



GeoStrategies Inc.

WORK PLAN

Chevron Service Station #0338
5500 Telegraph Avenue
Oakland, California

Report No. 7263-1

October 6, 1989



GeoStrategies Inc.

2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545

(415) 352-4800

October 6, 1989

Gettler-Ryan Inc.
1992 National Avenue
Hayward, California 94545

Attn: Mr. Jerry Mitchell

Re: WORK PLAN
Chevron Service Station #0338
5500 Telegraph Avenue
Oakland, California

RECEIVED
OCT 11 1989
GETTLER-RYAN INC.
GENERAL CONTRACTORS

Gentlemen:

This work plan has been prepared for the Chevron Service Station #0338 located at 5500 Telegraph Avenue in Oakland, California (Plate 1). The work plan addresses the need to evaluate the extent of petroleum hydrocarbons in the soil and to evaluate groundwater quality beneath the site.

BACKGROUND

Based on the information provided to GeoStrategies Inc. (GSI), the subsurface 1,000 gallon waste oil tank was removed in October, 1988. A soil sample from beneath the tank was collected by Blaine Tech Services, Inc. (Blaine). Blaine presented the results of this sampling event in their report dated October 11, 1988. In this report Blaine inadvertently stated that all constituents analyzed were reported as non detected (ND). GSI reviewed the certified analytical reports which indicated that the chemical analyses revealed Total Oil and Grease (TOG) at a concentration of 81 parts per million (ppm). Total Petroleum Hydrocarbons calculated as Diesel (TPH-Diesel) and Volatile Organic Compounds (VOCs) were reported by the laboratory as ND.

In July 1989, Chevron replaced the subsurface piping associated with the underground gasoline storage tanks. During the removal and replacement of the subsurface piping, contaminated soil was discovered in the western-most pipe trench (closest to Telegraph Avenue). Blaine collected soil samples in the gasoline product line trench on July 11 and 14, 1989. Total Petroleum Hydrocarbons calculated as Gasoline (TPH-Gasoline) ranged from ND to 480 ppm. Blaine issued a report summarizing analytical results and field procedures dated August 9, 1989.

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The contaminated soil was excavated and removed from the piping trench in July 1989, in compliance with the Regional Water Quality Control Board (RWQCB) guidelines for investigations associated with leaking underground fuel tanks.

SITE DESCRIPTION

The site is presently occupied by an operating Chevron Service Station. The station is comprised of two 10,000 gallon tanks and one 7,000 gallon tank containing regular, unleaded and supreme unleaded gasoline products, one 1,000 gallon waste oil tank, three fueling islands and the station building. The location and designation for the underground storage complex (UGST) are shown on Plate 1. Presently there are no known monitoring wells on-site.

TECHNICAL APPROACH

Based on our review of the Blaine reports we recommend that three exploratory borings be drilled at the site. These borings will be converted into ground-water monitoring wells after completion. Data obtained from the wells will be used to assess the vertical and lateral extent of hydrocarbon contamination in the soil, if present, and to evaluate groundwater quality beneath the site. The location of the three proposed wells are shown on Plate 1.

TASK 1: Three exploratory soil borings will be drilled at the location of the proposed monitoring wells. Soil samples will be collected at five-foot intervals, as a minimum, to describe subsurface lithology, perform head-space analysis for Volatile Organic Vapor presence, and for the selection of soil samples for chemical analysis. Selected soil samples will be analyzed for TPH-Gasoline using EPA Method 8015 (Modified) and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) using EPA Method 8020. Samples collected from the boring adjacent to the former waste oil tank will also be analyzed for TPH-Diesel using EPA Method 8015 (Modified). Additional soil samples may also be collected for geologic description and/or chemical analysis.

