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 Department

91 OCT -7 [illegible]2:03

[illegible] T.L.H.

October 3, 1991

Mr. Ravi Arulamanthum
Alameda County Environmental Health
80 Swan Way, Room 200
Oakland, CA 94621

Re: Chevron Station # 9-5542
7007 San Ramon Valley Blvd., Dublin, CA 94568

Dear Mr. Arulamanthum:

Enclosed is a work plan dated September 9, 1991 which was prepared by Chevron's consultant, Sierra Environmental Services (Sierra), to describe the proposed installation of one off-site groundwater monitoring well at the site referenced above. I believe that a copy of this work plan may have already been sent to Alameda County Environmental Health by Sierra, however I am sending another copy to show that this work plan is being submitted by Chevron.

The well will be installed under the supervision of field personnel from Chevron's consultant, GeoStrategies, Inc. (GSI), upon receipt of the necessary permits from Alameda County and the City of Dublin.

If you have any questions or comments, you may contact me at (510) 842-8658.

Sincerely,

Clint B. Rogers

Clint B. Rogers
Environmental Engineer

Enclosure

cc: Richard Hiett, San Francisco Bay RWQCB, Oakland, CA
Randy Young, GeoStrategies/Gettler-Ryan, Hayward, CA
Sharon Halper, Sierra Environmental, Martinez, CA (w/o enclosure)

SIERRA
Environmental Services

September 9, 1991

Clint Rogers
Chevron USA
P.O. Box 5004
San Ramon, CA 94583

Re: Chevron Service Station #9-5542
7007 San Ramon Valley Boulevard
Dublin, California
SES Project #1-214-01

Dear Mr. Rogers:

As is required, Sierra Environmental Services (SES) presents the following work plan for subsurface work at the Chevron Service Station located at 7007 San Ramon Valley Boulevard, Dublin, California (Figure 1, Appendix A).

SUMMARY

SES proposes to drill one additional monitoring well in order to evaluate the downgradient extent of hydrocarbons in ground water and to verify the ground water flow direction and gradient in the site vicinity.

INTRODUCTION

Site History and Current Site Use

The following site history information was obtained from Mr. Clint Rogers of Chevron USA.[1]

[1] Rogers, Clint, 1991, Memorandum from Clint Rogers, Chevron Engineer to Sharon Halper, SES Senior Project Geologist, May 28, 1991, 1 pp.

Four steel tanks were installed at the site in 1965 (two 10,000-gallon underground fuel tanks and one 4,000-gallon underground fuel tank and one 500-gallon waste oil tank). In 1983, a hole was discovered in the regular leaded gasoline tank and the tank was lined with fiberglass.

In December 1983, five monitoring wells were installed at the site. All five wells were drilled to a depth of approximately 20 feet below grade. Ground water was not encountered in any of the wells. In January 1984, well MW-3 was deepened to a depth of 25 feet below grade. Free-phase motor oil was observed and bailed from the well. No further free-phase hydrocarbons were observed in bi-weekly monitoring through October 1984.

In September 1984 a corroded section of piping was replaced and cathodic protection was installed. In November 1984, the regular leaded product line failed a leak test.

In February 1990, the station was rebuilt and the fuel tanks and product lines were replaced. Three 12,000-gallon fiberglass tanks were installed. The waste oil tank was removed but was not replaced. Soil samples were collected from beneath the fuel tanks and waste oil tank. Hydrocarbons were detected in soil samples from beneath all of the tanks. The highest concentration of total purgeable petroleum hydrocarbons as gasoline [TPPH(G)], 5,100 parts per million (ppm), was detected beneath the northern end of the eastern fuel tank.[2]

Soil was removed to a depth of 22 feet below grade at the southern end of the tank excavation. Soil samples collected from 22 feet below grade in the southern portion of the tank excavation contained over 1,000 ppm TPPH(G).

Tank test results were not available for inclusion in this work plan.

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[2] Blaine Tech, 1990, Consultant's Tank Removal Report, Chevron Service Station #9-5542, prepared for Chevron February 13, 1990.

In March 1990, the five existing monitoring wells were abandoned and four new wells were installed at the site. Hydrocarbons were detected in soil samples collected from three of the monitoring wells (MW-1, MW-3, and MW-4). The highest concentration of TPPH(G), 1,300 ppm, was detected in a soil sample collected from 25 feet below grade in boring/well MW-1.

In June 1991, SES installed three off-site monitoring wells to further define the extent of hydrocarbons in ground water in the site vicinity.[3] Analytic results for soil from the installation of the monitoring wells are shown in Table 1 (Appendix B). Hydrocarbons as gasoline were detected in one soil sample from boring/well MW-6, located downgradient of the former underground fuel tanks area. The total purgeable petroleum hydrocarbons and benzene, toluene, ethylbenzene and xylenes detected in the sample were probably the result of hydrocarbons in ground water. Hydrocarbons were not detected in soil samples from the other two borings/wells drilled for the investigation.

Soil in the site vicinity generally consists of low- to moderate-permeability clay with lenses of clayey sand. Ground water was encountered at 26 to 28 feet below grade and stabilized at approximately 23 to 23.5 feet below grade. The ground water flow direction at the site is easterly with a gradient of 0.05 to 0.06 ft/ft (Figure 2, Appendix A).

Ground water samples from five of the seven wells associated with the site contained total purgeable petroleum hydrocarbons as gasoline. Analytic results for ground water are shown in Table 2 (Appendix B). Ground water samples from all five of these wells contained benzene at or above the Department of Health Services (DHS) Maximum Contaminant Level (MCL). The ground water sample from well MW-3 also contained ethylbenzene above the DHS MCL. The ground water samples from wells MW-1 and MW-3 contained xylenes above the DHS MCL and toluene above the DHS Recommended Action Level.

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[3] Sierra Environmental Services, 1991, Consultant's Subsurface Investigation Report prepared for Chevron, July 22, 1991, 10 pages and 5 appendices.

Two other potential sources of hydrocarbons were identified near the site, a Unocal station and a Shell station. The Unocal station has reported petroleum releases and is potentially upgradient of the Chevron station.

TOPOGRAPHIC AND GEOLOGIC SETTING

The site is located in Dublin, in the San Ramon Valley region of California. The topography of the site is relatively flat. The site is mapped as Quaternary alluvium which is composed of clay, silt, sand and gravel.[4] The closest surface water is Dublin Creek, located approximately 2,000 feet south of the site.

