1.3	32	11
MW-18	26 Mar 90	1.7	<0.5	0.9	<0.5	2.4	33	20
MW-19	26 Mar 90	10	<0.5	3.2	<0.5	2.5	41	53
TB	21 Mar 90	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TB	26 Mar 90	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5

NOTES:

ppb = Parts-Per-Billion
ppm = Parts-Per-Million
E-Benzene = Ethylbenzene
TPPH(G) = Total Purgeable Petroleum Hydrocarbons characterized as gasoline
O&G = Oil and Grease
1,2-DCE = trans-1,2-Dichloroethene
1,1-DCA = 1,1-Dichloroethane
1,2-DCA = 1,2-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
TCE = Trichloroethene
PCE = Tetrachloroethene

045T1APO.WP

APPENDIX A

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURES
RE: SOIL SAMPLING
SOP-2

Soil samples for chemical analysis are collected in thin-walled brass tubes, 4-inches long by 2-inches outside diameter. Four of these tubes and a spacer tube are set in a 2-inch inside diameter 18-inch split-barrel sampler.

The split-barrel sampler is driven its entire length either hydraulically or using a 140-pound drop hammer. The sampler is extracted from the borehole and the brass tubes, containing the soil samples, are removed. Upon removal from the sampler, the selected brass tubes are immediately trimmed and capped with aluminum foil and plastic caps. They are then hermetically sealed with duct tape, labeled and refrigerated for delivery, under chain-of-custody, to the analytic laboratory. These procedures minimize the potential for cross-contamination and volatilization of volatile organic compounds (VOC) prior to chemical analysis.

One soil sample collected at each sampling interval is analyzed in the field using either a photoionization detector (PID), a flame ionization detector (FID), or an explosimeter. The purpose of this field analysis is to qualitatively determine the presence or absence of hydrocarbons and to establish which soil samples will be analyzed at the laboratory. The soil sample is sealed in a zip-lock plastic bag and placed in the sun to enhance volatilization of the hydrocarbons from the sample. The data is recorded on the drill logs at the depth corresponding to the sampling point.

Other soil samples are collected to document the stratigraphy and estimate relative permeability of the subsurface materials. All drilling and sampling equipment are steam-cleaned prior to use at each site and between boreholes to minimize the potential for cross-contamination.

STANDARD OPERATING PROCEDURES
RE: HOLLOW-STEM AUGER MONITOR WELL INSTALLATION AND DEVELOPMENT
SOP-3

The boreholes for monitor wells are drilled using a truck-mounted hollow-stem auger drill rig. The diameter of the borehole will be a minimum of four inches larger than the outside diameter (OD) of the casing when installing well screen. The hollow-stem auger provides minimal interruption of drilling while permitting soil sampling at desired intervals. Soil samples are collected by hammering a conventional split-barrel sampler containing pre-cleaned 2-inch brass sample tubes. A geologist from Western Geologic Resources continuously logs each borehole during drilling and constantly checks drill cuttings for odors. The sampler is rinsed between samples and steam-cleaned with all other drilling equipment between borings to prevent cross-contamination.

Monitor wells are cased with threaded, factory-perforated and blank Schedule 40 PVC. The perforated interval consists of slotted casing, generally 0.020-inch wide by 1.5-inch long slot size, with 42 slots per foot. A PVC cap is fastened to the bottom of the casing with stainless steel screws; no solvents or cements are used. Centering devices may be fastened to the casing to assure even distribution of filter material and grout within the borehole annulus. The well casing is thoroughly washed and steam-cleaned prior to installation.

After setting the casing inside the hollow stem, sand or gravel filter material is poured into the annular space to fill from the bottom of the boring to 1 foot above the perforated interval. A 1- to 2-foot thick bentonite plug is placed above this filter material to prevent grout from infiltrating down into the filter material. Neat cement, containing about 5% bentonite, is then tremied into the annular space from the top of the bentonite plug to the surface. A lockable PVC cap is placed on each wellhead. Traffic-rated Christy boxes are installed around the wellhead for wells in parking lots and driveways while steel stove pipes are usually set over wellheads in landscaped areas.

After installation, the wells are thoroughly developed to remove residual drilling materials from the wellbore, and to improve well performance by removing any fine material in the filter pack that can pass from the formation into the well. Well development techniques used include pumping, bailing, surging, swabbing, jetting, flushing, and airlifting. All development water is collected in 55-gallon drums for temporary storage, and is then disposed of properly depending on analytic results. To assure that cross-contamination does not occur between wells during drilling and development, all development equipment is steam-cleaned.

STANDARD OPERATING PROCEDURES
RE: GROUNDWATER PURGING AND SAMPLING
SOP-4

Prior to water sampling, each well is purged by evacuating a minimum of three well-casing volumes of groundwater or until the discharge water temperature, conductivity, and pH stabilize. The groundwater sample should be taken when the water level in the well recovers to 80% of its static level.

The sampling equipment used consists of either a teflon bailer or a stainless steel bladder pump with a teflon bladder. If the sampling system is dedicated to the well, then the bailer is made of teflon, but the bladder pump is PVC with a polypropylene bladder. Forty milliliter (ml) glass volatile-organic-analysis (VOA) vials, with teflon septa, are used as sample containers.

The groundwater sample is decanted into each VOA vial in such a manner that there is a meniscus at the top of the vial. The cap is quickly placed over the top of the vial and securely tightened. The VOA vial is then inverted and tapped to see if air bubbles are present. If none are present, the sample is labeled and refrigerated for delivery under chain-of-custody to the laboratory. Label information should include a sample identification number, job identification number, date, time, type of analysis requested, and the sampler's name.

For quality control purposes, a duplicate water sample is collected from each well. This sample is put on hold at the laboratory. A trip blank is prepared at the laboratory and placed in the transport cooler. It remains with the cooler and is analyzed by the laboratory along with the groundwater samples. A field blank is prepared in the field when sampling equipment is not dedicated. The field blank is prepared after a pump or bailer has been steam-cleaned, prior to use in a second well, and is analyzed along with the other samples. The field blank demonstrates the quality of in-field cleaning procedures to prevent cross-contamination.

To minimize the potential for cross-contamination between wells, all the well-development and water-sampling equipment that is not dedicated to a well is steam-cleaned between each well. As a second precautionary measure, wells will be sampled in order of least to highest concentrations as established by previous analyses.

APPENDIX B

BORING LOGS AND WELL CONSTRUCTION DETAILS

APPENDIX C

CHAIN-OF-CUSTODY FORMS

APPENDIX D

LABORATORY ANALYTICAL REPORTS AND

QUALITY ASSURANCE/QUALITY CONTROL REPORTS