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TASK 2: The exploratory soil borings will subsequently be converted into groundwater monitoring wells. The wells will be installed to an anticipated depth of 30 feet below existing grade or to the bottom of the first encountered saturated zone of aquifer material. We recommend that the monitoring wells be installed with a minimum three-foot well screen extended above the equilibrated water-level to accommodate for separate-phase product (if present) and potential diurnal and seasonal groundwater fluctuations. Notwithstanding, the wells will be designed so as to be compatible with subsurface geologic conditions. No well screen will be installed that potentially may permit cross-contamination of adjacent aquifers.

TASK 3: Depth to water measurements will be made in each well and used to calculate the local ground-water gradient and generate potentiometric maps. In addition, the wells will be sampled and analyzed for TPH-Gasoline using EPA Method 8015 (Modified), and BTEX using EPA Method 8020. Ground-water samples collected from the monitoring well located near the former waste oil tank will also be analyzed for TPH-Diesel using EPA Method 8015 (Modified) and TOG using EPA Method 503E, BTEX/Chlorinated Hydrocarbons using EPA Method 8240/8260 and priority pollutant metals: Cadmium, Chromium, Lead and Zinc using ICAP or AA analytical methods.

TASK 4: After completion of the field work and review of the field and chemical data, GSI will prepare a report documenting the well installations and present the results of soil and groundwater chemical analytical data. Recommendations for additional work, if necessary, will be proposed at that time.

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Attached to this work plan are the procedures, protocols and methods that will be used to perform the above mentioned scope of work (Appendix A). Additional scopes of work, if necessary, will follow the procedures described in this work plan, or shall be added as an appropriate addendum.

If you have any questions, please call.

