Chevron U.S.A. Inc.
2410 Camino Ramon, San Ramon, California • Phone (415) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

Marketing Operations

May 25, 1990

D. Moller
Manager, Operations
S. L. Patterson
Area Manager, Operations
C. G. Trimbach
Manager, Engineering

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

Re: Chevron Service Station #9-5607
5269 Crow Canyon Road
Castro Valley, CA

Dear Mr. Shahid:

Enclosed we are forwarding the Quarterly Groundwater Sampling REPORT DATED MAY 22, 1990, CONDUCTED BY OUR CONSULTANT PACIFIC Environmental Group Inc., at the above referenced site.

Pacific has installed eight (8) additional wells to further define the extent of contamination at this site. A formal report documenting this additional work is included in the attached report. Pacific Environmental Group, Inc. has evaluated the quarterly monitoring system and has recommended changes in the frequency. We will implement the proposed changes unless we hear from you otherwise. The groundwater extraction system is operational and within the next two (2) quarters we will evaluate the effectiveness of the extraction and treatment system.

I declare under penalty of perjury that the information contained in the attached report is true and correct, and that any recommended actions are appropriate under the circumstances, to the best of my knowledge.

If you have any questions or comments, please do not hesitate to contact me at (415) 842-9581.

Very truly yours,

C.G. Trimbach

By Nancy Vukelich
Nancy Vukelich

NLV/jmr
Enclosure
cc: Mr. Lester Feldman-RWQCB-Bay Area
1800 Harrison St., Ste. 700
Oakland, CA 94612

90 MAY 31 PM 12:55

PACIFIC
ENVIRONMENTAL
GROUP, INC.

KLD MAY 24 '90

May 8, 1990
Project 320-18.02

Chevron USA, Inc.
2410 Camino Ramon Way
San Ramon, CA 94583

Attn: Mr. John Randall

RE: Chevron USA Station 5607
5269 Crow Canyon Road
Castro Valley, California

Dear Mr. Randall:

This letter presents a progress report updating investigative activities performed by Pacific Environmental Group, Inc. (PACIFIC) at the Chevron USA service station located at the above referenced site (Figures 1 and 2). Presented in this letter is a brief discussion of investigative background, scope of work performed during the current investigation, results, and conclusions and recommendations.

BACKGROUND

Groundwater Technology, Inc. (GTI) performed several investigations at the site between March 1985 and March 1988. GTI's initial investigative report to Chevron was issued on April 1, 1985. Reports were issued quarterly by GTI from November 1986 through April 1988.

The following is a summary of results obtained from the above referenced reports, as well as tasks performed by PACIFIC:

- On February 26, 1985 an inventory discrepancy was recorded at the site. Inventory discrepancies occurring since September 1984 indicated an estimated loss of approximately 670 gallons of regular gasoline. The suspected leaking underground storage tank was installed in September 1971 and was removed along with product lines in April 1985 after failing a petro-tite test. According to Chevron's leak report, product was not observed in the tank excavation or on the water table.

1601 Civic Center Drive, Suite 202, Santa Clara, California 95050, (408) 984-6536
FAX: (408) 243-3911

- GTI installed eight monitoring wells (MW-1 through MW-8) on site in March 1985. These are shown as Wells C-1 through C-8 on Figure 3. Static groundwater ranged from approximately 17 to 26 feet below grade. The groundwater gradient was documented to be predominantly to the south-southwest. There is no documentation that soil samples collected from the borings were submitted for laboratory analysis.

- GTI's initial investigative report dated April 1, 1985 documented the installation and monitoring of Wells MW-1 through MW-8. Separate-phase product was measured in Wells MW-1 through MW-3 on March 6, 1985 and ranged in thickness from trace amounts to 4.30 feet. GTI therefore installed a recovery well (RW-1) to initiate remediation as well as an additional monitoring well (MW-9, shown as C-9 on Figure 3) to further assess the extent of hydrocarbons.

- PACIFIC conducted a soil-gas investigation at the site on September 12, 1989 which was documented in a report to Chevron dated November 18, 1989. Sixteen exploratory probes were installed at the site. Soil vapor data was collected from depth intervals between 8 and 20 feet. Hydrocarbons detected in the soil pore spaces at these intervals ranged from less than 1 part per million (ppm) to 505 ppm. **Total BTEX concentrations suggested that hydrocarbon vapors extend from the tank complex on site, downgradient** (southwesterly) **beneath the adjacent residential area and toward Crow Creek.**

On September 13, 1989, PACIFIC implemented a quarterly monitoring program at the site. The results of quarterly sampling events performed by PACIFIC on September 13 and December 4, 1989 were documented in reports to Chevron USA dated January 4 and February 20, 1990, respectively. Analysis of water samples collected during the September and December 1989 sampling events showed the highest concentrations of dissolved hydrocarbons to be found in the vicinity of the underground storage tank complex. These dissolved hydrocarbons were noted to extend off-site in a southwest (downgradient) direction during each sampling event. Table 1 presents a summary of historical groundwater analytical results. Groundwater elevation data for September and December 1989 suggested a groundwater flow direction toward the southwest with an approximate gradient of 0.2 (December 1989). Groundwater elevation data is presented in Table 2.

The purpose of the current investigation was to document groundwater conditions in the north (upgradient) direction, in the southwest (downgradient) direction, and in the south (lateral) direction of the site.

SCOPE OF WORK

Based on the above findings PACIFIC performed additional investigative activities at the site between February and March 1990. PACIFIC's additional investigative activities included:

- Installation of eight additional groundwater monitoring wells (C-10A, C-10B, C-11 through C-16) off-site.
- Groundwater sampling and analysis in accordance with a quarterly groundwater monitoring program.

A brief description of each of these tasks is presented below. Also attached to this report are: procedures for field and laboratory investigations; exploratory boring logs with well completion details; and certified analytical reports.

INVESTIGATIVE RESULTS

The following is a summary of investigative tasks completed and results obtained:

- PACIFIC installed eight groundwater monitoring wells (C-10A, C-10B, and C-11 through C-16) at the site on February 21 through 24, 1990. Wells C-10A, C-10B, C-15 and C-16 were installed southwest (downgradient) of the site, between Crow Creek and the condominium complex. Well C-11 was installed approximately 130 feet south of the site, Well C-12 was installed approximately 70 feet west of the site, Well C-14 was installed approximately 50 feet south of the site, and Well C-13 was installed north (upgradient) of the site in the center-divider of Crow Canyon Road.
- Soils encountered during drilling consisted primarily of surficial deposits of interbedded clays, silts, clayey sands and clayey gravels to depths ranging between approximately 15-1/2 and 34-1/2 feet. Underlying the surficial soils were deposits of the Cretaceous-age Chico Formation (Robinson 1956) consisting of interbedded siltstone, silty sandstone and claystone to the total explored depth of 35 feet. Detectable organic vapor concentrations (measured with an H-NU) were noted to range between a low of 0.5 ppm and 313 ppm. The highest organic vapor concentrations (45 ppm to 313 ppm) were noted in Borings C-12, C-13, C-15 and C-16 between the approximate depths of 10 and 20 feet. All remaining readings were below 4.6 ppm. Organic vapor concentrations are noted on the borings logs in Appendix A.

- Soil samples collected from Borings C-12 (at the depth interval of 14-1/2 to 16 feet), C-13 (at the depth interval of 14-1/2 to 16 feet) and C-15 (at the depth interval of 9-1/2 to 11 feet) were submitted for laboratory analysis. Low-boiling hydrocarbons (calculated as gasoline) were detected in soil samples from Borings C-12 and C-15 at 200 ppm and 10 ppm, respectively. Benzene was detected only in the soil sample from Boring [redacted] at a concentration of 1.7 ppm. Table 3 presents a summary of soil analytical results. Certified analytical reports are in Appendix B.

- Groundwater from all site wells was sampled on March 9, 1990. Depth to static groundwater on March 7, 1990 was noted to range between approximately 9 and 30 feet. Groundwater contours (based on mean sea level datum) were constructed using water level data obtained during the March 1990 sampling event. The contours are presented on Figure 3. Groundwater underlying the site flowed to the southwest at an approximate gradient of 0.12 at that time. This flow direction is consistent with previous sampling events. Groundwater elevation data for the site is presented in Table 2.

- During the March 1990 sampling event, separate-phase hydrocarbons were noted in Well C-1 at an approximate thickness of less than 0.005 foot. Dissolved gasoline was noted in Wells C-2, C-3, C-4, C-6, C-7, C-9, C-12 and C-15 at concentrations ranging between 390 parts per billion (ppb) and 73,000 ppb. The highest concentrations of dissolved hydrocarbons were noted in groundwater samples collected from wells located in the vicinity of the underground storage tank complex and downgradient (southwest) of the site. A summary of groundwater analytical results is presented in Table 1. Dissolved gasoline and benzene concentrations, and hydrocarbon isoconcentration contours are presented on Figure 4.

CONCLUSIONS AND RECOMMENDATIONS

The highest concentration of dissolved hydrocarbons were noted in groundwater samples collected from wells located in the vicinity of the underground storage tank complex. Hydrocarbons were noted to extend off-site in a southwest (downgradient) direction towards Crow Creek.

PACIFIC has noted that based on the distance between monitoring wells, and current and historic groundwater analytical results, certain wells provide overlapping groundwater analytical data.

Therefore, PACIFIC proposes that Wells C-2, C-4 and C-8 be sampled on an annual basis. Also, if Well C-13 is noted to have non-detectable concentrations of dissolved hydrocarbons during the next sampling event, then it should also be sampled on an annual basis.

To determine if the groundwater extraction equipment installed in Well RW-1 will influence groundwater conditions at the site, PACIFIC recommends operation and performance verification of the groundwater extraction and treatment system.

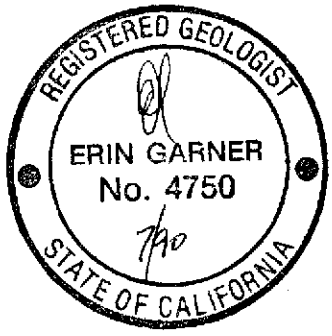
If you have any questions regarding the contents of this letter, please call.

Sincerely,

PACIFIC ENVIRONMENTAL GROUP, INC.

