**Chevron U.S.A. Products Company**
2410 Camino Ramon, San Ramon, California • Phone (510) 842-9500
Mail Address. P.O. Box 5004, San Ramon, CA 94583-0804

September 25, 1992

4037

Ms. Jennifer Eberle
Alameda County Health Care Services
80 Swan Way, Room 200
Oakland, CA 94621

**Re: Chevron Service Station #9-4587**
**609 Oak Street, Oakland**

Dear Ms. Eberle:

Enclosed we are forwarding the Ground Water Remediation Work Plan dated September 22, 1992, prepared by our consultant Geraghty & Miller, Inc. for the above referenced site. This work plan proposes to install a ground water extraction and treatment system. The system design is based on the physical characteristics of the saturated zone and the anticipated extraction flow rates of this zone. During system operation, aquifer transmissivity will be determined to assist in evaluating the effectiveness of the extraction system in obtaining hydraulic capture of the hydrocarbon plume. Purging of the separate-phase hydrocarbons will continue on a monthly basis until the dedicated recovery system is started up. Also enclosed is a schedule depicting the approximate time required to complete each task for your information.

Bailing ?

Chevron will proceed with the permitting and installation of the remediation system. We would appreciate your review and formal concurrence prior to implementation of this work plan.

If you have any questions or comments, please do not hesitate to contact me at (510) 842-9581.

Very truly yours,
CHEVRON U.S.A. PRODUCTS COMPANY

Nancy Vukelich
Site Assessment and Remediation Engineer

Enclosure

cc: Mr. Rich Hiett, RWQCB
Mr. S.A. Willer
File (9-4587W1)

September 22, 1992
Project No. RC11301

Ms. Nancy Vukelich
Chevron U.S.A. Products Company
2410 Camino Ramon
San Ramon, CA 94583

SUBJECT: Ground-Water Remediation Work Plan for Chevron Service Station #9-4587, 609 Oak Street, Oakland, California.

Dear Ms. Vukelich:

Geraghty & Miller, Inc. (Geraghty & Miller) has developed this work plan for ground-water remediation activities at the above-referenced site (Figure 1), based on information provided to Geraghty & Miller by Chevron and on Chevron's stated objective of initiating ground-water remediation by installing and operating a ground-water extraction and treatment system at this site.

## BACKGROUND

In response to your request, Geraghty & Miller has reviewed the job file provided by Chevron. The job file contained the following reports:

- Report entitled Quarterly Ground Water Monitoring Report (Alton Geoscience, 1992);
- Report entitled Site Update regarding the installation of Monitor Well C-7 (GeoStrategies, Inc., 1991);
- Report entitled Well Installation Report regarding the installation of Monitor Wells C-4, C-5, C-6, and CR-1 (GeoStrategies, Inc., 1990);
- Report entitled Sampling Report (Blaine Tech Services, Inc., 1987);
- Letter report regarding the installation of Monitor Wells C-1, C-2, and C-3 (Gettler-Ryan, Inc., 1983); and
- Report entitled Progress Report No. 1 regarding the installation of Monitor Wells B-1 and B-2 (IT Enviroscience, 1982).

## DRILLING AND WELL-INSTALLATION ACTIVITIES

Monitor Wells B-1 and B-2 (not shown) were installed in April 1982 by IT Enviroscience of Martinez, California, in the vicinity of the underground storage tanks (IT Enviroscience, 1982). Wells B-1 and B-2 were completed to a depth of 20 feet using 2-inch PVC casing. No reference to these wells is made in the subsequent documents provided to Geraghty & Miller. Monitor Wells A, B, and C are located in the vicinity of the underground storage tanks. Information regarding these wells was not provided to Geraghty & Miller. Monitor Wells C-1 through C-3 were installed on-site in July 1983 by Gettler-Ryan (Gettler-Ryan, 1983); they were completed to a depth of 20 feet using 3-inch PVC casing. Wells C-4 through C-6 were installed off-site in September 1990 by GeoStrategies, Inc. to better define the extent of dissolved petroleum hydrocarbons in the shallow ground water (GeoStrategies, Inc., 1990). At that time, Extraction Well CR-1 was also installed for use as a potential ground-water extraction well. Wells C-4 through C-6 were drilled to total depth of 30 feet and completed using 2-inch diameter Schedule 40 PVC well casing, and Extraction Well CR-1 was installed to a total depth of 30 feet and completed using 6-inch Schedule 40 PVC well casing. Subsequently, during February 1991, GeoStrategies drilled Boring C-7 to the south of the site to a total depth of 30 feet; it was completed as a ground-water monitor well using 2-inch diameter Schedule 40 PVC casing.

## SUBSURFACE STRATIGRAPHY

Boring logs from C-1 through C-7 and CR-1 indicate that the site is underlain by interbedded clay (CL), clayey sands (SC), and sand (SP) to a depth of 18 to 22 feet; sand (SP) has been encountered from 18 feet to 30 feet (IT Enviroscience, 1982; Gettler-Ryan, 1983; GeoStrategies, 1990). The boring log for CR-1 has been included in Attachment 1.

## SOIL CHEMISTRY

Soil samples were not collected for analysis during the installation of Monitor Wells C-1, C-2, and C-3.

On March 27, 1987, Gettler-Ryan collected soil samples from below the southern pump island at the site. This work was done as part of a product-line leak investigation. A composite sample was analyzed for total petroleum hydrocarbons (TPH) as gasoline by United States Environmental Protection Agency (USEPA) Method 8015, modified and for

benzene, toluene, ethylbenzene, and xylenes (BTEX) by USEPA Method 8020. The composite sample collected contained 1,300 milligrams per kilogram (mg/kg) of TPH as gasoline and 150 mg/kg of benzene (Blaine Tech Services, 1987).