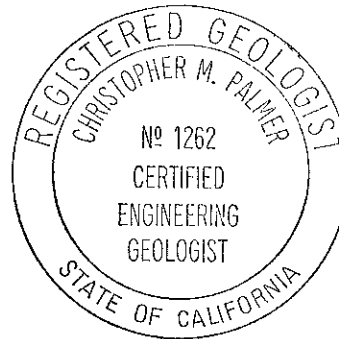
GeoStrategies Inc. by,

Randall Young

Randall S. Young
Geologist

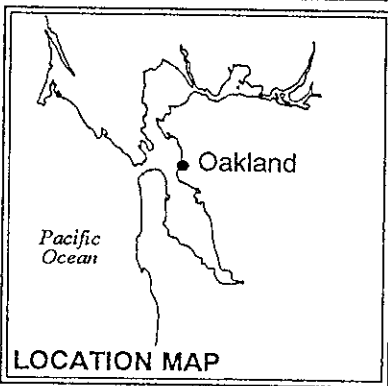
Christopher M. Palmer

Christopher M. Palmer
Senior Geologist
C.E.G. 1262, R.E.A. 285

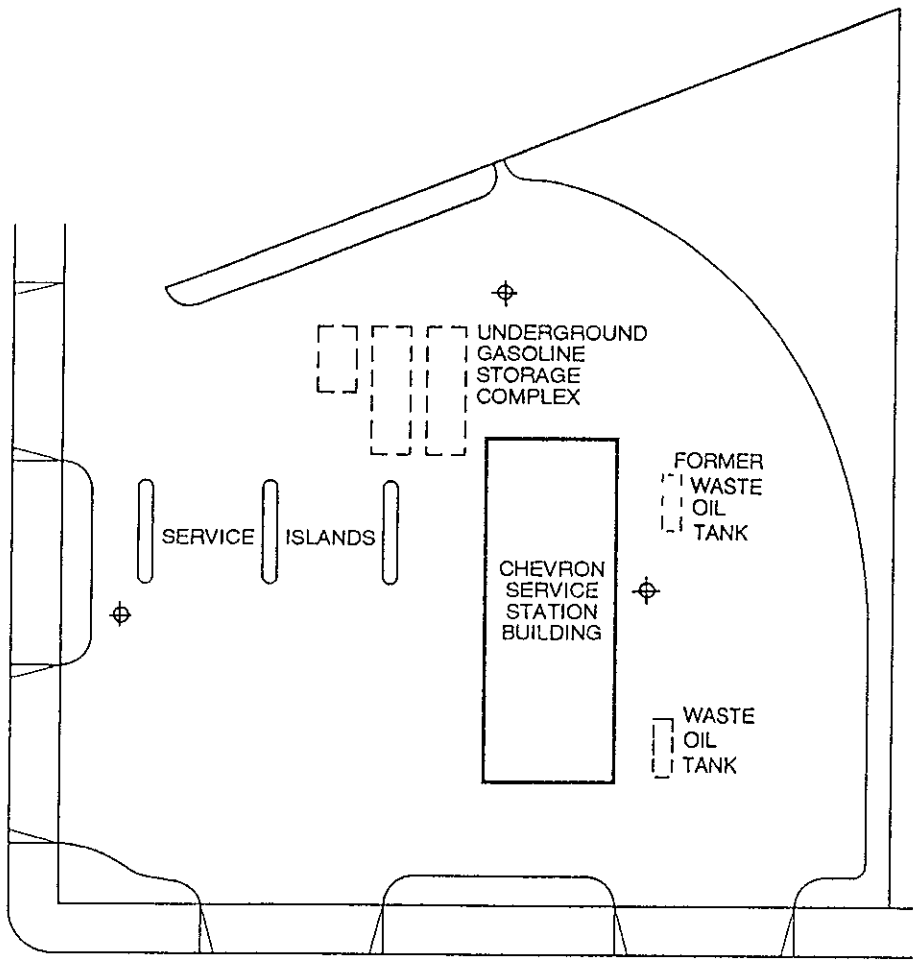


RSY/CMP/mg

Plate 1. Site Plan
Appendix A: Field Methods and Procedures



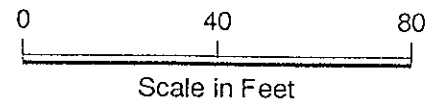
TELEGRAPH AVENUE



55TH AVENUE

EXPLANATION

⊕ Proposed ground-water monitoring well location



GeoStrategies Inc.

Site Plan
Chevron Service Station #0338
5500 Telegraph Avenue
Oakland, California

PLATE

1

JOB NUMBER
7263

REVIEWED BY RG/CEG
UMP CEG 1262

DATE
10/89

REVISED DATE

REVISED DATE

FIELD METHODS AND PROCEDURES

EXPLORATION DRILLING

Mobilization

Prior to any drilling activities, GSI will verify that necessary drilling permits have been secured.

Utility locations will be located and drilling will be conducted so as not to disrupt activities at a project site. GSI will obtain and review available public data on subsurface geology and if warranted, the location of wells within a half-mile of the project site will be identified. Drillers will be notified in advance so that drilling equipment can be inspected prior to performing work.

Drilling

The subsurface investigations are typically performed to assess the lateral and vertical extent of petroleum hydrocarbons present in soils and ground water. Drilling methods will be selected to optimize field data requirements as well as be compatible with known or suspected subsurface geologic conditions.

Monitoring wells are installed using a truck-mounted hollow-stem auger drill rig or mud-rotary drill rig. Typically, the hollow-stem rig is used for wells up to 100 feet, if subsurface conditions are favorable. Wells greater than 100-feet deep are typically drilled using mud-rotary techniques. When mud rotary drilling is used, an electric log will be performed for additional lithological information. Also during mud rotary drilling, precautions will be taken to prevent mud from circulating contaminants by using a conductor casing to seal off contaminated zones. Samples will be collected for lithologic logging by continuous chip, and where needed by drive sample or core as specified by the supervising geologist.

Soil Sampling

Shallow soil borings will be drilled using a truck-mounted hollow-stem auger drilling rig, unless site conditions favor a different drilling method. Drilling and sampling methods will be consistent with ASTM Method D-1452-80. The auger size will be a minimum 6-inch nominal outside-diameter (O.D). No drilling fluids will be used during this drilling method. The augers and other tools used in the bore hole will be steam cleaned before use and between borings to minimize the possibilities of cross-contamination between borings.