Steven E. Krcik
Project Geologist

Erin Garner
Senior Geologist



Reference:

Robinson, G.D., 1956, "Geologic Map of the Hayward Quadrangle, California", USGS.

enclosure

TABLE 1

SUMMARY OF [redacted] ANALYTICAL RESULTS

Low-Boiling Hydrocarbons

Well No.	Sample Date	Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl-Benzene (ppb)	Xylenes (ppb)
C-1	09/13/89	22,000	3,600	1,100	1,000	3,500
	12/04/89	13,000	2,000	550	610	1,600
	03/09/90	< 0.005 FOOT SEPARATE PHASE HYDROCARBONS				
C-2	09/13/89	320	62	4	10	14
	12/04/89	1,000	240	37	66	130
	03/09/90	390	280	35	27	50
C-3	09/13/89	60,000	1,400	6,800	2,300	10,000
	12/04/89	56,000	1,300	3,300	1,400	5,700
	03/09/90	42,000	1,100	5,700	1,600	7,900
C-4	09/13/89	57,000	21,000	3,100	3,200	11,000
	12/04/89	48,000	17,000	2,200	2,800	9,800
	03/09/90	43,000	20,000	2,300	2,800	11,000
C-5	09/13/89	310	ND	ND	ND	ND
	12/04/89	ND	ND	ND	ND	1
	03/09/90	ND	ND	ND	ND	ND
C-6	09/13/89	47	5,600	3,000	2,400	10,000
	12/04/89	40,000	8,100	1,800	1,700	7,500
	03/09/90	73,000	23,000	5,900	3,400	17,000
C-7	09/13/89	410	1.3	ND	10	ND
	12/04/89	1,000	1	ND	5	ND
	03/09/90	590	2.8	2.4	3.5	2.0
C-8	09/13/89	ND	ND	ND	ND	ND
	12/04/89	64	0.6	0.6	ND	1
	03/09/90	ND	ND	ND	ND	ND
C-9	09/13/89	42,000	14,000	1,100	2,800	4,200
	12/04/89	36,000	11,000	670	2,500	3,800
	03/09/90	28,000	12,000	940	3,000	4,700
C-10A	03/09/90	ND	1.6	0.7	0.8	3.5
C-11	03/09/90	ND	1.2	0.7	ND	1.4

TABLE 1
(continued)

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

Low-Boiling Hydrocarbons

Well No.	Sample Date	Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethyl-Benzene (ppb)	Xylenes (ppb)
C-12	03/09/90	1,400	230	140	33	180
C-13	03/09/90	ND	15	3.7	1.0	6.2
C-14	03/09/90	ND	ND	ND	ND	ND
C-15	03/09/90	410	ND	1.4	0.5	0.6
C-16	03/09/90	ND	ND	ND	ND	ND
RW-1	12/04/89	62,000	29,000	1,700	1,800	8,800

Notes: ppb - parts per billion
ND - none detected
detection limits shown on attached certified analytical reports

TABLE 2

SUMMARY OF HISTORICAL GROUNDWATER ELEVATION DATA

Well No.	Sample Date	Well Elevation (ft., MSL)	Depth to Water (ft.)	Groundwater Elevation (ft., MSL)
C-1	03/26/85	283.46	22.83	260.63
	07/03/86		23.58	259.88
	03/26/87		20.50	262.96
	03/28/88		26.00	257.46
	03/10/89		15.86	267.60
	04/03/89		16.85	266.61
	05/08/89		22.68	260.78
	06/05/89		24.66	258.80
	07/12/89		25.56	257.90
	08/10/89		25.89	257.57
	09/13/89		26.55	256.91
	10/04/89		25.24	258.22
	11/03/89		25.03	258.43
	12/04/89		26.37	213.28
	03/07/90		22.48	260.98
C-2	03/26/85	284.37	NA	NA
	07/03/86		19.69	264.68
	03/26/87		15.45	268.92
	03/28/88		20.92	263.45
	03/10/89		12.80	271.57
	04/03/89		14.26	270.11
	05/08/89		18.42	265.95
	06/05/89		20.09	264.28
	07/12/89		20.79	263.58
	08/10/89		21.40	262.97
	09/13/89		21.86	262.51
	10/04/89		19.89	264.48
	11/03/89		20.76	263.61
	12/04/89		20.82	263.55
	03/07/90		17.83	266.54
C-3	03/26/85	285.98	NA	NA
	07/03/86		26.04	259.94
	03/26/87		25.64	260.34
	03/28/88		28.82	257.16
	03/10/89		22.78	263.20
	04/03/89		22.71	263.27

TABLE 2
(continued)

SUMMARY OF HISTORICAL GROUNDWATER ELEVATION DATA

Well No	Sample Date	Well Elevation (ft., MSL)	Depth to Water (ft.)	Groundwater Elevation (ft., MSL)
C-3	05/08/89		25.95	260.03
	06/05/89		27.62	258.36
	07/12/89		28.29	257.69
	08/10/89		28.46	257.52
	09/13/89		29.33	256.65
	10/04/89		28.97	257.01
	11/03/89		28.72	257.26
	12/04/89		29.01	256.97
	03/07/90		27.69	258.29
C-4	03/26/85	273.01	15.14	257.87
	07/03/86		15.37	257.64
	03/26/87		NA	NA
	03/28/88		18.04	254.97
	03/10/89		NA	NA
	04/03/89		13.34	259.67
	05/08/89		15.60	257.41
	06/05/89		16.51	256.50
	07/12/89		16.99	256.02
	08/10/89		17.27	255.74
	09/13/89		18.16	254.85
	10/04/89		18.24	254.77
	11/03/89		18.17	254.84
	12/04/89		18.45	254.56
	03/07/90		17.20	255.81
C-5	03/26/85	287.95	25.33	262.62
	07/03/86		26.41	261.54
	03/26/87		24.96	262.99
	03/28/88		29.80	258.15
	03/10/89		25.89	262.06
	04/03/89		24.38	263.57
	05/08/89		27.80	260.15
	06/05/89		29.42	258.53
	07/12/89		29.86	258.09
	08/10/89		29.77	258.18
	09/13/89		30.95	257.00
	10/04/89		31.48	256.47
	11/03/89		31.32	256.63
	12/04/89		31.70	256.25
	03/07/90		30.28	257.67

TABLE 2
(continued)

SUMMARY OF HISTORICAL GROUNDWATER ELEVATION DATA

Well No.	Sample Date	Well Elevation (ft., MSL)	Depth to Water (ft.)	Groundwater Elevation (ft., MSL)
C-6	03/26/85	NA	16.74	NA
	07/03/86	275.28	17.46	257.82
	03/26/87		18.37	256.91
	03/28/88		19.84	255.44
	03/10/89		14.44	260.84
	04/03/89		14.44	260.84
	05/08/89		17.16	258.12
	06/05/89		18.51	256.77
	07/12/89		18.71	256.97
	08/10/89		19.32	255.96
	09/13/89		19.95	255.33
	10/04/89		19.87	255.44
	11/03/89		19.35	255.93
	12/04/89		19.59	255.69
	03/07/90		18.39	256.89
C-7	03/26/85	NA	09.61	NA
	07/03/86	270.70*	10.74	259.96
	03/26/87		10.08	260.62
	03/28/88		13.79	256.91
	03/10/89		10.42	260.28
	04/03/89		09.14	261.56
	05/08/89		11.91	258.79
	06/05/89		11.54	259.16
	07/12/89		13.45	257.25
	08/10/89		13.37	257.33
	09/13/89		14.60	256.10
	10/04/89		15.17	255.53
	11/03/89		15.28	255.42
	12/04/89		15.70	255.00
	03/07/90		14.22	256.48
C-8	03/26/85	NA	08.68	NA
	07/03/86	288.40	13.89	274.51
	03/26/87		06.01	282.39
	03/28/88		10.66	277.74
	03/10/89		06.61	281.79
	04/03/89		06.46	281.94
	05/08/89		08.97	279.43
	06/05/89		10.88	277.52
	07/12/89		12.15	276.25
	08/10/89		12.46	275.94

TABLE 2
(continued)

SUMMARY OF HISTORICAL GROUNDWATER ELEVATION DATA

Well No.	Sample Date	Well Elevation (ft., MSL)	Depth to Water (ft.)	Groundwater Elevation (ft., MSL)
C-8	09/13/89		12.78	275.62
	10/04/89		12.51	275.89
	11/03/89		14.63	273.77
	12/04/89		09.59	278.81
	03/07/90		08.80	279.60
C-9	07/03/86	268.46	13.89	254.57
	03/26/87		13.74	254.72
	03/28/88		14.99	253.47
	03/10/89		13.39	255.07
	04/03/89		12.84	255.62
	05/08/89		14.38	254.08
	06/05/89		15.36	253.10
	07/12/89		15.65	252.81
	08/10/89		15.80	252.66
	09/13/89		16.53	251.93
	10/04/89		16.52	251.94
	11/03/89		16.51	251.95
	12/04/89		16.79	251.67
	03/07/90		16.22	252.24
C-10A	03/07/90	264.84	20.21	244.63
C-10B	03/07/90	264.85	21.44	243.41
C-11	03/07/90	265.30	22.74	242.56
C-12	03/07/90	269.66	14.92	254.74
C-13	03/07/90	284.32	11.18	273.14
C-14	03/07/90	270.74	15.18	255.56
C-15	03/07/90	246.15	11.10	235.05
C-16	03/07/90	246.69	18.50	256.02
RW-1	03/07/90	274.52	18.50	256.02

Note: data prior to 3/10/89 from Groundwater Technology Inc. (GTI)
not all GTI data presented
MSL - mean sea level
* - top of well casing.