During September 1990, GeoStrategies, Inc. collected soil samples from Borings C-4 through C-8 from depths of approximately 10 and 15 feet. An additional soil sample was collected from 5 feet from Boring CR-1. Soil samples were analyzed for TPH as gasoline by USEPA Method 8015, modified and for BTEX by USEPA Method 8020. TPH as gasoline, benzene, toluene, ethylbenzene, and xylenes were not detected in soil samples collected from C-4 through C-6 or C-8. Toluene (0.010 mg/kg) and xylenes (0.015 mg/kg) were detected in the sample from a depth of 15 feet in C-7. Benzene was detected at 0.26 mg/kg in the soil sample collected from a depth of 15 feet in CR-1. Ground water was encountered at a depth of approximately 10 feet. Ground water flows to the south-southeast.

## GROUND-WATER CHEMISTRY

Quarterly ground-water monitoring was performed on April 1, 1992, by Alton Geosciences. Depth to water ranged from approximately 8.5 to 10.3 feet. Ground-water flow direction was to the south-southeast. Ground-water samples were collected from and analyzed for TPH as gasoline (USEPA Method 8015, modified) and for BTEX (USEPA Method 8020). TPH as gasoline was detected in ground-water samples from C-2 (15,000 µg/L), C-4 (480 µg/L), C-5 (960 µg/L), and CR-1 (29,000 µg/L). Benzene was detected in ground-water samples from C-2 (1,900 µg/L), C-4 (4.9 µg/L), C-5 (200 µg/L), and CR-1 (5,300 µg/L). Wells C-1, B, and C (identified as C-B and C-C, respectively, by Alton Geosciences) contained liquid-phase hydrocarbons and were not sampled. TPH as gasoline and BTEX were not detected in ground-water samples from C-3, C-6, or C-7. Well A was not located (Alton Geosciences, 1992).

CR-1 is screened fm 10-30' bgs (sandy layers)

## REMEDIATION APPROACH

Chevron has requested that Geraghty & Miller install a ground-water extraction and treatment system at the above-referenced site to initiate ground-water extraction. Based on the geologic characteristics of the saturated zone in the vicinity of the extraction well (fine sands interbedded with clayey sands) (GeoStrategies, Inc., 1990), and on the most recent ground-water sampling results (Alton Geoscience, 1992), it is anticipated that the flow rate

from Extraction Well CR-1 could range from 0.5 to 4 gallons per minute (gpm). A copy of the boring log for this well is provided in Attachment 1. Furthermore, based on sampling data, it is anticipated that TPH concentrations could range from 9,600 to 29,000 µg/L. These flow and concentration values yield a mass throughput range from 0.06 to 1.4 pounds of TPH per day (lbs TPH/day).

This TPH-mass throughput range is economically treated by aqueous-phase carbon using two 1,000-pound vessels, considering capital and operating costs over a 5-year economic life. While 55-gallon size carbon drums can be relatively cost-effective for TPH-mass throughputs of 0 to 0.1 lbs/day due to their low capital costs, they are not recommended for this project because more frequent carbon replacement would be required. To additionally reduce project costs, surplus 1,000-pound carbon vessels from another Chevron site will be utilized in the treatment system if they are available. After a period of consistent operation, a biological reactor may be considered for the site if the actual mass throughput range is significantly over 1 lb TPH/day. At or above this throughput, a bioreactor offers substantial savings in operating costs over carbon consumption. Furthermore, an important design consideration of this plan is that the incremental cost of modifying the system is relatively low in comparison with installing and operating an over-designed system, if the TPH-mass throughput differs from the anticipated range.

Flow-rate and hydrocarbon-concentration data that would be obtained from an aquifer test at this site would not be expected to affect the selection of the initial treatment system. Additionally, the expense of installing a temporary extraction and water treatment/storage system needed to conduct an aquifer test is nearly that of installing the permanent system described below. This is because a temporary system would require obtaining necessary permits, installing a pump in Extraction Well CR-1, and siting an aqueous-carbon water-treatment system or, alternatively, a temporary water-storage tank for the extracted ground water. Consequently, an aquifer test is not recommended prior to installation of the treatment system, although a less expensive determination of aquifer transmissivity is recommended during the initial system operation. It is unlikely that the results of an aquifer test would affect the selection of the initial ground-water treatment system; however, determination of aquifer transmissivity during initial operation is recommended to help evaluate the effectiveness of the extraction system in CR-1 in obtaining hydraulic capture of the hydrocarbon-affected shallow ground water. This test will use Monitor Well C-1 as an observation well.

The ground-water extraction system will use existing Extraction Well CR-1 in the southeast corner of the site (Figure 2). Initially, the ground-water treatment system will consist of two 1,000-pound, aqueous-phase carbon vessels plumbed in series. As discussed above, the flow rate from the initial extraction well is expected to be less than 4 gpm. The aqueous-phase carbon system will be designed to operate at flow rates up to 15 gpm, which would allow for adding extraction wells to the system if required. Operational results, including flow rate and influent concentrations, will be obtained during the first 3 months of operation. These data will be evaluated to determine if the aqueous-carbon treatment system should be augmented with either additional extraction wells and/or additional treatment equipment upstream of the aqueous carbon vessels to reduce the rate of carbon usage.

## SCOPE OF WORK

### TASK 1: REVIEW DOCUMENTS, DEVELOP WORK PLAN, AND PROJECT SETUP

Geraghty & Miller will review documents pertaining to this site provided by Chevron in order to develop an appropriate site work plan. Geraghty & Miller will also develop specifications, as needed, to complete the work plan and will remain in regular contact with Chevron.