Previous work at the site indicates that it is underlain by relatively low-permeability sandy clay.[5,6] Depth to ground water in July 1991 was approximately 24 to 26.5 feet below grade.

The ground water flow direction at the site was easterly, based on water level measurements collected in July 1991. The ground water gradient was approximately 0.05 to 0.06 ft/ft.

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4 Dibblee, Thomas, 1980, Preliminary Geologic Map of the Dublin Quadrangle, Alameda and Contra Costa Counties, United States Geological Survey Open File Report 80-537.

5 Chempro, 1990, Consultant's boring logs, borings drilled for Chevron USA, March 26, 1990 through March 28, 1990.

6 Sierra Environmental Services, 1991, Consultant's Subsurface Investigation Report prepared for Chevron, July 22, 1991, 10 pages and 5 appendices.

SCOPE OF WORK

In order to further define the extent of hydrocarbons in ground water and to verify the ground water flow direction and gradient in the site vicinity, SES will drill one additional soil boring and install one monitoring well in the boring. The location of the proposed soil boring/monitoring well is shown on Figure 3 (Appendix A). The following outlines the proposed scope of work and procedures for this investigation.

1. Prepare a site safety plan specific to this investigation based on past and present site use.

2. Drill one soil boring at the site. The soil samples from the boring will be surveyed in the field with an organic vapor meter (OVM) to determine whether volatile hydrocarbons are present in the samples. OVM readings and field observations will be used to select soil samples from the monitoring well boring for analyses. At a minimum, one soil sample will be analyzed from the boring. The soil samples will be analyzed for TPPH(G), and benzene, toluene, ethylbenzene, and xylenes (BTEX). Soil cuttings will be analyzed for organic lead for disposal purposes.

3. Install one 2-inch diameter monitoring well in the boring.

4. Develop and sample the well. Analyze the ground water sample from the well for TPPH(G), halogenated volatile organic compounds (HVOCs) and BTEX.

5. Survey the top-of-casing elevation of the well and measure depth to water and product thickness (if product is present) in all site wells. The survey and water level data will be used to verify the ground water flow direction in the site vicinity.

6. Arrange for disposal of the drill cuttings from the boring, the steam-cleaning rinseate and the monitoring well purge water.

7. Report the results and make recommendations for additional work, if needed.

Each of these tasks is described below.

Task 1 - Site Safety Plan

Using available site history information, SES will prepare a site-specific safety plan. The safety plan will identify potential site hazards and specify procedures to protect site workers. The safety plan will be on-site during field operations. The site safety plan is included under separate cover.

Tasks 2 and 3 - Drilling and Monitoring Well Installation

One soil boring will be drilled in the site vicinity and one monitoring well will be installed in the boring in accordance with SES Standard Operating Procedure - Monitoring Well Design and Construction (Appendix C). A typical well construction detail is included in Appendix A.

The well will be drilled by Soils Exploration Services of Vacaville, California, C57#582696. Prior to drilling, utilities will be located by USA and a private locator.

All drilling equipment will be steam-cleaned prior to use and all sampling equipment will be washed between samples using an EPA-approved detergent such as Liquinox and rinsed with potable water.

The boring will be logged in accordance with SES Standard Operating Procedure - Logging Method (Appendix C) under the supervision of Roger Greensfelder, R.G. #003011.

Soil samples will be collected from the boring at intervals no greater than 5 feet in steam-cleaned or new stainless steel or brass tubes in accordance with SES Standard Operating Procedure - Soil Sampling (Appendix C). SES will attempt to collect a soil sample at the soil/ground water interface. Soil samples will be collected at intervals of less than 5 feet if there is a change in soil type or if hydrocarbons are detected by field personnel or with the OVM.

The soil samples will be field screened with an OVM in accordance with SES Standard Operating Procedure - OVM Readings (Appendix C). If hydrocarbons are detected with the OVM or by SES field personnel at the bottom of the proposed boring/well, SES personnel will attempt to collect sufficient samples to define the vertical extent of hydrocarbons in the boring.

Drill cuttings will be stored on-site in 55-gallon Department of Transportation (DOT) approved drums pending analytic results. Each drum will be sealed and labeled.

The soil sample(s) from the boring will be analyzed for TPPH(G) and BTEX by EPA Method 5030/8015 and EPA Method 8020, respectively. One soil cuttings sample from the boring will be analyzed for organic lead by the DHS LUFT Method in accordance with Class III landfill disposal requirements. All quality assurance/quality control (QA/QC) data from the laboratory will be included in the subsurface investigation report.

Information from previous work conducted at the site indicates that the soils in the site vicinity are relatively fine-grained. SES will use 0.010 slotted well screen for the monitoring wells and #212 sand for gravel pack around the well screen.

Task 4 - Well Development, Ground Water Sampling and Analysis

The monitoring well will be developed no sooner than 48 hours after drilling with a vented surge block and over pumping in accordance with the SES Standard Operating Procedure - Well Development (Appendix C). Ground water will be removed from the well using a submersible pump. Ground water removed from the well will be temporarily stored on-site in 55-gallon DOT-approved drums.

The ground water sample will be collected from the well no sooner than 24 hours after development in accordance with SES Standard Operating Procedure - Water Sampling (Appendix C). The evacuated water will be stored on-site in 55-gallon drums.

The water sample will be collected using steam-cleaned teflon bailers. Sample containers will be obtained from the analytic laboratory prior to sampling. The water sample will be decanted in sample containers, labeled and refrigerated for transport to the laboratory. Chain of custody records will be maintained for the sample.

A bailer blank will be prepared at the site and a trip blank will accompany the samples to the laboratory. Both the trip blank and the bailer blank will be analyzed for TPPH(G) and BTEX.

The ground water sample from the well will be analyzed for TPPH(G) and BTEX by EPA Method 5030/8015 and EPA Method 602, respectively. In addition, the ground water sample will be analyzed for HVOCs by EPA Method 601. All QA/QC data from the laboratory will be included in the subsurface investigation report.

Task 5 - Surveying and Ground Water Gradient

The top of casing elevations of the new well will be surveyed by a licensed land surveyor. The casing elevation will be surveyed relative to mean sea level using a USGS benchmark.