TABLE 3

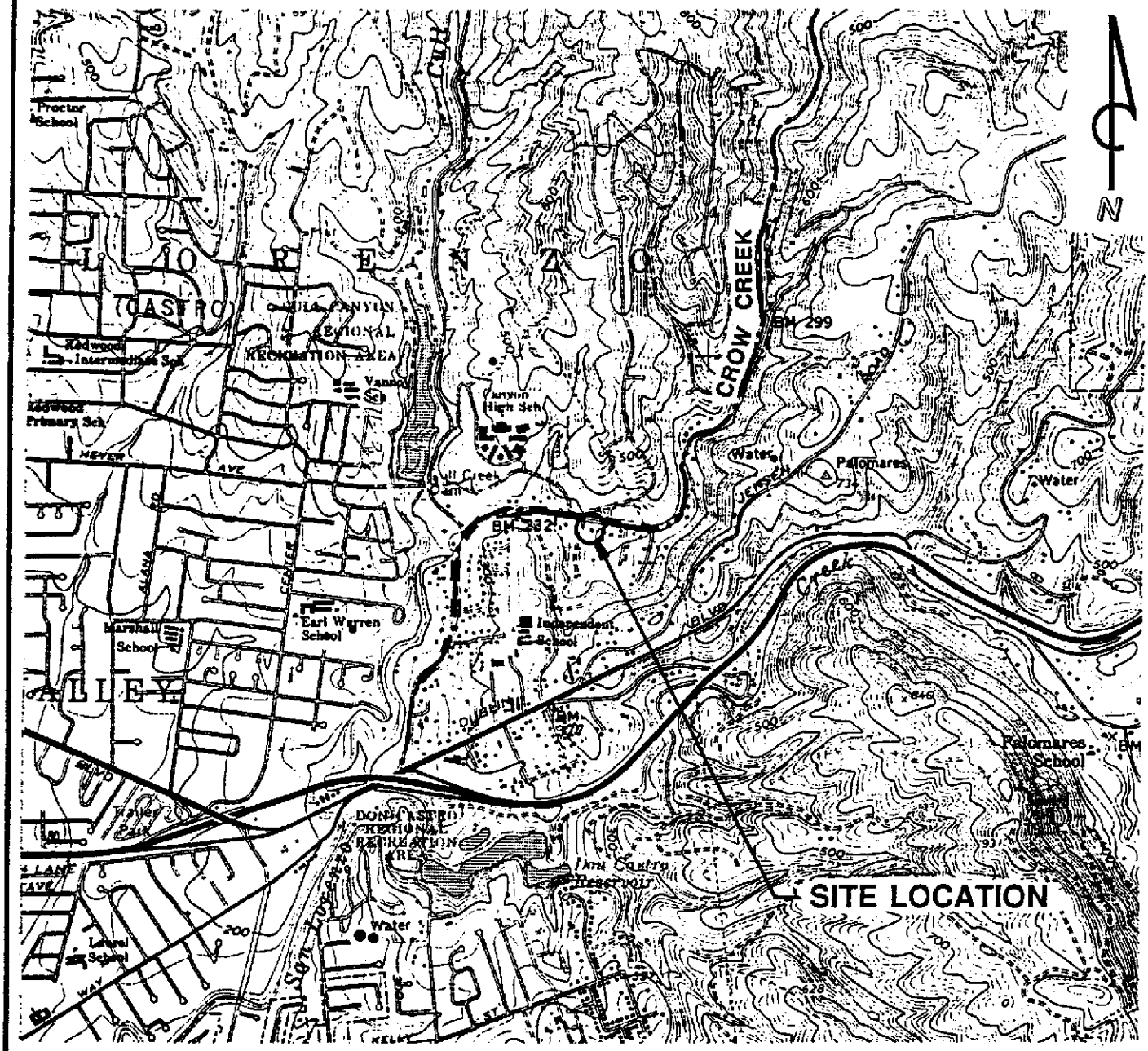
SUMMARY OF SOIL ANALYTICAL RESULTS

Low-Boiling Hydrocarbons

(Sampled Date: February 22 through 24, 1990)

Boring No.	Sample Date	Gasoline (ppm)	Benzene (ppm)	Toluene (ppm)	Ethyl-Benzene (ppm)	Xylenes (ppm)
C-12	02/22/90	200	1.7	4.7	3.4	18
C-13	02/23/90	ND	ND	ND	ND	ND
C-15	02/24/90	10	ND	0.10	ND	ND

Notes: ppm - parts per million
ND - none detected
detection limits shown on attached certified analytical reports



QUADRANGLE LOCATION

REFERENCE:
USGS 7.5 MIN. TOPOGRAPHIC MAP
TITLED: HAYWARD, CALIFORNIA
DATED: 1959 REVISED: 1980

SCALE

2000 0 2000 FEET

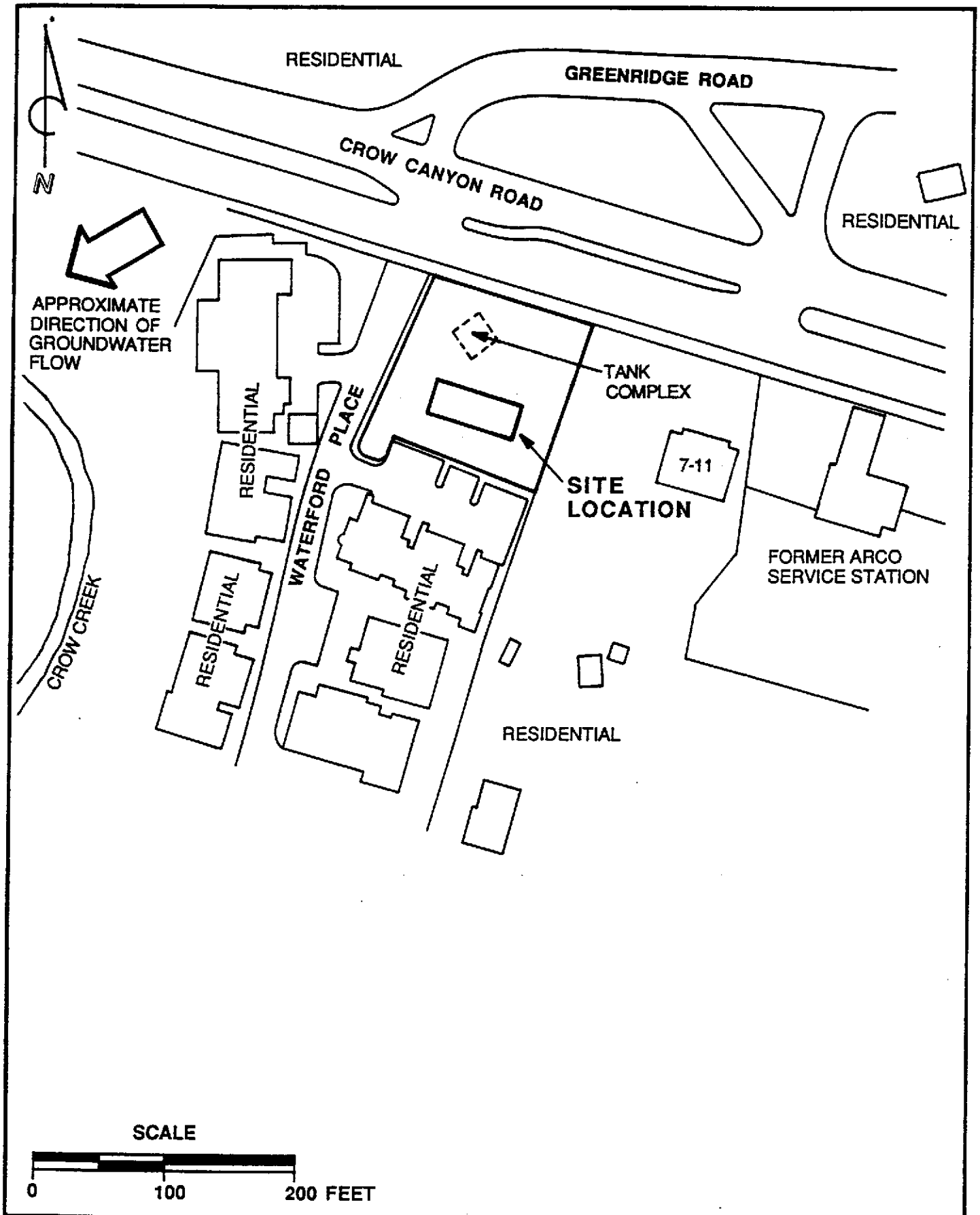
PACIFIC ENVIRONMENTAL GROUP INC.