### TASK 2: DETAIL SYSTEM DESIGN

Design of the remediation system includes sizing and layout of piping, pump, particulate filters, flow meters, sample taps, valves, treatment equipment, electrical service, and control system. Geraghty & Miller will prepare four construction sketches to be used by Geraghty & Miller technicians for the purpose of obtaining building permits and communicating with Geraghty & Miller subcontractors. The drawings will consist of trenching detail, enclosure layout, sewer connection detail, and control panel layout. In the event that portions of this work are subcontracted directly by Chevron, engineering drawings, stamped by a California registered engineer, will be prepared at an approximate cost of $400 each. As-built drawings, if modified from construction sketches or engineering drawings, can also be completed for an additional cost of approximately $350 each. This task also includes two site visits to meet with the station operator and

contractors for the purpose of identifying acceptable locations for the treatment enclosure and service trench routings.

## TASK 3: PERMITTING

Geraghty & Miller will negotiate with the East Bay Municipal Water District (EBMUD) to obtain a ground-water discharge permit sufficient to allow for an initial flow rate of 4 gpm. Geraghty & Miller will obtain building and electrical permits from the City of Oakland as required for the trenching and equipment installation activities. This task assumes that the design and drawings completed in Task 1 will be accepted by the City of Oakland Building Department for the purpose of obtaining building permits.

## TASK 4: SYSTEM INSTALLATION

### Pump Installation

Geraghty & Miller will install a 1/2 horsepower, two-wire, 240-volt single-phase electric submersible pump in Extraction Well CR-1. A pump protector (Coyote Box™) will be installed in the treatment enclosure for on/off control and run-dry protection of the ground-water pump. Both the pump and the pump protector are to be provided from Chevron inventory if they are available.

### Trench and Piping Installation

The containment piping will consist of 2-inch diameter PVC Schedule 40 conduit. A 3/4-inch, hydrocarbon-resistant rubber hose will be pulled through this pipe from the extraction well to the treatment enclosure. The subsurface piping for the treated ground-water discharge will run from the treatment enclosure to an approved EBMUD sewer line connection point; it is assumed that this piping will be 2-inch diameter PVC Schedule 40 conduit. The City of Oakland may require that a vacuum break be installed prior to the sewer connection point. The final connection point for the sewer discharge line will be determined during the detail design task. All piping between the extraction well, enclosure, and discharge point will be below grade at a depth of 24 inches for the electrical conduit, ground-water extraction pipes, and sewer discharge conduit. The trench will be backfilled and compacted with native material.

## Treatment-System Enclosure

The treatment-system enclosure will consist of a lockable chain-link fence with vinyl slats. To fit the two 1,000-pound carbon vessels, the enclosure needs to be at least 8 feet wide, 10 feet deep, and 8 feet high. If required, a 6-inch pad of concrete will be placed within the treatment enclosure as a base for the ground-water treatment system. The supporting poles for the fence will be set 1 foot below grade and encased in concrete. The proposed location for the treatment-system enclosure is shown in Figure 3. These dimensions are subject to change, pending system-location approval by the site operator, Chevron, and the City of Oakland.

## Electrical Service Installation

Pending further investigation of existing electrical service at the site, Geraghty & Miller will either use the existing station power distribution panel or will install a service connection from the nearest PG&E service connection point. The exact placement and source of electrical service will be determined during the detail design task.

## Carbon Vessels

The ground-water treatment system will consist of two 1,000-pound aqueous phase activated carbon vessels arranged in series (Figure 4). The first vessel will be for loading and the second vessel will be for backup. As discussed under Remediation Approach, 1,000-pound carbon vessels are recommended over the 55-gallon drum-size because the larger units will allow greater flow-rate flexibility and decrease the frequency of carbon changeout. It is assumed that the carbon vessels will be obtained through Chevron's existing inventory. The ground-water treatment system will include a Geraghty & Miller pre-engineered ancillary equipment package to be installed on the carbon vessels. The equipment package consists of the following:

- 1-inch diameter reinforced flex hose with camlock connectors for secure and rapid connection and alternation of loading and backup service units;
- One 20-inch particulate filter, with convenient fiber-cartridge feature;
- A pressure gauge before and after the particulate filter, to indicate need for filter-cartridge replacement;
- One air-release valve for each carbon vessel to avoid accumulation of air in the vessel, which would impair treatment capacity;

- A 1-inch diameter totalizing flowmeter installed on the effluent pipe from the carbon system;
- Three water sample ports: before, between, and after the carbon vessels in each set; and
- Purge-water drum to receive the flow from the extraction well and to process water generated during ground-water sampling activities through the treatment system.

## TASK 5: SYSTEM STARTUP

Startup activities will include two site visits to start up the equipment and collect the required samples of the treatment-system influent and effluent. EBMUD may require that the treatment system be sampled prior to issuing a permit to discharge. Upon receipt of the permit application and the initial laboratory results, EBMUD will determine the sampling constituents and frequency. The factors used by EBMUD to determine the constituents for analysis and the sampling frequency include:

- The concentration of petroleum hydrocarbons in the ground water for determining carbon loading;
- The design capacity of the treatment unit;
- The level of preventive maintenance;
- The frequency of sampling between carbon vessels; and
- Consistent compliance with discharge limits.

As part of startup, a step-drawdown test will be conducted to determine the sustainable yield of the well.

## TASK 6: GROUND-WATER TREATMENT SYSTEM OPERATION AND MAINTENANCE

This task assumes that sampling operation and maintenance visits to the site will be on a monthly basis, but this may be reduced to quarterly upon demonstrating to EBMUD that the treatment system is operating reliably. During each site visit, samples from the treatment system's influent and effluent will be collected from the sampling ports, and the total amount of water discharged will be recorded from the totalizer. This task does not include unscheduled visits due to site conditions, vandalism, or mechanical failures. This task assumes that the influent and effluent samples will be analyzed for total petroleum

hydrocarbons (TPH) as gasoline by USEPA Method 8015, modified, and for benzene, toluene, ethylbenzene, and total xylenes (BTEX) by USEPA Method 8020. All EBMUD fees will be billed directly to Chevron.