Water and product (if present) levels will be measured in all wells associated with the site using an MMC flexi-dip interface probe. Water and product levels will be reported to the nearest 1/100th of a foot.

A ground water contour map will be prepared using survey and water level data. If free-phase hydrocarbons are detected in more than two wells, a product thickness contour map will also be prepared.

Task 6 - Drill Cuttings Disposal and Monitoring Well Purge Water

Disposal of the soil cuttings will be based on the analytic results. The monitoring well development and purge water will be taken to a Chevron Company-designated disposal facility.

Task 7 - Report

A report presenting the results of the investigation will be prepared. The report will include:

Text:
- Summary of the results
- Site background and history
- Topographic and geologic setting
- Description of soil sampling and subsurface sediments
- Monitoring well installation
- Depth to ground water and ground water flow direction and gradient
- Conclusions

Tables:
- Tabulated soil and ground water analytic results
- Ground water elevation data and well construction details

Figures:
- Site location map
- Monitoring well location and ground water elevation contour map

Appendices:
- Appendix A: Figures
- Appendix B: Tables
- Appendix C: SES Standard Operating Procedures
- Appendix D: Boring Log
- Appendix E: Chain of Custody Documents and Laboratory Analytic Results

SES will submit a schedule for the proposed work within 5 business days of work plan approval. SES personnel will be at the site on the days shown. We will notify you 48 hours in advance of any schedule changes. If there are delays in any phase of the work a written request

for an extension will be submitted to the regulatory agencies. We will notify the Alameda County Department of Environmental Health 48 hours prior to field work at the site.

Please call if you have any questions regarding this work plan.

Sincerely,
Sierra Environmental Services

Sharon Halper
Senior Project Geologist

Robert Eddy
PE #22958

REGISTERED PROFESSIONAL ENGINEER
ROBERT LEE EDDY
No. C 22,958
12/93
CIVIL
STATE OF CALIFORNIA

SH/RE:ly
21401WP.AU1

Attachments: Appendix A - Figures
Appendix B - Tables
Appendix C - SES Standard Operating Procedures

cc: Alameda County Department of Environmental Health
Regional Water Quality Control Board - San Francisco Bay Region

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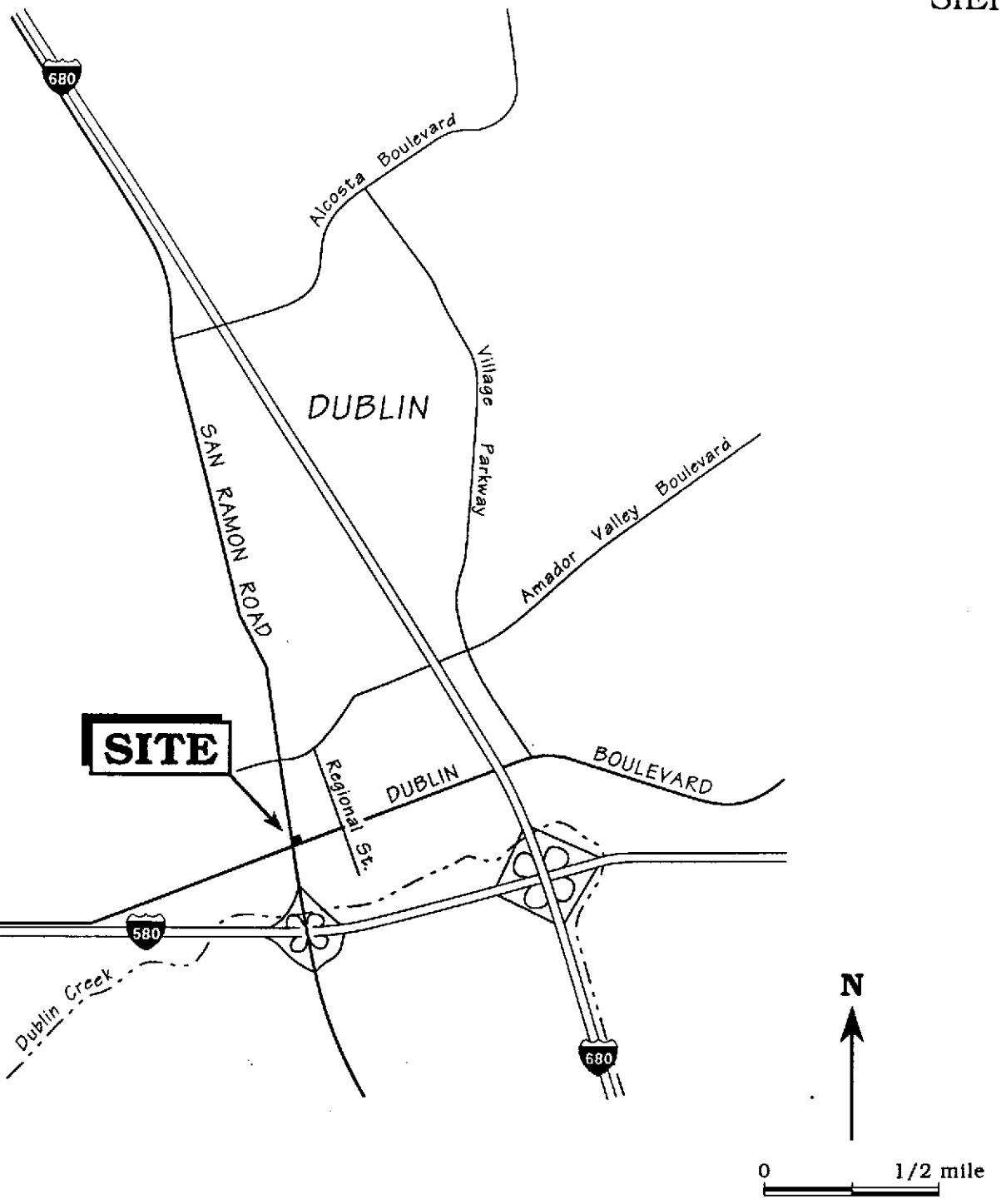

Base map ref: California State Automobile Association (AAA)

Figure 1. Site Location Map – Chevron Service Station #9-5542 – 7007 San Ramon Road, Dublin, California