CHEVRON USA STATION #5607
5269 Crow Canyon Road
Castro Valley, California

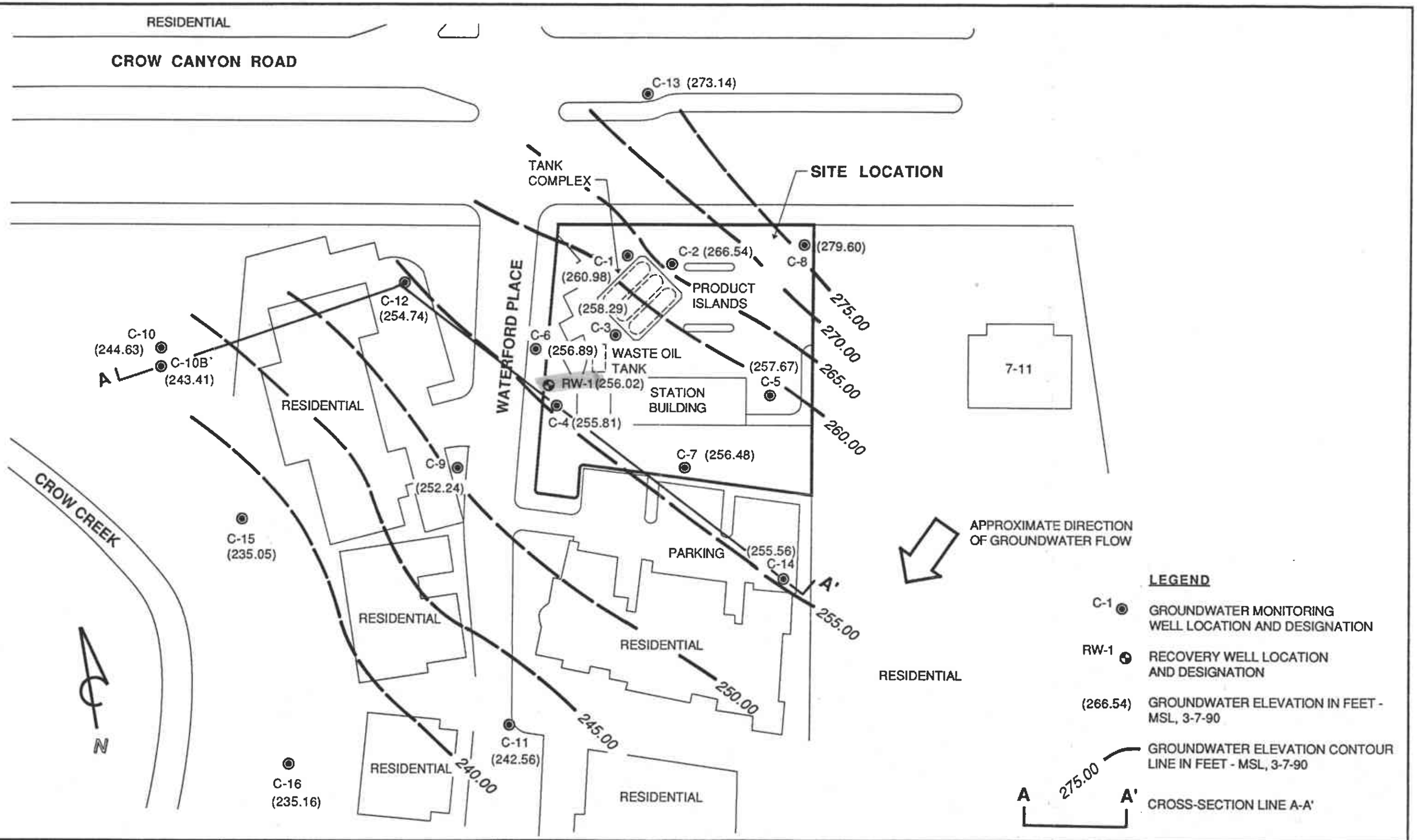
SITE LOCATION MAP

FIGURE: 1

PROJECT: 320-18.02



PACIFIC ENVIRONMENTAL GROUP INC.	CHEVRON USA STATION #5601 5269 Crow Canyon Road Castro Valley, California EXTENDED SITE MAP	FIGURE: 2 PROJECT: 320-18.02



PROJECT NUMBER

DRAWN BY | DATE/NUMBER

REVISIONS

PACIFIC ENVIRONMENTAL GROUP, INC.

SCALE
0 50 100 FEET

CHEVRON USA STATION #5607
5269 Crow Canyon Road
Castro Valley, California

GROUNDWATER ELEVATION CONTOUR MAP

FIGURE: 3

PROJECT: 320-18.02

PROJECT NUMBER

RESIDENTIAL

CROW CANYON ROAD

C-13 ND/15

TANK COMPLEX

SITE LOCATION

≤0.005 SPH

C-1

C-2 390/280

C-8 ND/ND

PRODUCT ISLANDS

42,000/1,100

C-3

C-6 73,000/23,000

WASTE OIL TANK

RW-1*

STATION BUILDING

C-5 ND/ND

C-4 43,000/20,000

C-7 590/2.8

7-11

APPROXIMATE DIRECTION OF GROUNDWATER FLOW

WATERFORD PLACE

C-12 1,400/230

1,000

10,000

10

?

C-10 ND/1.6

C-10B*

RESIDENTIAL

C-9 28,000/12,000

CROW CREEK

C-15 410/ND

PARKING

C-14 ND/ND

RESIDENTIAL

RESIDENTIAL

RESIDENTIAL

C-11 ND/1.2

C-16 ND/ND

RESIDENTIAL

RESIDENTIAL

RESIDENTIAL

N

LEGEND

C-1 — GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION

RW-1 — RECOVERY WELL LOCATION AND DESIGNATION

1,400/230 — DISSOLVED GASOLINE/BENZENE CONCENTRATION IN PARTS PER BILLION (PPB) 3-9-90

≤0.005 SPH — SEPARATE-PHASE HYDROCARBONS - IN FEET, 3-9-90

ND — NONE DETECTED

10,000 — DISSOLVED GASOLINE ISOCONCENTRATION CONTOUR LINE (PPB), 3-9-90

10 — BENZENE ISOCONCENTRATION CONTOUR LINE (PPB), 3-9-90

* NO DATA AVAILABLE

REVISIONS | DRAWN BY | DATE/NUMBER

PACIFIC ENVIRONMENTAL GROUP, INC.

SCALE 0 50 100 FEET

CHEVRON USA STATION #5607
5269 Crow Canyon Road
Castro Valley, California

DISSOLVED GASOLINE/BENZENE ISOCONCENTRATION CONTOUR MAP

FIGURE: 4

PROJECT: 320-18.02

APPENDIX A

INVESTIGATIVE FIELD PROCEDURES

Exploratory Drilling and Monitoring Well Installation

Field work for PACIFIC's investigation included the installation of eight off-site groundwater monitoring wells (C-10A, C-10B, and C-11 through C-16). Wells C-10A, C-10B, C-15 and C-16 were installed south of the site between Crow Creek and the condominium complex. Well C-11 was installed approximately 130 feet south of Well C-9, Well C-12 was installed approximately 70 feet west of the site, Well 13 was installed in the center-divider of Crow Canyon Road and Well C-14 was installed approximately 75 feet south of Well C-7.

Wells C-10A, C-10B,and C-11 through C-16 were installed on February 21 through 24, 1989. The borings for the monitoring wells were drilled using eight-inch diameter hollow-stem auger drilling equipment. During drilling, the borings were logged by a PACIFIC geologist using the Unified Soil Classification System and standard geologic techniques. Soil samples for logging and chemical analysis were collected at five-foot depth intervals by advancing a California-modified split-spoon sampler with brass liners into undisturbed soil beyond the tip of the auger. The sampler was driven a maximum of 18-inches, using a 140-pound hammer with a 30-inch drop. Soil samples for chemical analysis were retained in brass liners, wrapped with aluminum foil and plastic end caps, and sealed in clean glass containers. These samples were stored and transported to the laboratory on ice along with the appropriate chain-of-custody documentation. Boring logs and well completion details are presented in this appendix.

The borings for the monitoring wells were advanced between approximately 1 and 32 feet into the water-bearing zone to a maximum depth of approximately 35 feet. Borings C-10A, C-10B, and C-11 through C-16 were converted to groundwater monitoring wells by installing 3-inch diameter, schedule 40 PVC casing and 0.02-inch factory-slotted screen. Screen was placed through the entire saturated section and extends approximately 1/2 to 9 feet above the static water level. Static water has been noted to extend above the screen interval in Wells C-13 and C-16, approximately 2 to 3 feet. A graded sand pack was placed in the annular space across the screen interval and extends approximately 1 to 2 feet above the top of the screens. A bentonite and concrete seal extends from the sand pack to the ground surface. A locking cap and protective vault box were installed on the top of each well. Following well completion, the elevations of the vault boxes of all site monitoring wells were surveyed by a licensed surveyor to mean sea level datum.

Organic Vapor Analysis

Soil samples collected from the borings were analyzed in the field for ionizable organic compounds using the H-NU Model PI 101 photo-ionization detector with a 10.2 eV lamp. The test

procedure involved measuring approximately 30 grams from an undisturbed sample, placing this sub-sample in a clean glass jar, and sealing the jar with aluminum foil secured under a ring-type threaded lid. The jar was warmed for approximately 20 minutes. The foil was then pierced and the head-space within the jar was tested for total organic compounds, measured in ppm as benzene (volume/volume). The instrument had been previously calibrated using a 100 ppm isobutylene standard (in air) and a sensitivity factor of 0.7, which relates the photo-ionization sensitivity of benzene (10.0 ppm) to the ionization potential of isobutylene (7.0 ppm). Results of these tests (in ppm) appear on the attached boring logs.

Groundwater Sampling

Site monitoring wells were sampled by PACIFIC on March 9, 1990. The sampling procedure consisted of first measuring the water level in each well with an electronic water-level indicator, and checking each well for the presence of separate phase hydrocarbons using an electronic interface probe. Separate phase hydrocarbons were detected in Well C-1 at a thickness of less than 0.005 foot. Therefore Well C-1 was not sampled. Wells that did not contain separate phase hydrocarbons were then purged of approximately four casing volumes of water using a gas displacement pump, during which time temperature, pH, and electrical conductivity were monitored to insure that a representative sample was obtained. After purging, the water levels in the wells were allowed to restabilize. Groundwater samples were collected using a Teflon bailer, placed into appropriate EPA-approved containers, labeled, logged onto chain-of-custody documents, and transported on ice to the laboratory. Chain-of-custody documentation is attached.

Analytical Program

Selected soil samples collected from Borings C-12, C-13 and C-15 between the depths of approximately 9-1/2 and 16 feet were analyzed for low-boiling hydrocarbons (calculated as gasoline), including benzene, toluene, ethylbenzene and xylenes (BTEX) compounds. Groundwater samples collected from site wells were analyzed for the presence of gasoline and BTEX compounds.

The analyses for gasoline and BTEX compounds were performed according to Modified EPA Methods 8015 and 8020 by a State certified laboratory. A purge and trap technique was utilized with final detection by gas chromatography using a flame-ionization and a photo-ionization detector. Laboratory analytical reports are attached.

Unified Soil Classification System

Primary Divisions			Group Symbol/Graphic	Typical Names
COARSE GRAINED SOILS more than half is larger than #200 sieve	GRAVELS half of coarse fraction larger than #4 sieve	CLEAN GRAVELS (less than 5% fines)	G W	Well graded gravels, gravel-sand mixtures; little or no fines
			G P	Poorly graded gravels or gravel-sand mixtures; little or no fines
		GRAVEL WITH FINES	G M	Silty gravels, gravel-sand-silt mixtures
			G C	Clayey gravels, gravel-sand-clay mixtures
	SANDS half of coarse fraction smaller than #4 sieve	CLEAN SANDS (less than 5% fines)	S W	Well graded sands, gravelly sands, little or no fines
			S P	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES	S M	Silty sands, sand-silt mixtures
			S C	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS more than half is smaller than #200 sieve	SILTS AND CLAYS liquid limit less than 50%		M L	Inorganic silts and very fine sand, rock flour, silty or clayey fine sands or clayey silts, with slight plasticity
			C L	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			O L	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS liquid limit more than 50%		M H	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			C H	Inorganic clays of high plasticity, fat clays
			O H	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			P t	Peat and other highly organic soils

Pacific Environmental Group, Inc.