This task includes the preparation of the spent-carbon profile form needed for the transport and destruction of spent carbon from the site. It also includes the scheduling of one carbon changeout to be done during one of the regularly scheduled sampling events. Westates Carbon will provide removal of spent carbon and delivery of new carbon and will bill for their services directly to Chevron. It is assumed that Westates Carbon will leave the carbon vessels in working order and that an additional site visit will not be necessary to restart the system.

## TASK 7: PREPARATION OF DISCHARGE COMPLIANCE REPORTS

As required by EBMUD, a letter report containing the results of the analysis of the treatment system influent and effluent and totalizer readings will be prepared and submitted, along with analytical results and chain-of-custody documentation.

## TASK 8: AQUIFER TEST AND EVALUATION OF GROUND-WATER REMEDIATION SYSTEM

Once the sewer-discharge permit has been received, an aquifer test will be conducted to determine the transmissivity of the aquifer which is then used to calculate the hydraulic capture radius of the pumping well. This test will be conducted at a constant flow rate, using downhole pressure transducers in Recovery Well CR-1 and Observation Well C-1, and a data logger. It is assumed that running the aquifer test for three days will provide sufficient data for the purpose of determining aquifer parameters. Geraghty & Miller will prepare a system evaluation report after the first 3 months of operation. This report will include the results of the aquifer test and a description of the ground-water extraction and treatment system operation during the evaluation period. The report will also include ground-water levels and chemical analysis results presented in tabulated form for all on- and off-site monitoring wells; updated potentiometric surface maps for the shallow ground-water table and updated site plans depicting isoconcentration contours; and the description and schedule of any additional site work and/or modifications anticipated, as well as calculations of the quantity of hydrocarbons removed from the recovered ground water.

## SCHEDULE

Geraghty & Miller, Inc. (Geraghty & Miller) has developed the following schedule for implementation of the ground-water remediation work plan for the above-referenced site dated September 22, 1992.

| Task | Description | Date of Completion |
|---|---|---|
| Task 1: | Review Documents, Develop Work Plan, and Project Setup | Completed |
| Task 2: | Detail System Design | October 16, 1992 |
| Task 3: | Permitting | October 30, 1992 |
| Task 4: | System Installation | November 13, 1992 |
| Task 5: | System Startup | December 1, 1992 ✓ |
| Task 6: | Ground-Water Treatment System Operation and Maintenance | Monthly |
| Task 7: | Preparation of Discharge Compliance Reports | Quarterly |
| Task 8: | Aquifer Test and Evaluation of Ground-Water Remediation System | ~~March 15, 1992~~ Jan 93 |

## LABORATORY SERVICES

Laboratory services will be provided by Superior Precision Analytical, Inc. located in San Francisco and Martinez, California. Analytical costs will be billed directly to Chevron by the laboratory. The laboratory costs have been estimated based on monitoring conditions stipulated in the EBMUD discharge requirements.

## EBMUD PERMITTING AND DISCHARGE FEES

Permitting and discharge fees will be billed directly to Chevron by EBMUD. These costs have been estimated based on a flow rate of 4 gpm.

Geraghty & Miller appreciates the opportunity to be of service to Chevron. If you have any questions regarding this work plan, please call the undersigned at (510) 233-3200.

Sincerely,
GERAGHTY & MILLER, INC.

Kent O'Brien
Hydrogeologist/Project Manager

Gary W. Keyes
Principal Engineer/Project Officer

References

Enclosures:

| | | |
|---|---|---|
| | Figure 1 | Site Location Map |
| | Figure 2 | Locations of Ground-Water Monitoring Wells |
| | Figure 3 | Proposed Treatment System Location |
| | Figure 4 | Schematic of Ground-Water Treatment System |
| | Attachment 1 | Copy of Boring Log CR-1 |

## REFERENCES

Alton Geoscience. April 24, 1992. Quarterly Ground Water Monitoring Report, Chevron Station No. 9-4587, 609 Oak Street, Oakland, California..

Blaine Tech Services, Inc. April 23, 1987. Field Sampling Report, Chevron #4587, 609 Oak Street, Oakland, California.

Gettler-Ryan, Inc. July 19, 1983. Installation of Monitor Wells C-1, C-2, and C-3, Service Station 4587, 609 Oak & Sixth, Oakland, California.

GeoStrategies, Inc. November 30, 1990. Well Installation Report, Chevron Service Station No. 4587, 609 Oak Street, Oakland, California.

———. March 11, 1991. Site Update, Chevron Service Station No. 4587, 609 Oak Street, Oakland, California.

IT Enviroscience. May 15, 1982. Progress Report No. 1, Gasoline Leakage, Chevron Service Station #4587, 609 Oak Street, Oakland, CA 94607.