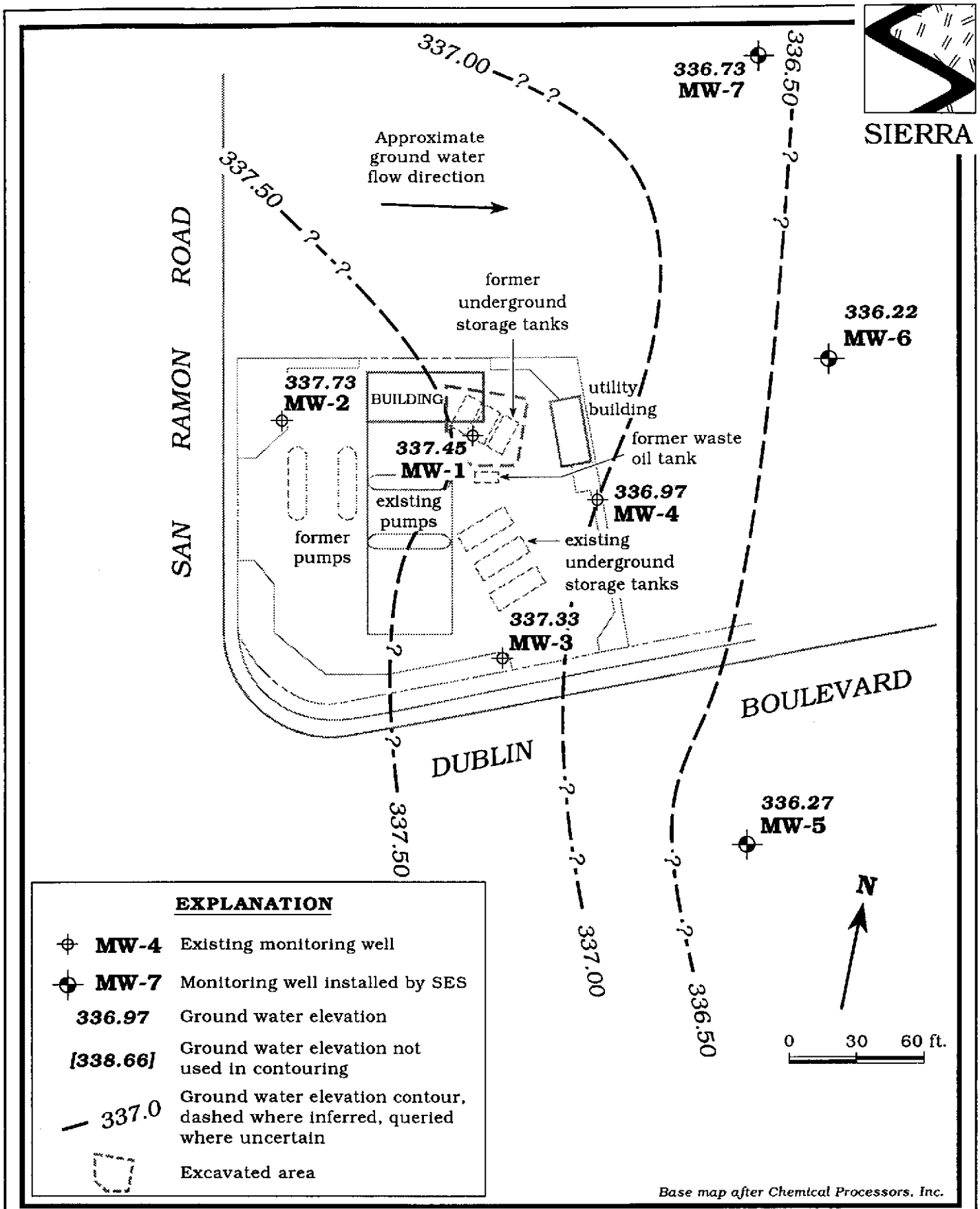

Figure 2. Monitoring Well Location and Ground Water Elevation Contour Map – July 17, 1991 – Chevron Service Station #9-5542 – 7007 San Ramon Road, Dublin, California