Soil samples are typically collected at 5-foot intervals as a minimum from ground surface to total depth of boring. Additional soil samples will be collected based on significant lithologic changes and/or potential chemical content. Soil samples from each sampling interval will be lithologically described by a GSI geologist (Figure 1). Soil colors will be described using the Munsell Color Chart. Rock units will be logged using appropriate lithologic terms, and colors described by the G.S.A. Rock Color Chart.

Head-space analyses will be performed to check for the evidence of volatile organic compounds. Head-space analyses will be performed using an organic vapor analyzer; either an OVA, HNU, or OVM. Organic vapor concentrations will be recorded on the GSI field log of boring (Figure 1). The selection of soil samples for chemical analysis are typically based on the following criteria:

- 1) Soil discoloration
- 2) Soil odors
- 3) Visual confirmation of chemical in soil
- 4) Depth with respect to underground tanks (or existing grade)
- 5) Depth with respect to ground water
- 6) OVA reading

Soil samples (full brass liners) selected for chemical analysis are immediately covered with aluminum foil and the liner ends are capped to prevent volatilization. The samples are labeled and entered onto a Chain-of-Custody form, and placed in a cooler on blue ice for transport to a State-certified analytical laboratory.

Soil cuttings are stockpiled on-site. Soils are sampled and analyzed for site-specific chemical parameters. Disposition of soils is dependent of chemical analytical results of the samples.

Soil Sampling - cont.

Soil borings not converted to monitoring wells will be backfilled (sealed) to ground surface using either a neat cement or cement-bentonite grout mixture. Backfilling will be tremied by continuously pumping grout from the bottom to the top of the boring where depth exceeds 20' or as required by local permit requirements.

All field and office work, including exploratory boring logs, are prepared under the direction of a registered geologist.

Monitoring Well Installation

Monitoring well casing and screen will be constructed of Schedule 40, flush-joint threaded polyvinylchloride (PVC). The well screen will be factory mill-slotted unless additional open area is required (eg. conversion to an extraction well in a low-yield aquifer). The screen length will be placed adjacent to the aquifer material to a minimum of 2-feet above encountered water. No screen shall be placed in a borehole that potentially creates hydraulic interconnection of two or more aquifer units. Screen slot size and well sand pack will be compatible with encountered aquifer materials, as confirmed by sieve analysis.

Monitoring wells will be completed below grade (Figure 2) unless special conditions exist that require above-grade completion design. In the event a monitoring well is required in an aquifer unit beneath an existing aquifer, the upper aquifer will be sealed off by installing a steel conductor casing with an annular neat cement or cement-bentonite grout seal. This seal will be continuously tremied pumped from the bottom of the annulus to ground surface.

The monitoring well sand pack will be placed adjacent to the entire screened interval and will extend a recommended minimum distance of 2-feet above the top of the screen. No sand pack will be placed that interconnects two or more aquifer units. A minimum 2-foot bentonite pellet or bentonite slurry seal will be placed above the sand pack. Sand pack, bentonite, and cement seal levels will be confirmed by sounding the annulus with a calibrated weighted tape. The remaining annular space above the bentonite seal will be grouted with a bentonite-cement mixture and will be tremie-pumped from the bottom of the annular space to the ground surface. The bentonite content of the grout will not exceed 5 percent by weight. A field log of boring and a field well completion form will be prepared by GSI for each well installed.

Decontamination of drilling equipment before drilling and between wells will consist of steam cleaning, and/or Alconox wash.

Well Development

Monitoring wells will be developed using a submersible pump, bladder pump or bailer. All well developing equipment will be decontaminated prior to development using a steam cleaner and/or Alconox detergent wash. Wells will be developed until discharge water is visibly clear and free of sediment. The adequacy of well development will be assessed by the GSI geologist. Indicator parameters (pH, specific conductance, and temperature) will be monitored and recorded during well development. Field instrument calibrations will be performed according to manufacturer's specifications.