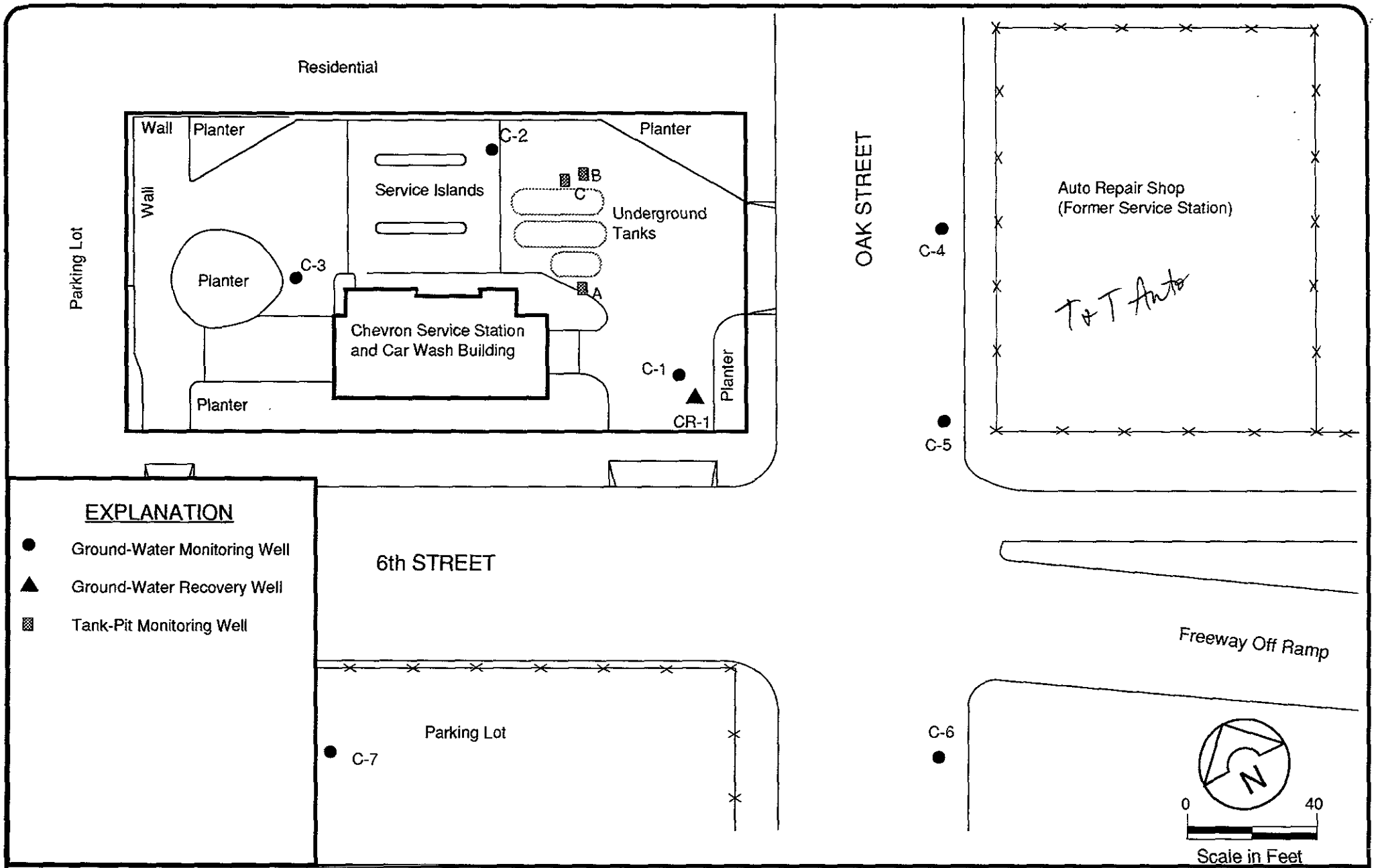

GERAGHTY & MILLER, INC.
*Environmental Services*

Project No. RC11300

**SITE LOCATION**

Chevron Service Station #9-4587
609 Oak Street
Oakland, California

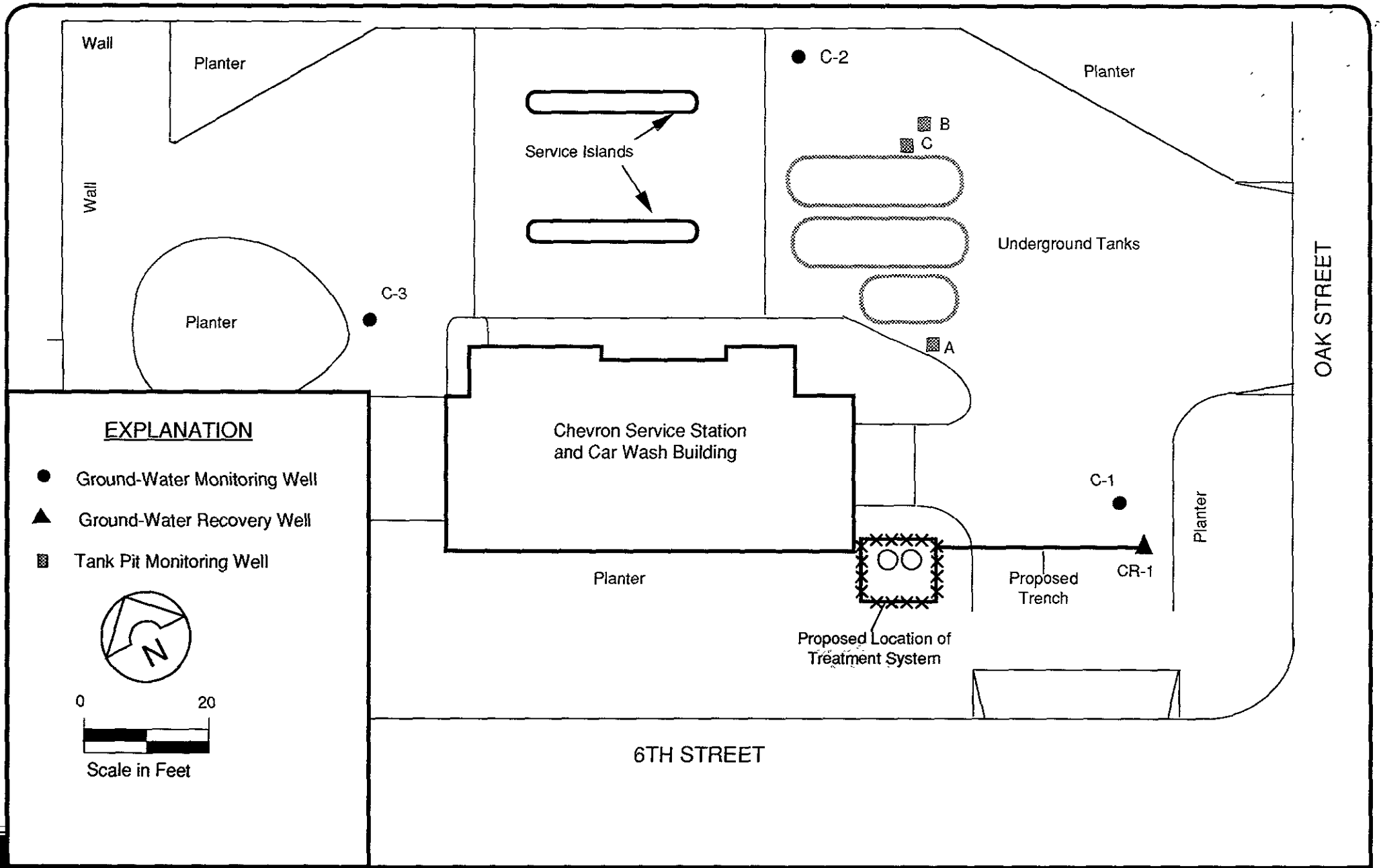
FIGURE
**1**




GERAGHTY & MILLER, INC.
*Environmental Services*
Project No. RC11300

**LOCATIONS OF GROUND-WATER MONITORING WELLS**
Chevron Service Station #9-4587
609 Oak Street
Oakland, California

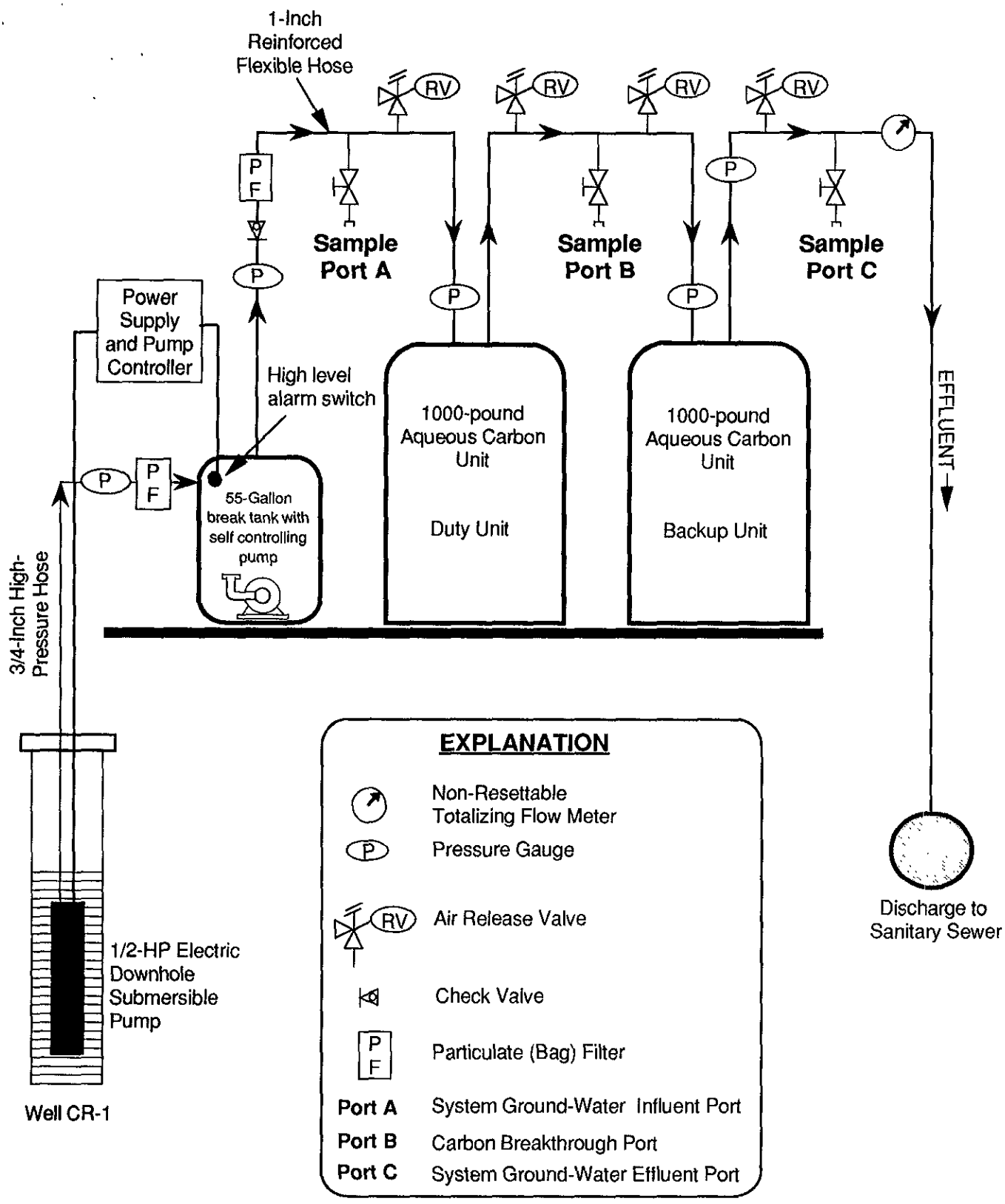
FIGURE
**2**




GERAGHTY & MILLER, INC.
*Environmental Services*
Project No. RC11300

**PROPOSED TREATMENT SYSTEM LOCATION**
Chevron Service Station #9-4587
609 Oak Street
Oakland, California

FIGURE
**3**




GERAGHTY & MILLER, INC.
*Environmental Services*

Project No. RC11300

**SCHEMATIC OF GROUND-WATER TREATMENT SYSTEM**
Chevron Service Station #9-4587
609 Oak Street
Oakland, California

FIGURE
**4**

# ATTACHMENT 1

## COPY OF BORING LOG CR-1

| MAJOR DIVISIONS | | | | | TYPICAL NAMES |
|---|---|---|---|---|---|
| COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE | GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE | CLEAN GRAVELS WITH LITTLE OR NO FINES | GW |  | WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES |
| | | | GP |  | POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES |
| | | GRAVELS WITH OVER 15% FINES | GM |  | SILTY GRAVELS, SILTY GRAVELS WITH SAND |
| | | | GC |  | CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND |
| | SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE | CLEAN SANDS WITH LITTLE OR NO FINES | SW |  | WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES |
| | | | SP |  | POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES |
| | | SANDS WITH OVER 15% FINES | SM |  | SILTY SANDS WITH OR WITHOUT GRAVEL |
| | | | SC |  | CLAYEY SANDS WITH OR WITHOUT GRAVEL |
| FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE | SILTS AND CLAYS LIQUID LIMIT 50% OR LESS | | ML |  | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS |
| | | | CL |  | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS |
| | | | OL |  | ORGANIC SILTS OR CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50% | | MH |  | INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS |
| | | | CH |  | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | | | OH |  | ORGANIC SILTS OR CLAYS OF MEDIUM TO HIGH PLASTICITY |
| HIGHLY ORGANIC SOILS | | | PT |  | PEAT AND OTHER HIGHLY ORGANIC SOILS |

| | |
|---|---|
| Perm | - Permeability |
| Consol | - Consolidation |
| LL | - Liquid Limit (%) |
| PI | - Plastic Index (%) |
| $G_s$ | - Specific Gravity |
| MA | - Particle Size Analysis |
| 2.5 YR 6/2 | - Soil Color according to Munsell Soil Color Charts (1975 Edition) |
| 5 GY 5/2 | - GSA Rock Color Chart |

| | |
|---|---|
| ☒ | - No Soil Sample Recoverd |
| ■ | - "Undisturbed" Sample |
| ⊠ | - Bulk or Classification Sample |
| ▽ | - First Encountered Ground Water Level |
| ▼ | - Piezometric Ground Water Level |
| Penetration | - Sample drive hammer weight - 140 pounds falling 30 inches. Blows required to drive sampler 1 foot are indicated on the logs |

GeoStrategies Inc.

**Unified Soil Classification - ASTM D 2488-85 and Key to Test Data**

Field location of boring: (See Plate 2)

| | | | |
|---|---|---|---|
| Project No.: | 7191 | Date: | 09/11/90 |
| Client: | Chevron USA S.S. No. 4587 | | |
| Location: | 609 Oak Street | | |
| City: | Oakland, California | | |
| Logged by: | R.S.Y. | Driller: | Bayland |