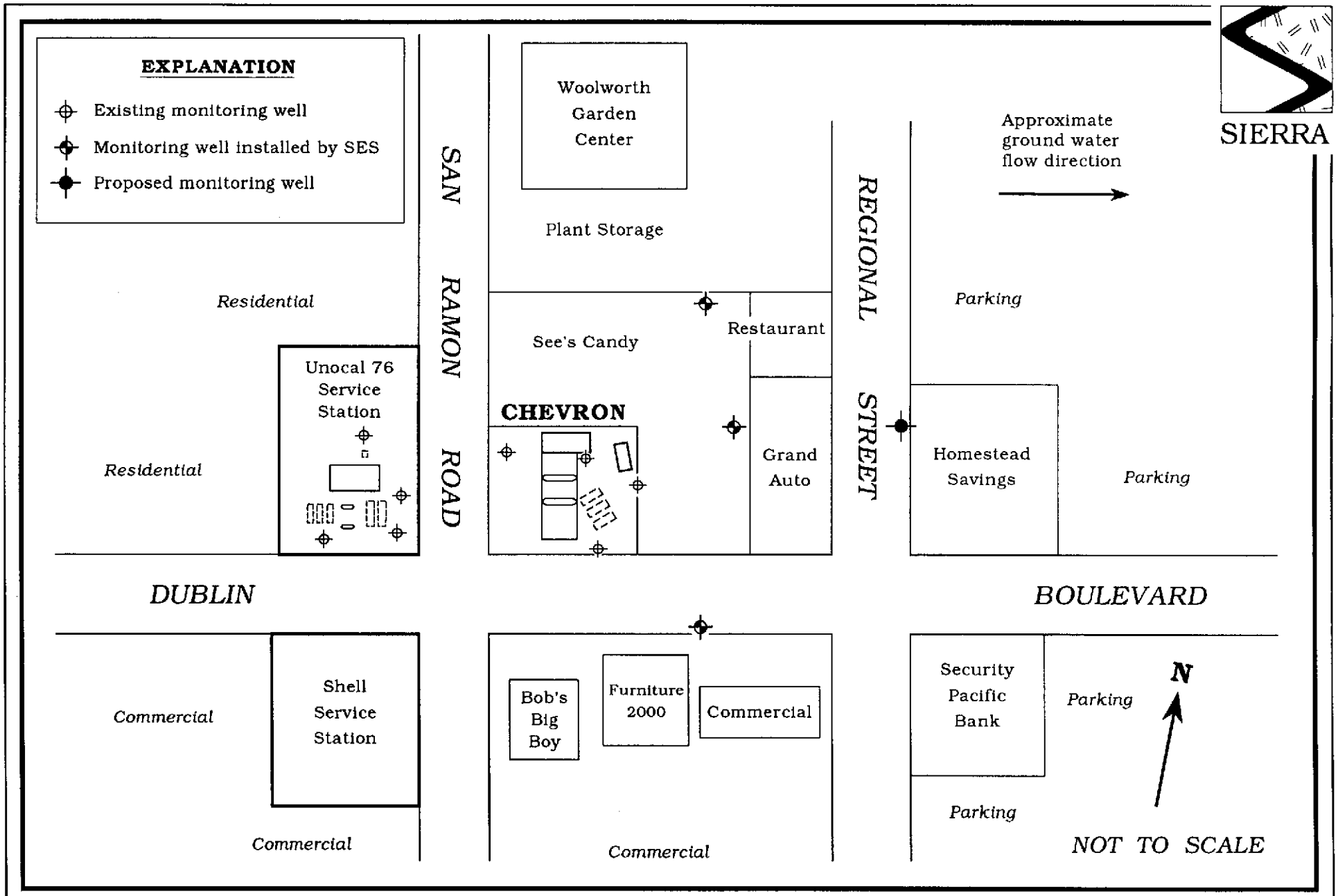

Figure 3. Proposed Monitoring Well Location Map – Chevron Service Station #9-5542, 7007 San Ramon Road, Dublin, California

EXPLANATION
TYPICAL WELL CONSTRUCTION

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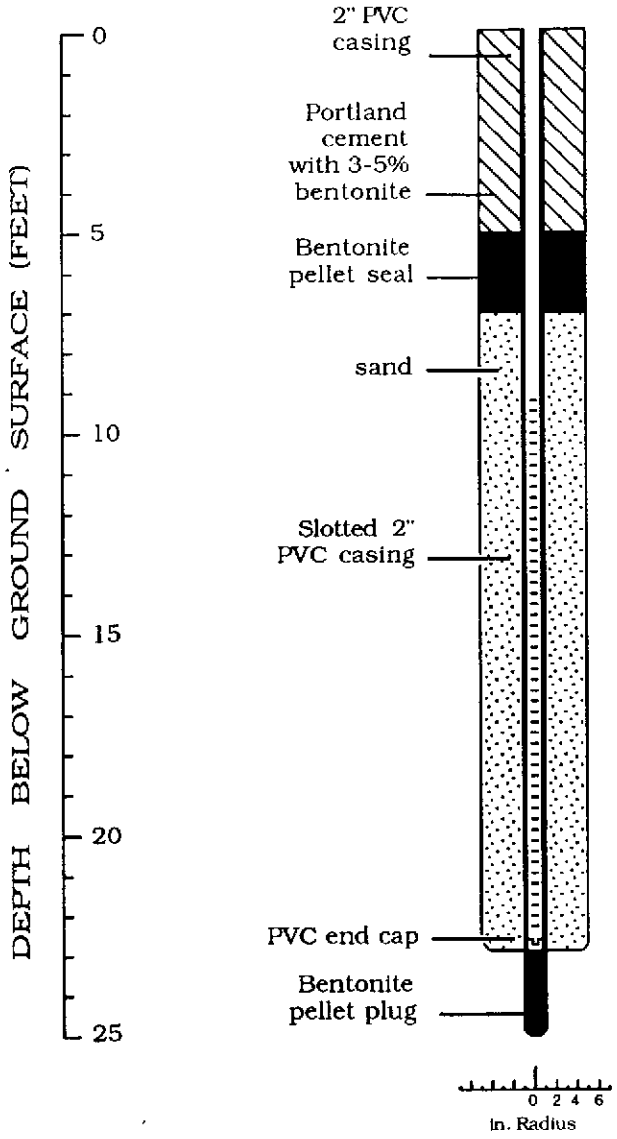
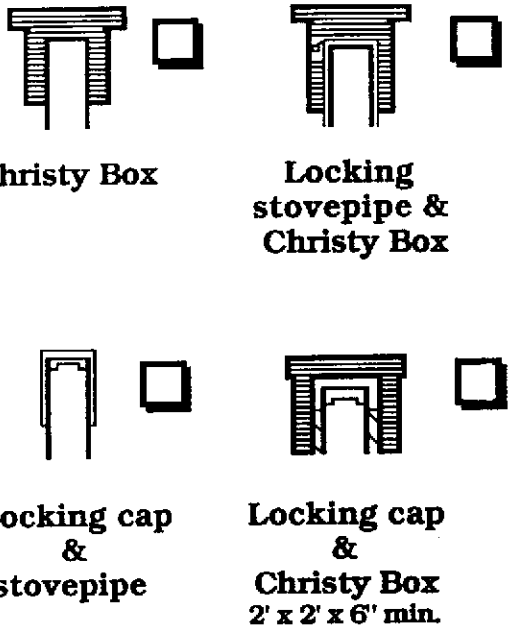


Well Head Completion Schematic
Not to scale



Christy Box

Locking stovepipe & Christy Box

Locking cap & stovepipe

Locking cap & Christy Box
2' x 2' x 6" min.

Water level depth and date:

▽ Initial water level

▼ Static water level

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Table 1. Analytic Results for Soil - Chevron Service Station #9-5542, 7007 San Ramon Road, Dublin, California