WELL LOG
KEY TO ABBREVIATIONS

Drilling Method
- HSA - Hollow stem auger
- CFA - Continuous flight auger
- Air - Reverse air circulation

Gravel Pack
- CA - Coarse aquarium sand

Sampling Method
- Cal. Mod. - California modified split-spoon sampler (2" inner diameter) driven 18" by a 140-pound hammer having a 30" drop. Where penetration resistance is designated "P," sampler was instead pushed by drill rig.
- Disturbed - Sample taken from drill-return materials as they surfaced.
- n/a - Not applicable.

Moisture Content
- Dr - Dry
- Dp - Damp
- Mst - Moist
- Wt - Wet
- Sat - Saturated

Sorting
- PS - Poorly sorted
- MS - Moderately sorted
- WS - Well sorted

Plasticity
- L - Low
- M - Moderate
- H - High

H-NU (ppm)
- ND - No detection

Symbols

▽ - First encountered ground water

▼ - Static ground water level

Density

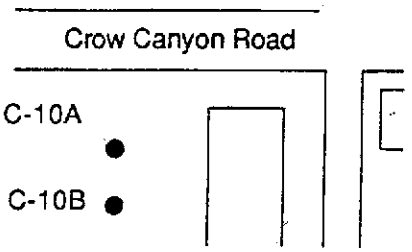
Sands and gravels		Silts and clays	
0 - 4	- Very Loose	0 - 2	- Very Soft
5 - 10	- Loose	3 - 4	- Soft
11 - 30	- Medium dense	5 - 8	- Firm
31 - 50	- Dense	9 - 16	- Stiff
over 50	- Very dense	17 - 32	- Very stiff
		over 32	- Hard

GRAIN-SIZE SCALE

GRADE LIMITS U.S. Standard inches	sieve size	GRADE NAME
12.0		Boulders
3.0	3.0 in.	Cobbles
0.19	No. 4	Gravel
	coarse	
0.08	No. 10	
	medium	Sand
	No. 40	
	fine	
	No. 200	
		Silt
		Clay Size

PACIFIC ENVIRONMENTAL GROUP, INC.

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

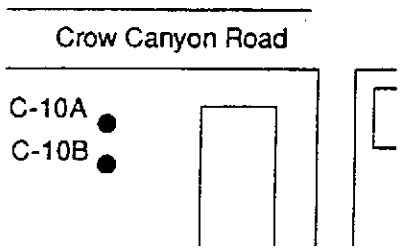
WELL / C-10A
BORING NO.
PAGE 1 OF 1

PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

CLIENT: Chevron USA
DATE DRILLED: 2-22-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 21'
WELL DEPTH: 21'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
GROUT	Dp			2			GC	CLAYEY GRAVEL; dark brown; moderate plasticity; 15% clay and silt; 25% fine sand; 20% medium to coarse sand; <10% fine sub-angular gravel; medium dense; no product odor.
	Mst			4			CL SC	CLAY; dark brown; moderate plasticity; 40% fine to coarse sand; 5% fine gravel; stiff; no product odor.
	Mst			6				
	Mst			8			SM	CLAYEY SAND; dark yellow brown; grayish brown; gravelly; low to moderate plasticity; 30% clay and silt; 30% fine sand; 20% medium to coarse sand; 20% fine sub-angular gravel (well cemented sandstone); medium dense; no product odor.
	Dp			10			SC	@4': concrete with rebar.
				12				SILTY SAND: dark gray; low plasticity; 30% silt; 50% fine sand; 30% medium sand; 10% coarse sand; trace fine gravel; medium dense; no product odor.
SAND	Wt			14				
				16			ML	CLAYEY SAND; dark gray; low to moderate plasticity; 20% clay and silt; 20% fine sand; 50% medium to coarse arkosic sub-angular sand; 10% fine sub-angular to rounded gravel; medium dense; no product odor.
	Mst			18			CL	@10-14': wood chips and sweet odor.
	Dp			20			CH	SILT; very dark brown; low plasticity; 30% fine to medium sand; root material; hard; no product odor.
	Mst			22				CLAY; brown to yellow brown; moderate to high plasticity; 20-40% fine to coarse sand; trace fine gravel; occasional caliche cemented nodules <1cm; iron oxide stain; olive mottling; black speckling; very stiff; no product odor.
				24				CLAY; brown; high plasticity; trace gravel; very soft.
				26				@21': stiff and very stiff; no product odor.
				28				
				30				BOTTOM OF BORING AT 21'
				32				
				34				NOTE: Refer to boring log for Well C-10B for Sampling Intervals, Penetration Resistance, and PID Vapor readings.
				36				
				38				
				40				
				42				
				44				

LOCATION MAP

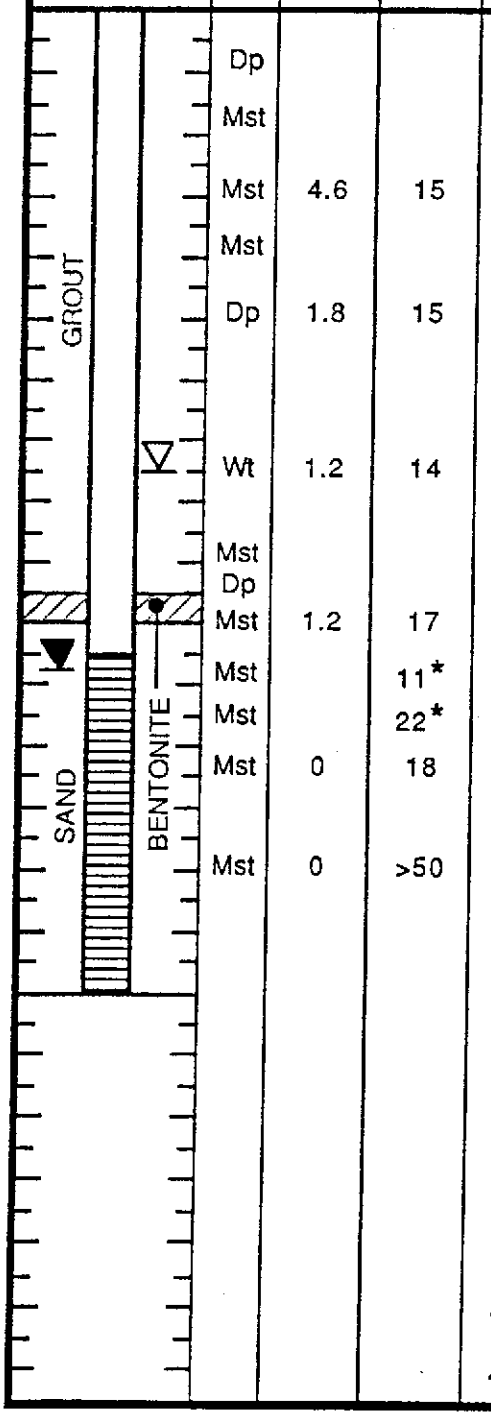


PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-10B
BORING NO.
PAGE 1 OF 1

PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

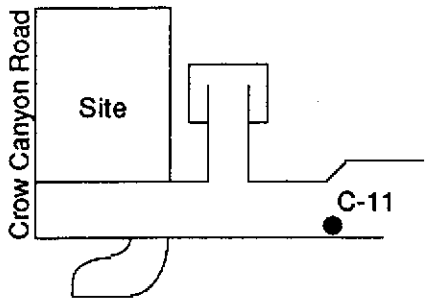
CLIENT: Chevron USA
DATE DRILLED: 2-21,22-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 32'
WELL DEPTH: 32'
WELL DIAMETER: 3"



MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SOIL TYPE	LITHOLOGY / REMARKS
Dp			2	GC	CLAYEY GRAVEL; dark brown; moderate plasticity; 15% clay and silt; 25% fine sand; 20% medium to coarse sand; <40% fine sub-angular gravel; medium dense; no product odor.
Mst			4	CL SC	CLAY; dark brown; moderate plasticity; 40% fine to coarse sand; 5% fine gravel; stiff; no product odor.
Mst	4.6	15	6		
Mst			8	SM	CLAYEY SAND; dark yellow brown; grayish brown gravelly; low to moderate plasticity; 30% clay and silt; 30% fine sand; 20% medium to coarse sand; 20% fine sub-angular gravel (well cemented sandstone); medium dense; no product odor.
Dp	1.8	15	10	SC	
			12		SILTY SAND: dark gray; low plasticity; 30% silt; 50% fine sand; 30% medium sand; 10% coarse sand; trace fine gravel; medium dense; no product odor.
Wt	1.2	14	14		
Mst			16	ML CL	CLAYEY SAND; dark gray; low to moderate plasticity; 20% clay and silt; 20% fine sand; 50% medium to coarse arkosic sub-angular sand; 10% fine sub-angular to rounded gravel; medium dense; no product odor.
Dp			18	CH	
Mst	1.2	17	20		SILT; very dark brown; low plasticity; 30% fine to medium sand; root material; hard; no product odor.
Mst		11*	22		CLAY; brown to yellow brown; moderate to high plasticity; 20-40% fine to coarse sand; trace fine gravel; occasional caliche cemented nodules <1cm; iron oxide stain; olive mottling; black speckling; very stiff; no product odor.
Mst		22*	24		
Mst	0	18	26		
Mst	0	>50	28	SM	CLAY; brown; high plasticity; trace gravel; very soft. @21': stiff and very stiff; no product odor. @23.5': brown; high plasticity; 70% clay and silt; 25% fine sand; 5% medium to coarse black well rounded sand grains; weak platy structure; thin zoneof sub-angular blocky structure; minor iron oxide discoloration; trace small (<5mm) caliche nodules; very stiff; no productodor.
			30		
			32		**SILTY SANDSTONE**; dark yellow brown; arkosic; sub-angular; moderate to well sorted; thin (1/2 cm) thick moderately cemented laminations interbedded with friable and loose sands; vertical gray sand structure; caliche zones; no visible fractures; moderate to deep weathering; friable; moist; no product odor.
			34		
			36		
			38		
			40		
			42		BOTTOM OF BORING AT 32'
			44		