Boring No.: CR-1

Sheet 1 of 2

Casing installation data:

Drilling method: Hollow Stem Auger

Hole diameter: 8-inches

Top of Box Elevation: Datum:

| | | | | | |
|---|---|---|---|---|---|
| Water Level | 13' | 10.51' | | | |
| Time | 1300 | 1220 | | | |
| Date | 09/11/90 | 10/30/90 | | | |

| PID (ppm) | Blows/ft. or Pressure (psi) | Type of Sample | Sample Number | Depth (ft.) | Sample | Well Detail | Soil Group Symbol (USCS) | Description |
|---|---|---|---|---|---|---|---|---|
| | | | | 1 | | | | PAVEMENT SECTION - .25 feet |
| | | | | 2 | | | | |
| | | | | 3 | | | | CLAY (CL) - olive (5Y 5/3), medium stiff, damp, trace sand, medium to high plasticity; no chemical odor. |
| | 50 | S&H | | 4 | | | | |
| | 50 | push | CR-1- | 5 | | | | |
| 3 | 150 | | 5.0 | | | | | COLOR CHANGE to gray (7.5 YR 5/0) at 4.0 feet; increase coarse sand to 20 %; weak chemical odor |
| | | | | 6 | | | | |
| | | | | 7 | | | | |
| | | | | 8 | | | | gravel and wood fragments at 7.0 feet. |
| | 11 | S&H | | 9 | | | | |
| | 8 | | CR-1- | 10 | | | | SAND (SP) - black (10YR 2/1), medium dense, damp; 95% fine sand; 5% clay; moderate chemical odor. |
| 3 | 8 | | 10.0 | | | ▼ | | |
| | | | | 11 | | | | |
| | | | | 12 | | | | |
| | | | | 13 | | ▽ | | CLAYEY SAND (SC) - dark yellow brown (10YR 4/4), loose, saturated; 70% fine sand; 25-30% clay; voids; weak chemical odor. |
| | 2 | S&H | | 14 | | | | |
| | 3 | | CR-1- | 15 | | | | |
| 80 | 4 | | 15.0 | | | | | |
| | | | | 16 | | | | |
| | | | | 17 | | | | |
| | | | | 18 | | | | SAND (SP) - dark olive (5Y 3/2), dense, saturated; 100% fine sand; no chemical odor. |
| | 10 | S&H | | 19 | | | | |
| | 16 | | CR-1- | | | | | |
| 23 | 22 | | 20.0 | 20 | | | | |

Remarks:

GeoStrategies Inc.