Sample ID	Depth (ft)	Sample Date	Analytic Lab	Analytic Method	TPPH(G)	TPH(D)	O&G	B	T	E	X	Cd	Cr	Pb	Zn
					<---------- ppm ----------										
MW-1	25	3/27/90	*	8015/8020	1,300	---	---	38	150	34	180	---	---	---	---
	30	3/27/90	*	8015/8020	270	---	---	1	4	4	18	---	---	---	---
MW-2	15	3/26/90	*	8015/8020	<10	---	---	<0.005	<0.005	<0.005	<0.015	---	---	---	---
MW-3	15	3/26/90	*	8015/8020	<10	---	---	<0.005	<0.005	<0.005	<0.015	---	---	---	---
	20	3/26/90	*	8015/8020	<10	---	---	<0.005	0.01	0.01	0.12	---	---	---	---
	25	3/26/90	*	8015/8020	51	---	---	<0.005	0.02	0.05	0.28	---	---	---	---
MW-4	15	3/28/90	*	8015/8020	<10	<10	---	---	---	---	---	---	---	---	---
	15	3/28/90	*	7130/7190/7420/7950	---	---	---	---	---	---	---	<3	26	37	39
	20	3/28/90	*	8015/8020	<10	<10	---	---	---	---	---	---	---	---	---
	20	3/28/90	*	7130/7190/7420/7950	---	---	---	---	---	---	---	<3	25	41	44
	25	3/28/90	*	8015/503E/8240**	<10	<10	39	2.7	23	5.6	46	---	---	---	---
	25	3/28/90	*	7130/7190/7420/7950	---	---	---	---	---	---	---	<3	13	26	28
MW-5	28.5	6/11/91	SAL	8015/8020/7420	<1	---	---	<0.005	<0.005	<0.005	<0.005	---	---	<10	---
MW-6	26	6/12/91	SAL	8015/8020/7420	5	---	---	0.006	0.006	0.060	0.12	---	---	<10	---
MW-7	26	6/11/91	SAL	8015/8020/7420	<1	---	---	<0.005	<0.005	<0.005	<0.005	---	---	<10	---

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Table 1. Analytic Results for Soil - Chevron Service Station #9-5542, 7007 San Ramon Road, Dublin, California (continued)

EXPLANATION:

TPPH(G) = Total Purgeable Petroleum Hydrocarbons as Gasoline
TPH(D) = Total Petroleum Hydrocarbons as Diesel
O&G = Oil & Grease
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes
Cd = Cadmium
Cr = Chromium
Pb = Lead
Zn = Zinc
ppm = Parts per million
--- = Not analyzed/Not applicable
** = Method 8240 compounds not detected, detection limits were not stated

ANALYTIC METHODS:

8015 = EPA Method 8015 for TPPH(G) and TPH(D)
8020 = EPA Method 8020 for BTEX
503E = Standard Method 503E for O&G
7130 = EPA Method 7130 for Cd
7190 = EPA Method 7190 for Cr
7420 = EPA Method 7420 for Pb
7950 = EPA Method 7950 for Zn

ANALYTIC LABORATORY:

* Analytic data was compiled from a draft report prepared by Chempro, undated. Analytic laboratory not shown.

SAL = Superior Analytical Laboratories, Inc., of San Francisco and Martinez, California

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Table 2. Analytic Results for Ground Water - Chevron Service Station #9-5542, 7007 San Ramon Road, Dublin, California

Sample ID	Date	Analytic Method	Analytic Lab	TPPH(G)	O&G	B	T	E	X	HVOCs	1,2-DCA	EDB	OL
				<----------ppb---------->									
MW-1	4/3-4/90	*	8015/602/504	46,000	---	8,400	7,400	860	5,600	---	---	1.04	---
(D)	4/3-4/90	*	8015/602/504	43,000	---	8,400	7,200	840	5,200	---	---	1.1	---
	5/31/91	SAL	8015/8020/8010	31,000	---	7,400	2,500	630	2,100	ND	2	---	---
	5/31/91	SAL	503E	---	<5,000	---	---	---	---	---	---	---	---
MW-2	4/3-4/90	*	8015/602/504	<50	---	<0.3	<0.3	<0.3	<0.6	---	---	<0.02	---
	5/31/91	SAL	8015/8020/8010	100	---	3.1	4.2	0.7	2.0	ND	<0.5	---	---
	5/31/91	SAL	503E	---	<5,000	---	---	---	---	---	---	---	---
MW-3	4/3-4/90	*	8015/602/504	2,200	---	36	5	6	17	---	---	<0.02	---
	5/31/91	SAL	8015/8020/8010	2,200	---	130	11	31	78	ND	19	---	---
	5/31/91	SAL	503E	---	<5,000	---	---	---	---	---	---	---	---
MW-4	4/3-4/90	*	8015/413.1/602/504	43,000	18,000	4,000	5,000	790	5,500	---	---	<0.02	---
	4/3-4/90	*	624**	---	---	6,000	8,200	1,500	---	---	---	---	---
	5/31/91	SAL	8015/8020/8010	34,000	---	2,900	2,900	680	3,300	ND	<0.5	---	---
	5/31/91	SAL	503E	---	<5,000	---	---	---	---	---	---	---	---
MW-5	6/21/91	SAL	8015/8020	<50	---	<0.5	<0.5	<0.5	<0.5	---	<0.5	---	---
	6/21/91	SAL	8010/LUFT	---	---	---	---	---	---	ND	---	---	<4,000
MW-6	6/21/91	SAL	8015/8020	3,700	---	50	2.6	150	340	---	<0.5	---	---
	6/21/91	SAL	8010/LUFT	---	---	---	---	---	---	ND	---	---	<4,000
MW-7	6/21/91	SAL	8015/8020	<50	---	<0.5	<0.5	<0.5	<0.5	---	<0.5	---	---
	6/21/91	SAL	8010/LUFT	---	---	---	---	---	---	ND	---	---	<4,000
Trip Blank													
(MW-AA)	5/31/91	SAL	8015/8020	<50	---	<0.5	<0.5	<0.5	<0.5	---	---	---	---
	6/21/91	SAL	8015/8020	<50	---	<0.5	<0.5	<0.5	<0.5	---	---	---	---
Bailer Blank													
(MW-BB)	5/31/91	SAL	8015/8020	<50	---	<0.5	<0.5	<0.5	<0.5	---	---	---	---
	6/21/91	SAL	8015/8020	<50	---	<0.5	<0.5	<0.5	<0.5	---	---	---	---

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Table 2. Analytic Results for Ground Water - Chevron Service Station #9-5542, 7007 San Ramon Road, Dublin, California (continued)

Sample ID	Date	Analytic Method	Analytic Lab	TPPH(G)	O&G	B	T	E	X	HVOCs	1,2-DCA	EDB	OL
				<----------ppb---------->									
DHS MCLs	---	---	---	NE	NE	1	---	680	1,750	***	0.5	0.02	NE
DHS RALs	---	---	---	---	NE	---	100	---	---	***	---	---	NE

EXPLANATION:

TPPH(G) = Total Purgeable Petroleum Hydrocarbons as Gasoline
O&G = Oil and Grease
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes
HVOCs = Halogenated Volatile Organic Compounds
1,2-DCA = 1,2-Dichloroethane
EDB = Ethylene dibromide
OL = Organic lead
ppb = Parts per billion
ND = Not detected at detection limits of 0.5 to 1 ppb
--- = Not analyzed/not applicable
DHS = Department of Health Services
MCLs = Maximum Contaminant Levels
RALs = Recommended Action Levels
NE = Not established
D = duplicate sample

ANALYTIC METHODS:

8015 = EPA Method 8015/5030 for TPPH(G)
602 = EPA Method 602 for BTEX
504 = EPA Method 504 for EDB
503E = Standards Methods Method 503E for O&G
8020 = EPA Method 8020 for BTEX
8010 = EPA Method 8010 for HVOCs
413.1 = EPA Method 413.1 for total O&G
624 = EPA Method 624 for BTEX and VOCs
LUFT = DHS LUFT Manual method for OL

ANALYTIC LABORATORY:

SAL = Superior Analytic Laboratory of San Francisco and Martinez, California

NOTES:

Well locations are shown on Figure 5 (Appendix A)

* Analytic data was compiled from a draft report prepared by Chempro, undated. Analytic laboratory was not shown.
** 624 compounds were not reported
*** DHS MCLs and RALs for HVOCs vary

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APPENDIX C
SIERRA ENVIRONMENTAL SERVICES
STANDARD OPERATING PROCEDURE

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SES STANDARD OPERATING PROCEDURE

LOGGING METHOD

Unconsolidated soil is classified and described by trained SES field personnel. All available information is used, including the following: soil recovered in the sampler, including the soil visible on both ends of the sample retained for possible analysis; soil cuttings generated during drilling; and the drilling contractor's observations of the drill rig's behavior.

Classification and description of unconsolidated soil is accomplished using the American Society of Testing and Materials (ASTM) Methods D2487-85 (Unified Soil Classification System (USCS)) and/or D2488-69 (Description and Identification of Soils (Visual-Manual Procedure)).

The soil classification and description is recorded on the field log sheet by SES field personnel and includes the following information:

1) Soil type;
2) Soil classification;
3) Soil color, including mottling;
4) Moisture content;
5) Plasticity and consistency (fine-grained material) or density (coarse-grained material);
6) Percentages of clay, silt, sand and gravel;
7) Grain size range of sands and gravels;
8) Angularity and largest diameter of gravel component;
9) Estimated permeability;
10) Odor; and
11) Any other observations which would assist in the interpretation of the depositional environment and/or differentiation between the various geologic units expected to be encountered.

In addition to the above, the ground water levels encountered during drilling and measured after the water stabilized is also recorded on the field log.

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SES STANDARD OPERATING PROCEDURE

OVM READINGS

SES uses an organic vapor meter (OVM) to determine the presence or absence of volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and xylenes in soil samples chosen for field screening. The OVM uses a photoionization detector (PID) and is calibrated daily to 100 parts per million of 1-liter of isobutylene. The OVM, which measures in parts per million by volume (ppmv), is used for qualitative, not quantitative, assessment because the correlation between the volume measurements of the OVM and the weight measurements of the laboratory instruments is not well defined.

A field screen sample is obtained from the brass tube immediately above or below the brass tube containing the sample selected for possible analysis. The soil to be screened is removed from the brass tube, and is placed in a pre-cleaned brass tube with aluminum foil and a polyethylene cap on one end. The brass tube is loosely filled to approximately 1/2 full. Another square of aluminum foil is placed on the open end and a polyethylene cap with crossed slits is placed over it.

The field screen sample is allowed to temperature equilibrate for approximately 15 to 30 minutes in the sun, allowing any VOCs which might be present in the soil to volatilize out into the brass tube's headspace. The OVM nozzle is then placed inside the sealed brass tube, through the slits in the cap, in order to measure the VOCs present, if any, in the headspace. The nozzle should remain inside the brass tube for approximately 15 to 30 seconds or until the maximum reading has been recorded on the OVM readout panel.

The depth from which the sample came and the corresponding OVM reading is recorded on the original field log sheet. Field observations, OVM and (odor and staining) readings are used in determining which soil samples are to be analyzed in the laboratory.

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STANDARD OPERATING PROCEDURE

SOIL SAMPLING

The following describes sampling procedures used by SES field personnel to collect, handle, and transport soil samples. Before samples are collected, careful consideration is given to the type of analysis to be performed so that precautions are taken to prevent loss of volatile components or contamination of the sample, and to preserve the sample for subsequent analysis.

All drilling and sampling equipment is steam-cleaned between boreholes to prevent cross-contamination. The sampler is washed with an EPA approved detergent (such as liquinox or trisodium phosphate) between sample collection. Collection methods specific to soil sampling are presented below.

Soil samples are collected at pre-specified depth intervals or at a sediment/lithologic change for hydrogeologic description and possible chemical analysis. Samples are collected using a modified California split-spoon sampler lined with 2- or 2.5-inch I.D. x 4- or 6-inch long steam-cleaned or new brass tubes. The sampler is lowered into the borehole and driven 18-inches, using a 140-pound hammer. The drilling contractor provides the SES field personnel with the number of blows required to drive the sampler for each 6-inches of penetration.

The sampler is then extracted from the borehole and the middle or bottom brass tube is carefully removed for possible analysis. The soil material is immediately trimmed flush with the tube ends, and sealed with Teflon tape beneath polyethylene end caps. The caps are hermetically sealed to the brass tube with duct tape. The sample is then labeled to include the date, boring number, depth of sample, project number, SES, and the SES field personnel's initials. The samples are put into a plastic "zip-lock" type bag and placed into an ice chest maintained below 4°C with blue ice or dry ice, for transport under chain of custody to the laboratory. The chain-of-custody form includes the project number, analysis requested, sample ID, date analysis and the SES field personnel's name. The form is signed, dated and timed by each person who yields or receives the samples beginning with the field personnel and ending with the laboratory personnel.

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SES STANDARD OPERATING PROCEDURE

MONITORING WELL DESIGN AND CONSTRUCTION

Where possible, information from published and unpublished reports is reviewed prior to installation of monitoring wells. Relevant data includes highest and lowest anticipated ground water elevations, aquifer materials, aquifer yield and contaminants expected. This information is used to aid the field geologist rather than to predetermine how the wells will be constructed. Well construction is based on *site specific conditions* and is determined in the field after discussion with the senior geologist.