* Standard Penetration, Split-Spoon Sampler

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

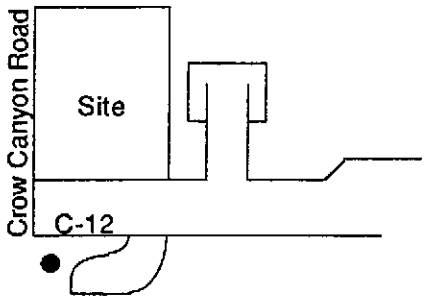
WELL / C-11
BORING NO.
PAGE 1 OF 1

PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

CLIENT: Chevron USA
DATE DRILLED: 2-22-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 35'
WELL DEPTH: 34'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
GROUT	Dp			2			CL	FILL; asphalt; road base. CLAY - FILL; brown; gravelly; 10% gravel; stiff; no product odor.
	Mst	0	PUSH	4				@4': dark yellow brown; gravelly; moderate to high plasticity; 50% clay and silt; 20% fine sand; 10% medium to coarse sand; 20% fine sand; 20% sub-angular to sub-rounded gravel; very stiff; no product odor.
				6				
				8				
	Dp	1.5	22	10				@9': angular blocks of sandstone; gravels; angular blocks of gray fill soil; very stiff; no product odor. @11': stiff; drilling change. @12': soft; drilling change.
				12				
BENTONITE				14			SC	CLAYEY SAND; dark gray; moderate to high plasticity; 30% clay and silt; 20% fine sand; 35% medium to coarse sand; 15% fine gravel; medium dense; no product odor.
	Mst	2.2	13	16			CL	CLAY; dark yellow brown; gravelly; moderate to high plasticity; 50% clay and silt; 20% fine sand; 10% medium to coarse sand; 20% fine sand; 20% sub-angular to sub-rounded gravel; very stiff; no product odor.
				18			SC	CLAYEY SAND (native); dark brown; moderate plasticity; 40% clay; 30% fine sand; 30% medium sand; medium dense; no product odor.
	Mst	1.5	18	20				@19': dark yellowish brown; moderate plasticity; 40% clay; 40% fine sand; 20% medium sand; weak sub-angular blocky structure; iron oxide discoloration patches (<1/2 cm diameter); medium dense; no product odor.
SAND				22				@24': 25% clay; 20% silt; 35% fine sand; 20% medium sand; weak platy structure; dense; no product odor.
	Mst	0.5	33	24				
				26				
				28				
	V. Mst	0.1	24	30			SM	SILTY SAND; brown; clayey; low to moderate plasticity; 30% silt and clay; 30% fine sand; 40% medium to coarse arkosic sub-angular sand; trace of angular blocks of 3/4" diameter iron oxide sandstone; dark brown to black speckling; iron oxide speckling; minor rootholes; <3mm with gray alteration and wet; medium dense; no product odor.
				32			GM	
				34			SM	
	Mst	0	>50	36				SILTY SANDSTONE; interlayered yellow brown to dark yellow brown; arkosic sand and terrigenous clay composition; poorly sorted; sub-angular; thinly bedded (<1/4" to 1/2") approximate dip ~30°; thin laminations of claystone with angular claystone clasts <1/2"; no observable fractures;deep weathering; weak to moderate cementation; friable to medium hardness; with soft (semi-plastic) claystone; no product odor.
				38				
				40				
				42				
				44				BOTTOM OF BORING AT 35'

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

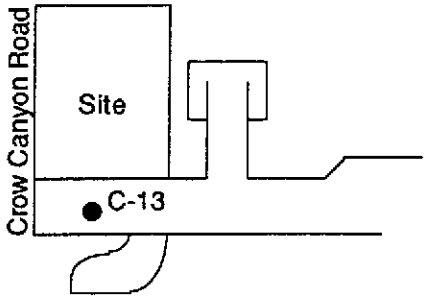
WELL / C-12
BORING NO.
PAGE 1 OF 1

PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

CLIENT: Chevron USA
DATE DRILLED: 2-22-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 34.5'
WELL DEPTH: 30.5'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
GROUT				2				FILL; dark brown; sandy organic top soil.
	Mst	1.5	PUSH	4			SC	CLAYEY SAND - FILL; dark brown to dark yellow brown; low plasticity; 10-20% clay and silt; 30% fine sand; 50-60% medium arkosic sub-angular sand; angular blocks of yellow brown sand and clay; medium dense; no product odor.
				6				
				8				@8': approximate fill material/native material contact.
BENTONITE	Mst	0	22	10			ML	@9.5': 10-20% fine sub-angular gravels; medium dense; no product odor.
				12				SILT; dark brown.
	V. Mst	123	13	14			ML	SILT; brown to yellow brown; sandy; low to moderate plasticity; 55-60% silt and clay; 30% fine sand; 10-15% medium sand; iron oxide discoloration; thin layer of sub-angular blocky clay with gravel; rootholes (<1mm); very moist; stiff; strong product odor.
	Wt			16				
				18			CH-ML	CLAY to SILT; brown; sandy; moderate to high plasticity; 35% clay; 30% silt; 35% fine sand; trace medium to coarse sand; wet rootholes (<1mm); firm; faint product odor.
SAND	Wt	2.0	7	20				
				22				
				24				
	Mst	2.0	16	26			CH	CLAY; dark yellow brown; sandy; moderate to high plasticity; 45% clay; 20% silt; 20% fine sand; 20% medium to coarse sand; fine rootholes and rootholes up to 2mm; stiff; no product odor.
				28				
	Mst	11	19	30				@29.5': 30% clay; 25% silt; 20% fine sand; 20% medium to coarse sand; 5% fine well rounded gravel; horizontal, lenticular iron oxide discoloration band <5mm thick; minor rootholes; stiff; no product odor.
	V. Mst			32			SM	SILTY SAND; brown; low plasticity; 10% clay; 35% silt; 35% fine sand; 20% medium to coarse sand; trace gravel; platy blocks of sandy claystone (<3cm diameter); iron oxide banding; medium dense; no product odor.
				34				
				36				
				38				
				40				BOTTOM OF BORING AT 34.5'
				42				
				44				

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

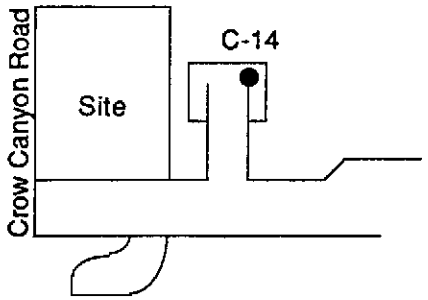
WELL / C-13
BORING NO.
PAGE 1 OF 1

PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

CLIENT: Chevron USA
DATE DRILLED: 2-23-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 33'
WELL DEPTH: 28.5'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
GROUT	Dp			2			GC	FILL; asphalt. CLAYEY GRAVEL; roadbase; dark yellow brown; occasional cobbles; dense; no product odor.
	Mst			4				@4.5': no sample taken; gravel and cobbles.
				6			CL	CLAY - FILL; dark gray; sandy; no product odor.
	Mst			8			GC	@6.5': yellow brown. CLAYEY GRAVEL - FILL; sandy; dark yellow brown; 30% clay and silt; 20% fine to coarse sand; 50% fine gravels; sub-angular; very dense; no product odor.
	Dp	0	>50	10			SB	**SILTSTONE** (Bedrock); sandy; yellow brown; terrigenous and arkosic sediments; no observable bedding; thin (<1/4") parting; no observable fractures; moderate to deep weathering; weak cementation; friable; no product odor.
BENTONITE				12				
	Dry	313	>50	14				@14.5': fissile, shale like parting; less sand; no product odor.
				16				
				18			SM	**SILTY SANDSTONE;** dark yellow brown; arkosic; sub-angular; poorly sorted; thin lenticular beds of silty sandstone interlayered with thin shaley beds of silt and claystone, oriented ~<10°; organic shales with thin (1 cm long and 1 mm wide) organic inclusions in-line with bedding; iron oxide discoloration; no observable fractures; weak to moderate cementation; angular sandstone inclusions; deep to moderate weathering; friable to moderate hardness; no product odor.
SAND	Dry-Dp	45	>50	20				
				22				
				24				
	Mst	3.0	>50	26			CS	**CLAYSTONE;** silty; very dark gray; organic marine shaley claystone; bedding oriented at 10-15°; thin lenticular and cemented beds <1/2" thick; very light gray; discoloration lamination <1mm to 5mm; plastic sediments between cemented zones; weak weathering; friable to soft; no product odor.
				28				
	Mst	NA	>50	30				@29.5': 1/2" bedding of dark gray; gray and brown gray claystone and siltstone; bedding apparently at ~65°; poorly cemented; soft; no product odor.
				32				
	Dry			34				@33': auger refusal; gray; well cemented; hard.
				36				
				38				BOTTOM OF BORING AT 33'
				40				
				42				
				44				

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

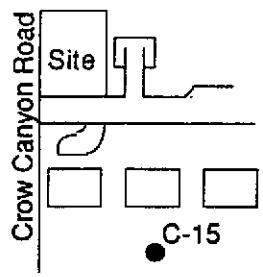
WELL / C-14
BORING NO.
PAGE 1 OF 1

PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

CLIENT: Chevron USA
DATE DRILLED: 2-23-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 30.5'
WELL DEPTH: 28.5'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
GROUT	Mst	0	PUSH	2–6			SC	FILL; asphalt and road base CLAYEY SAND; dark yellow brown; low to moderate plasticity; 30% clay and silt; 30% fine sand; 30% medium to coarse arkosic sub-angular sand; 10% fine gravel; medium dense; no product odor.
	Mst	0	15	8–12			CL	CLAY; dark yellow brown; moderate plasticity; 60% clay; 20% fine sand; 20% medium to coarse sand; trace angular blocks of sandstone gravel; rootholes (<1mm); weak sub-angular blocky; stiff; no product odor. @14': increase in fines; no gravel; increase in plasticity; stiff; no product odor.
BENTONITE	V. Mst	0	9	14–16				
				18			SC	CLAYEY SAND; yellow brown; moderate to high plasticity; 30% clay and silt; 30% fine sand; 30% medium to coarse sand; 10% fine to coarse sand; angular block of very dark brown iron oxide cemented sandstone; wet rootholes (<2mm) with no alteration; medium dense; no product odor.
SAND	Mst	0	22	20–22				
	Dp-Mst	0	>50	24–26			CS	**CLAYSTONE**; dark yellowish brown; terrigenous; no observable bedding; shaley; crushed after sampling; well lithified; deep weathering; friable; no product odor.
	Dp	0	>50	28–30				@30': flaser bedding in zones; bedding <45°; no product odor.
				32–44				BOTTOM OF BORING AT 30.5'