Log of Boring

BORING NO. CR-1

| JOB NUMBER | REVIEWED BY RG/CEG | DATE | REVISED DATE | REVISED DATE |
|---|---|---|---|---|
| 7191 | CMP CEG 12/92 | 9/90 | | |

| Field location of boring: | Project No.: 7191 | Date: 09/11/90 | Boring No: |
|---|---|---|---|
| (See Plate 2) | Client: Chevron USA | | CR-1 |
| | Location: 609 Oak Street | | |
| | City: Oakland, California | | Sheet 2 of 2 |
| | Logged by: R.S.Y. | Driller: Bayland | |
| Drilling method: Hollow Stem Auger | Casing installation data: | | |
| Hole diameter: 8-inches | Top of Box Elevation: | | Datum: |
| | Water Level | | |
| | Time | | |
| | Date | | |

| PID (ppm) | Blows/ft. or Pressure (psi) | Type of Sample | Sample Number | Depth (ft.) | Sample | Well Detail | Soil Group Symbol (USCS) | Description |
|---|---|---|---|---|---|---|---|---|
| | 15 | S&H | | 24 | | | | COLOR CHANGE to dark yellow brown (10YR 4/6); no chemical odor. |
| | 32 | | CR-1- | | | | | |
| 0 | 38 | | 25.0 | 25 | | | | |
| | 14 | S&H | | 29 | | | | no chemical odor. |
| | 23 | | CR-1 | | | | | |
| 0 | 38 | | 30.0 | 30 | | | | Bottom of Boring at 30.0 feet. |
| | | | | | | | | Bottom of Sample at 30.0 feet. |
| | | | | | | | | 09/11/90 |

Remarks:

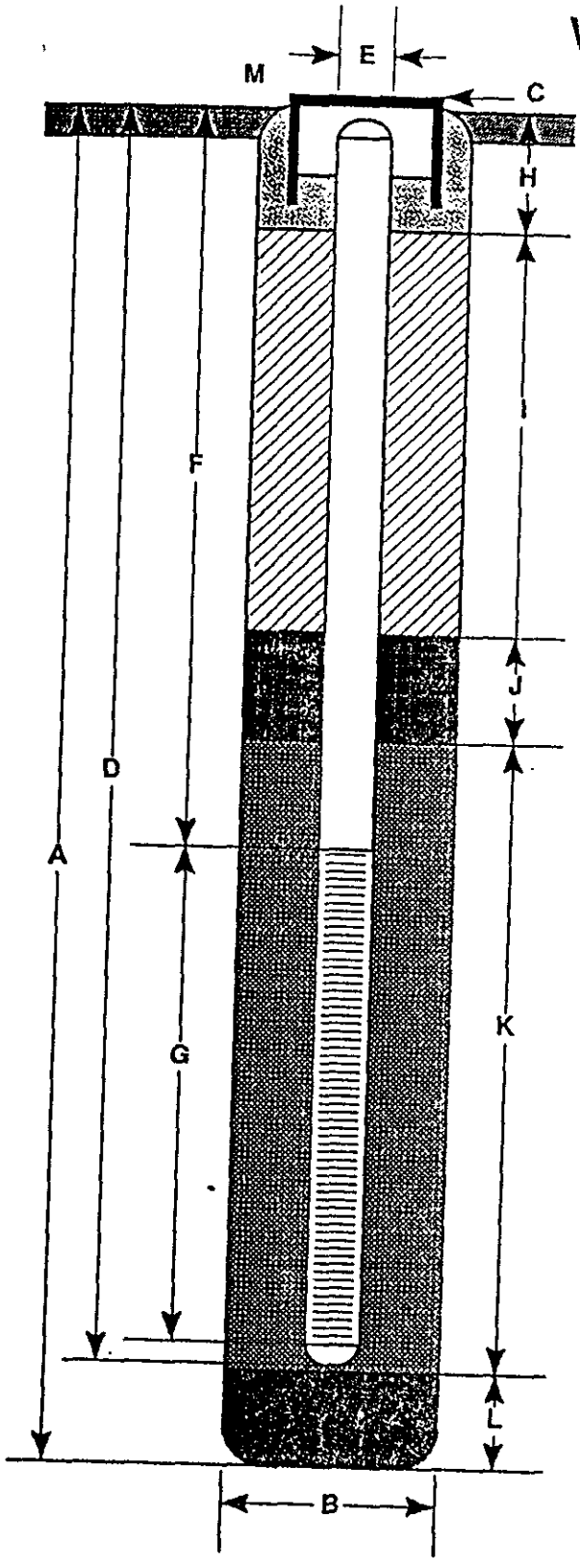
GeoStrategies Inc.

Log of Boring

BORING NO. CR-1

| JOB NUMBER | REVIEWED BY RG/CEG | DATE | REVISED DATE | REVISED DATE |
|---|---|---|---|---|
| 7191 | CWP CEG 1292 | 9/90 | | |

# WELL CONSTRUCTION DETAIL




A Total Depth of Boring 30 ft.

B Diameter of Boring 12 in.
Drilling Method Hollow Stem Auger

C Top of Box Elevation ft.
[X] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length 30 ft.
Material Schedule 40 PVC

E Casing Diameter 6 in.

F Depth to Top Perforations 10 ft.

G Perforated Length 20 ft.
Perforated Interval from 10 to 30 ft.
Perforation Type Continuous Wrap
Perforation Size 0.020 in.

H Surface Seal from 0.0 to 1.5 ft.
Seal Material Cement Grout

I Backfill from 1.5 to 6 ft.
Backfill Material Concrete Grout

J Seal from 6 to 8 ft.
Seal Material Bentonite Pellets

K Gravel Pack from 8 to 30 ft.
Pack Material Lonestar #2/12 sand

L Bottom Seal ft.
Seal Material

M Traffic-rated vault box with locking well cap and lock

Note: Depths measured from initial ground surface.

GeoStrategies Inc.

Recovery Well Detail
Chevron Service Station
609 Oak Street
Oakland, California

BORING NO. CR-1

| JOB NUMBER | REVIEWED BY RG/CEG | DATE | REVISED DATE | REVISED DATE |
|---|---|---|---|---|
| 7191 | CEG 1262 | 11/90 | | |