The wells are screened to monitor the first water-bearing zone encountered. If high ground water conditions exist the top of the well screen may be set at static water level or below static water level.

Fifteen feet of well screen will be used in the wells (five feet above static ground water and ten feet below static water) unless a five foot clay layer is encountered. If a clay layer is encountered, it will be confirmed by sampling. The sampling hole into the underlying confining layer will be sealed with bentonite pellets and the well screen will terminate 0 to 1 foot into the clay layer. When field observations indicate that low permeability materials are acting as an aquitard to prevent movement of contaminants less screen may be used.

Monitoring wells are constructed with flush-threaded, 2-inch or 4-inch diameter, slotted PVC, stainless steel or teflon well screen and PVC, stainless steel or teflon blank casing. Number 3 or #212 sand is used in the annular space around the well screen. The sand is placed into the annular space around the well screen to approximately 2 ft above the top of the well screen. If high ground water conditions exist, the sand may be placed 0 to 1 ft above the top of the well screen. Two feet of bentonite pellets are used to separate the sand from the sanitary surface seal (grout). If high ground water conditions exist 1/2 ft of bentonite may be used to separate the sand from the sanitary surface seal.

The grout (Portland cement with approximately 3-5% bentonite powder) is poured into the annular space above the bentonite pellets. If the surface seal is greater than 5 feet thick, grout consisting of cement mixed with 3-5% bentonite powder will be tremied or pumped into the

annular space above the bentonite pellets to prevent the infiltration of surface water into the well. If the surface seal is less than 5 feet thick, the grout will be poured from the surface. The resulting seal will be checked for shrinkage within 24 hours and additional grout will be added, if necessary. The surface seal is used to prevent infiltration of surface water into the well.

The monitoring well(s) is locked with a stovepipe or cap and covered with a traffic-rated vault if it is located in a developed area. The well I.D. is clearly marked on the cap or casing.

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SES STANDARD OPERATING PROCEDURE

WELL DEVELOPMENT

SES develops ground water monitoring wells not less than 48 hours after placement of the surface seal (grouting) to allow sufficient time for the cement grout to set. The wells are developed to restore the natural hydraulic conductivity of the formation(s) to be monitored, and to remove all sand and as much fine-grained material as possible. Well development consists of several cycles of surging (using a vented surge block) and over pumping of the well.

Prior to development, SES field personnel measure the depth to water and the total depth of the well. The total depth measurement is compared to the well completion diagram shown on the field log and any discrepancies are noted.

SES begins development by carefully lowering a pre-cleaned stainless steel vented surge block into the well casing to a position approximately three feet below the top of the well screen or the air/water interface, whichever is deepest. Surging begins with a slow upward stroke motion of the surge block at a stroke length not exceeding three feet. The stroke rate and length is progressively increased as surging continues for 10 to 15 minutes to loosen sand and fine-grained material from the screened interval. The surge block is then removed and placed in a clean 5-gallon bucket for future use.

During over pumping, the pump is run at the maximum flow rate to evacuate approximately two well casing volumes of ground water from the well. Over pumping will remove any sediment accumulated in the bottom of the well and any fine-grained material suspended in the water.

After a cycle of surging and over pumping has been completed SES field personnel record the time spent on each task, approximate discharge flow rate, and approximate volume of water evacuated. SES field personnel measure the depth to water, immediately after pumping and at various intervals, to approximate the recovery rate of the well.

Development shall continue until the turbidity of the water is less than 5 NTUs, or when ten well volumes have been removed, whichever occurs first.

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After development is completed, the total depth of the well is remeasured and compared to the total depth noted on the field log. The two depths should be approximately the same. All data measured during the procedures described herein are recorded on the SES Well Development Form, which is part of the project file.

The ground water removed from the wells during development remains on-site in 55-gallon Department of Transportation-approved drums. The drums are sealed and labeled with the Company name and telephone number, contents, and date. The water is removed by a licensed hauler and taken to an approved disposal facility.

WELLDVLP.V2

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SES STANDARD OPERATING PROCEDURE

GROUND WATER SAMPLING

The following describes sampling procedures used by SES field personnel to collect and handle ground water samples. Before samples are collected, careful consideration is given to the type of analysis to be performed so that precautions are taken to prevent loss of volatile components or contamination of the sample, and to preserve the sample for subsequent analysis. Wells will be sampled no less than 24 hours after well development. Collection methods specific to ground water sampling are presented below.

Prior to sampling, each well is checked for the presence of free-phase hydrocarbons using an MMC flexi-dip interface probe. Product thickness (measured to the nearest 0.01 foot) is noted on the sampling form. Water level measurements are also made using either a water level meter or the interface probe. The water level measurements are also noted on the sampling form.

Prior to sampling, each well is purged of a minimum of four well casing volumes of water using a steam-cleaned PVC bailer, or a pre-cleaned pump. Temperature, pH and electrical conductivity are measured at least three times during purging. Purging is continued until these parameters have stabilized (i.e., changes in temperature, pH or conductivity do not exceed ±0.5°F, 0.1 or 5%, respectively).

The purge water is stored temporarily on-site in 55-gallon Department of Transportation-approved drums pending analytic results. The drums are labeled with the date, contents, the SES field personnel initials and SES phone number.

Ground water samples are collected from the wells with steam-cleaned Teflon bailers. The water samples are decanted into the appropriate container for the analysis to be performed. Pre-preserved sample containers may be used or the analytic laboratory may add preservative to the sample upon arrival. Duplicate samples are collected from each well as a back-up sample and/or to provide quality control. The samples are labeled to include the project number, sample ID, date, preservative, and the field person's initials. The samples are placed in polyethylene bags and in an ice chest (maintained at 4°C with blue ice or ice) for transport under chain-of-custody to the laboratory.

The chain-of-custody form includes the project number, analysis requested, sample ID, date analysis and the SES field person's name. The form is signed and dated (with the transfer time) by each person who yields or receives the samples beginning with the field personnel and ending with the laboratory personnel.

A trip blank and bailer blank accompanies each sampling set, or 5% trip blanks and 5% bailer blanks are included for sets of greater than 20 samples. The bailer blank is prepared by pouring previously boiled water into a steam-cleaned Teflon bailer prior to sampling a well. The trip and bailer blanks are analyzed for some or all of the same compounds as the ground water samples.