LOCATION MAP



PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-15
BORING NO.
PAGE 1 OF 1

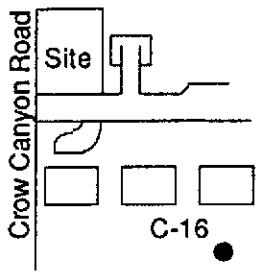
PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

CLIENT: Chevron USA
DATE DRILLED: 2-24-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 21'
WELL DEPTH: 17.5'
WELL DIAMETER: 3"

WELL COMPLETION	MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	DEPTH (FEET)	SAMPLE	GRAPHIC	SOIL TYPE	LITHOLOGY / REMARKS
GROUT	Mst			2				FILL; top soil (clayey sand); trace organics.
	Mst			4			CH-OH	CLAY; very dark brown; high plasticity; topsoil; 50% clay and silt; 40% fine sand; root material; stiff; no product odor.
	Dry	0	PUSH	6			SM	SILTY SAND; dark yellow brown; low plasticity; 20-30% silt and clay; 40% fine sand; 30-40% medium sand; clayey sand inclusions; rootholes <1mm; medium dense; no product odor.
BENTONITE				8				@8.5': soft; drilling change.
SAND	Mst	61	12	10			CL	CLAY; dark brown; sandy; moderate to high plasticity; 65% clay and silt; 35% fine sand; 5% medium sand; rootholes <4mm, wet, with 2-4mm gray alteration rinds;
				12				stiff; moderate to strong product odor.
				14			SC-SM	CLAYEY SAND to SILTY SAND; dark brown; low to moderate plasticity; 20% clay; 20% silt; 40% fine sand; 20% medium sand; rootholes (<1mm), wet, with minor gray alteration; one 3mm tap root with gray alteration rind; medium dense; no product odor.
	V. Mst	0	15	16				
NATURAL				18				
	Dp-Dry	0	>50	20			SM	SILTY SANDSTONE; dark yellow brown; arkosic; poorly sorted; sub-angular; bedding oriented at >45°; thin (1/4") thick lentucular laminations of sandstone with claystone inclusions; iron oxide discoloration; gray discoloration; deep brown discoloration; no visible fractures; moderate to deep weathering; friable; no product odor.
				22				
				24				
				26				
				28				
				30				
				32				
				34				
				36				
				38				
				40				
				42				
				44				

BOTTOM OF BORING AT 21'

LOCATION MAP

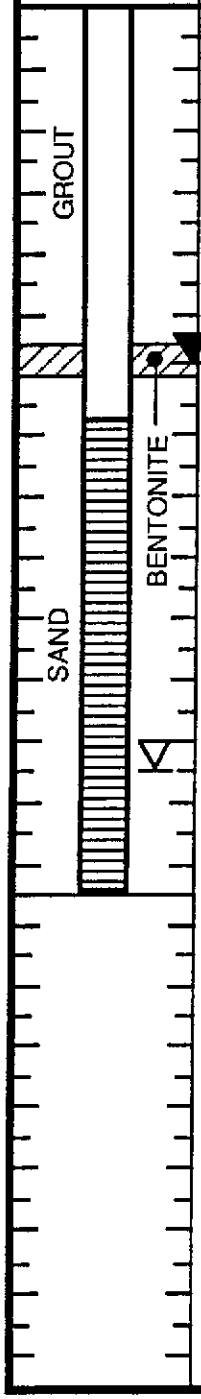


PACIFIC ENVIRONMENTAL GROUP, INC.

WELL / C-16
BORING NO.
PAGE 1 OF 1

PROJECT NO. 320-18.02
LOGGED BY: DKU
DRILLING METHOD: HSA
SAMPLING METHOD: CAL MOD
CASING TYPE: Sch 40 PVC
SLOT SIZE: 0.020"
GRAVEL PACK: 2 X 12 SAND

CLIENT: Chevron USA
DATE DRILLED: 2-24-90
LOCATION: Crow Canyon Road
HOLE DIAMETER: 8"
HOLE DEPTH: 29.0'
WELL DEPTH: 29.0'
WELL DIAMETER: 3"



DEPTH (FEET)	MOISTURE CONTENT	H-NU READING (PPM)	PENETRATION RESISTANCE (BLOWS/FT)	SOIL TYPE	LITHOLOGY / REMARKS
0-2	Mst			CL	CLAY - FILL; brown; sandy; moderate to high plasticity; 60% clay and silt; 30% fine to medium sand; 10% coarse sand and fine gravel; medium dense; no product odor.
2-4	V. Mst				
4-6	Mst	0	20	SC	CLAYEY SAND; dark yellow brown; low to moderate plasticity; 20-30% clay and silt; 30% fine sand; 40-50% medium arkosic, sub-angular sand; black speckling; moist rootholes (<1mm) with gray alteration; root material; soil fractures (vertical); weak sub-angular blocky; iron oxide discoloration; strong iron oxide and manganese oxide altered coarse sand grains; medium dense; no product odor.
6-8					
8-10	Mst	61	10	CL	CLAY; dark brown; sandy; moderate to high plasticity; 65% fat and lean clay and silt; 25% fine arkosic sand; 10% medium to coarse quartz sand; rootholes with tap root <3mm having a1cm gray alteration rind; iron oxide mottling; stiff; no product odor.
10-12					
12-14					
14-16	Mst-Dp	0	20	SC	CLAYEY SAND; dark yellow brown; moderate plasticity; 30% clay and silt; 40% fine sand; 20% medium arkosic sub-angular sand;10% claystone and sandstone angular blocks.
16-18				SS	**SILTY SANDSTONE;** dark yellow brown; arkosic; poorly sorted; no visible bedding; no visible fractures crushed after sampling; iron oxide laminations; black iron oxide and manganese oxidized claystone fragments and horizons; deep weathering; friable; no product odor.
18-20					
20-22	Dry	0	>50	MS	**SILTSTONE; brown**; clayey; sandy; terrigenous silts; no observable bedding; crushed after sampling; iron oxide patches; black manganese oxide patches; gray alteration patches; moderately weathered; moderately lithified; friable; no product odor.
22-24					
24-26	Dry	0	35		@25': very dark gray; shaley; sandy; bedding >45°; silty sandstone; iron oxide interbed<1" thick; possible crushed fracturing; shaley parting; calcite precipitate (sparite) lenses and sparse veins <3mm thick and <1" long, filling fractures; well lithified; moderate to weak weathering; friable to moderate hardness; wet on top and dry on bottom; no product odor.
26-28					
28-30	Dry	0	0		@29': gray; auger refusal; dusty dry recovery in tip.
30-32					
32-34					BOTTOM OF BORING AT 29.0'
34-36					
36-38					
38-40					
40-42					
42-44					

APPENDIX B

CERTIFIED LABORATORY ANALYTICAL REPORTS

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT 1 • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 80619
CLIENT: Pacific Environmental Group
CLIENT JOB NO.: 320-18.01

DATE RECEIVED: 03/08/90
DATE REPORTED: 03/09/90

Lab Number	Customer Sample Identification	Date Sampled	Date Analyzed
80619- 1	C-12	02/22/90	03/08/90
80619- 2	C-13	02/22/90	03/08/90
80619- 3	C-15	02/22/90	03/09/90

Laboratory Number:	80619 1	80619 2	80619 3
ANALYTE LIST	Amounts/Quantitation Limits (mg/kg)		
OIL AND GREASE:	NA	NA	NA
TPH/GASOLINE RANGE:	200	ND<1	10
TPH/DIESEL RANGE:	NA	NA	NA
BENZENE:	1.7	ND<0.05	ND<0.05
TOLUENE:	4.7	ND<0.05	0.10
ETHYL BENZENE:	3.4	ND<0.05	ND<0.05
XYLENES:	18	ND<0.05	ND<0.05

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT 1 • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

C E R T I F I C A T E O F A N A L Y S I S

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
Diesel by Modified EPA SW-846 Method 8015
Gasoline by Purge and Trap: EPA MEthod 8015/5030
ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

QA/QC INFORMATION
SET: 80619

NA = ANALYSIS NOT REQUESTED
ND = ANALYSIS NOT DETECTED ABOVE QUANTITATION LIMIT

ug/L = part per billion (ppb)

OIL AND GREASE ANALYSIS By Standard Methods Method 503E:
Duplicate RPD NA
Minimum Detection Limit in Soil: 20mg/kg

Modified EPA Method 8015 for Extractable Hydrocarbons:
Minimum Quantitation Limit for Diesel in Soil: 10mg/kg
Daily Standard run at 200mg/L; RPD Diesel = NA
MS/MSD Average Recovery = NA: Duplicate RPD = NA

8015/5030 Total Purgable Petroleum Hydrocarbons:
Minimum Quantitation Limit for Gasoline in Soil: 1mg/kg
Daily Standard run at 2mg/L; RPD Gasoline = 1%
MS/MSD Average Recovery = 97%: Duplicate RPD = 3%

8020/BTXE
Minimum Quantitation Limit in Soil: 0.05mg/kg
Daily Standard run at 20ug/L; RPD = <15%
MS/MSD Average Recovery = 104%: Duplicate RPD = <15%

Richard Srna, Ph.D.
Labortory Manager

80619

Chain-of-Custody Reco

Chevron U.S.A. Inc.
P.O. Box 5004
San Ramon, CA 94583
FAX (415) 842-9591

Chevron Facility Number: Service Station #5607
Consultant Release Number: 1254 2150
Consultant Project Number: 320-18.01
Consultant Name: Pacific Environmental Group, Inc.
Address: 1601 Civic Center Drive, Suite #202
Fax Number: (408) 243-3911
Project Contact (Name): Steve Krcik
(Phone): (408) 984-6536

Chevron Contact (Name): Brendon Dewitt
(Phone): (415) 842-7525
Laboratory Name: Superior Analytical
Contract Number:
Samples Collected by (Name): Douglas K. Unland
Collection Date: (5) 2/22-24/90
Signature: Douglas K. Unland

Sample Number	Lab Number	Number of Containers	Matrix S = Soil W = Water A = Air C = Charcoal	Type G = Grab C = Composite	Time	Sample Preservation	Iced	Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline	Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline + Diesel	503 Oil and Grease	Arom. Volatiles - BTXE Soil: 8020/Wtr.: 602	Arom. Volatiles - BTXE Soil: 8240/Wtr.: 624	Total Lead DHS-Luft	EDB DHS-AB 1803			Remarks
C-12 14.5'-16'		1	S			Refrigeration	yes	/			✓						Perform extraction no later than 3/7/90
C-13 14.5'-16'		1	S				yes	/			/						
C-15 9.5'-11'		1	S				yes	/			✓						

RUSH

Steve Krcik informed that samples must be analyzed out of holding time asap by S.K.

Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Organization	Date/Time
Douglas K. Unland	PEG, Inc.	3/7/90 0830	Express 1 Courier 945	Express 1	3-7-90 900
Brenda Woods	EXPRESS-IT		Received By (Signature)	Organization	Date/Time
Relinquished By (Signature)	Organization	Date/Time	Received For Laboratory By (Signature)		Date/Time
				3/7/0 1130	

Turn Around Time (Circle Choice): Exp. / 24 Hrs / 48 Hrs / 5 Days / 10 Days

Printed in U.S.A.

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 80628
CLIENT: Pacific Environmental Group
CLIENT JOB NO.: 320-18.02

DATE RECEIVED: 03/09/90
DATE REPORTED: 03/23/90

Lab Number	Customer Sample Identification	Date Sampled	Date Analyzed
80628- 1	C-2	03/09/90	03/22/90
80628- 2	C-3	03/09/90	03/22/90
80628- 3	C-4	03/09/90	03/22/90
80628- 4	C-5	03/09/90	03/22/90
80628- 5	C-6	03/09/90	03/22/90
80628- 6	C-7	03/09/90	03/22/90
80628- 7	C-8	03/09/90	03/22/90
80628- 8	C-9	03/09/90	03/22/90
80628- 9	C-10A	03/09/90	03/22/90
80628-10	C-11	03/09/90	03/22/90

Laboratory Number:	80628 1	80628 2	80628 3	80628 4	80628 5
ANALYTE LIST	Amounts/Quantitation Limits (ug/L)				
OIL AND GREASE:	NA	NA	NA	NA	NA
TPH/GASOLINE RANGE:	390	42000	43000	ND<50	73000
TPH/DIESEL RANGE:	NA	NA	NA	NA	NA
BENZENE:	280	1100	20000	ND<0.5	23000
TOLUENE:	35	5700	2300	ND<0.5	5900
ETHYL BENZENE:	27	1600	2800	ND<0.5	3400
XYLENES:	50	7900	11000	ND<0.5	17000

Laboratory Number:	80628 6	80628 7	80628 8	80628 9	80628 10
ANALYTE LIST	Amounts/Quantitation Limits (ug/L)				
OIL AND GREASE:	NA	NA	NA	NA	NA
TPH/GASOLINE RANGE:	590	ND<50	28000	ND<50	ND<50
TPH/DIESEL RANGE:	NA	NA	NA	NA	NA
BENZENE:	2.8	ND<0.5	12000	1.6	1.2
TOLUENE:	2.4	ND<0.5	940	0.7	0.7
ETHYL BENZENE:	3.5	ND<0.5	3000	0.8	ND<0.5
XYLENES:	2.0	ND<0.5	4700	3.5	1.4

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I · SAN FRANCISCO, CA 94124 · PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 80628
CLIENT: Pacific Environmental Group
CLIENT JOB NO.: 320-18.02

DATE RECEIVED: 03/09/90
DATE REPORTED: 03/23/90

Lab Number	Customer Sample Identification	Date Sampled	Date Analyzed
80628-11	C-12	03/09/90	03/22/90
80628-12	C-13	03/09/90	03/22/90
80628-13	C-14	03/09/90	03/22/90
80628-14	C-15	03/09/90	03/22/90
80628-15	C-16	03/09/90	03/22/90

Laboratory Number:	80628 11	80628 12	80628 13	80628 14	80628 15
ANALYTE LIST	Amounts/Quantitation Limits (ug/L)				
OIL AND GREASE:	NA	NA	NA	NA	NA
TPH/GASOLINE RANGE:	1400	ND<50	ND<50	410	ND<50
TPH/DIESEL RANGE:	NA	NA	NA	NA	NA
BENZENE:	230	15	ND<0.5	ND<0.5	ND<0.5
TOLUENE:	140	3.7	ND<0.5	1.4	ND<0.5
ETHYL BENZENE:	33	1.0	ND<0.5	0.5	ND<0.5
XYLENES:	180	6.2	ND<0.5	0.6	ND<0.5

SUPERIOR ANALYTICAL LABORATORY, INC.
1555 BURKE, UNIT I • SAN FRANCISCO, CA 94124 • PHONE (415) 647-2081

CERTIFICATE OF ANALYSIS

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
Diesel by Modified EPA SW-846 Method 8015
Gasoline by Purge and Trap: EPA MEthod 8015/5030
ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

QA/QC INFORMATION
SET: 80628

NA = ANALYSIS NOT REQUESTED
ND = ANALYSIS NOT DETECTED ABOVE QUANTITATION LIMIT

ug/L = part per billion (ppb)

OIL AND GREASE ANALYSIS By Standard Methods Method 503E:
Duplicate RPD NA
Minimum Detection Limit in Water: 5000ug/L

Modified EPA Method 8015 for Extractable Hydrocarbons:
Minimum Quantitation Limit for Diesel in Water: 1000ug/L
Daily Standard run at 200mg/L; RPD Diesel = NA
MS/MSD Average Recovery = NA: Duplicate RPD = NA

8015/5030 Total Purgable Petroleum Hydrocarbons:
Minimum Quantitation Limit for Gasoline in Water: 50ug/L
Daily Standard run at 2mg/L; RPD Gasoline = 6%
MS/MSD Average Recovery = 100%: Duplicate RPD = 0.34%

8020/BTXE
Minimum Quantitation Limit in Water: 0.50ug/L
Daily Standard run at 20ug/L; RPD = <15%
MS/MSD Average Recovery = 100%: Duplicate RPD = <2%

Richard Srna, Ph.D.
Labortory Manager

80628

Chain-of-Custody Record

Chevron U.S.A. Inc.
P.O. Box 5004
San Ramon, CA 94583
FAX (415) 842-9591

Chevron Facility Number 9-5607
Consultant Release Number 2542150
Consultant Project Number 320-18.02
Consultant Name Pacific Environmental Group
Address 1601 Civic Center Dr. #202 Santa Clara.
Fax Number 408-243-3911
Project Contact (Name) Lainie Demian
(Phone) 408-984-6536

Chevron Contact (Name) Gordon Davitt
(Phone) 415-842
Laboratory Name Superior Analytical
Contract Number
Samples Collected by (Name) Scott Piste
Collection Date 3-9-90
Signature Scott Piste

	Sample Number	Lab Number	Number of Containers	Matrix S = Soil W = Water A = Air C = Charcoal	Type G = Grab C = Composite	Time	Sample Preservation	Iced	Analyses To Be Performed: Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline	Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline + Diesel	503 Oil and Grease	Arom. Volatiles - BTXE Soil: 8020/Wtr.: 602	Arom. Volatiles - BTXE Soil: 8240/Wtr.: 624	Total Lead DHS-Luft	EDB DHS-AB 1803				Remarks
1	C-2	5C	3	W			HCl	Y	X			X							
2	C-3																		
3	C-4																		
4	C-5																		
6	C-6																		
6	C-7																		
7	C-8																		
8	C-9																		
9	C-10A																		
10	C-11																		
11	C-12																		
12	C-13																		
13	C-14																		

Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Organization	Date/Time
Scott Piste	PEG	3-9-90 13:45	D.W. Chesney #451		
Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Organization	Date/Time
Relinquished By (Signature)	Organization	Date/Time	Received For Laboratory By (Signature)		Date/Time 3/9/90

Turn Around Time (Circle Choice)
24 Hrs
48 Hrs
5 Days
(10 Days)

Printed in U.S.A.

MS 5136 (6 89)

80628

Chain-of-Custody Record

Chevron U.S.A. Inc.
P.O. Box 5004
San Ramon, CA 94583
FAX (415) 842-9591

Chevron Facility Number 9-5607
Consultant Release Number 2542150
Consultant Project Number 320-18.02
Consultant Name Pacific Environmental Group
Address 1601 Civic Center Dr #202 Santa Clara.
Fax Number 408-243-3911
Project Contact (Name) Lainie Demian
(Phone) 408-984-6536

Chevron Contact (Name) Gordon Davitt
(Phone) 415-842
Laboratory Name Superior Analytical
Contract Number
Samples Collected by (Name) Scott Pisle
Collection Date 3-9-90
Signature Scott Pisle

	Sample Number	Lab Number	Number of Containers	Matrix S = Soil W = Water A = Air C = Charcoal	Type G = Grab C = Composite	Time	Sample Preservation	Iced	Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline	Modified EPA 8015 Total Petro. Hydrocarb. as Gasoline + Diesel	503 Oil and Grease	Arom. Volatiles - BTXE Soil: 8020/Wtr.: 602	Arom. Volatiles - BTXE Soil: 8240/Wtr.: 624	Total Lead DHS-Luft	EDB DHS-AB 1,803				Remarks
4	C-15	5C	3	W			HCl	Y	X			X							
6	C-16	5C	3	W			HCl	Y	X			X							

Analyses To Be Performed

Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Organization	Date/Time	Turn Around Time (Circle Choice)
Scott Pisle	PEG	3-9-90 18:45				24 Hrs
Relinquished By (Signature)	Organization	Date/Time	Received By (Signature)	Organization	Date/Time	48 Hrs
						5 Days
Relinquished By (Signature)	Organization	Date/Time	Received For Laboratory By (Signature)		Date/Time	10 Days
					3/5/90	

Printed in U.S.A.

MS 5136 (8-89)