Well Surveying

Monitoring wells will be surveyed to obtain top of box elevations to the nearest ± 0.01 foot. Water level measurements will be recorded to the nearest ± 0.01 foot and referenced to mean sea level (MSL). If additional wells are required, then existing and newly installed wells are surveyed relative to MSL.

GROUND-WATER SAMPLING AND ANALYSISQuality Assurance/Quality Control Objectives

The sampling and analysis procedures employed by Gettler-Ryan Inc. (G-R) for ground-water sampling and monitoring follow specific Quality Assurance/Quality Control (QA/QC) guidelines. Quality Assurance objectives have been established by G-R to develop and implement procedures for obtaining and evaluating water quality and field data in an accurate, precise, and complete manner so that sampling procedures and field measurements provide information that is comparable and representative of actual field conditions. Quality Control (QC) is maintained by G-R by using specific field protocols and requiring the analytical laboratory to perform internal and external QC checks. It is the goal of G-R to provide data that are accurate, precise, complete, comparable, and representative. The definitions for accuracy, precision, completeness, comparability, and representativeness are as follows:

- Accuracy - the degree of agreement of a measurement with an accepted referenced or true value.
- Precision - a measure of agreement among individual measurements under similar conditions. Usually expressed in terms of the standard deviation.
- Completeness - the amount of valid data obtained from a measurement system compared to the amount that was expected to meet the project data goals.
- Comparability - expresses the confidence with which one data set can be compared to another.
- Representativeness - a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations which are under study.

As part of the G-R QA/QC program, applicable federal, state, and local reference guidance documents are followed. The procedures outlined in these regulations, manuals, handbooks, guidance documents, and journals are incorporated into the G-R sampling procedures to assure that; (1) ground-water samples are properly collected, (2) ground-water samples are identified, preserved, and transported in a manner such that they are representative of field conditions, and (3) chemical analysis of samples are accurate and reproducible.

Guidance and Reference Documents Used to Collect Groundwater Samples

These documents are used to verify Gettler-Ryan Inc. sampling procedures and consistent with current regulatory guidance. If site specific work and sampling plans are required, those plans will be developed from these documents.

U.S.E.P.A. - 330/9-51-002	NEIC Manual for Groundwater/Subsurface Investigation at Hazardous Waste Sites
U.S.E.P.A. - 530/SW611	Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities (August, 1977)
U.S.E.P.A. - 600/4-79-020	Methods for Chemical Analysis of Water and Wastes (1983)
U.S.E.P.A. - 600/4-82-029	Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)
U.S.E.P.A. - 600/4-82-057	Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (July, 1982)
U.S.E.P.A. - SW-846#, 3rd Edition	Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (November, 1986)
40 CFR 136.3e, Table II (Code of Federal Regulations)	Required Containers, Preservation Techniques, and Holding Times
Resources Conservation and Recover Act (OSWER 9950.1)	Groundwater Monitoring Technical Enforcement Guidance Document (September, 1986)
California Regional Water Quality Control Board (Central Valley Region)	A Compilation of Water Quality Goals (September, 1988); Updates (October, 1988)
California Regional Water Quality Control Board (North Coast, San Francisco Bay, and Central Valley)	Regional Board Staff Recommendations for Initial Evaluations and Investigation of Underground Tanks: Tri-Regional Recommendations (June, 1988)

Guidance and Reference Documents Used to Collect Groundwater Samples (cont.)

Regional Water Quality Control Board (Central Valley Region)	Memorandum: Disposal, Treatment, and Refuse of Soils Contaminated with Petroleum Fractions (August, 1986)
State of California Department of Health Services	Hazardous Waste Testing Laboratory Certification List (March, 1987)
State of California Water Resources Control Board	Leaking Underground Fuel Tank (LUFT) Field Manual (May, 1988), and LUFT Field Manual Revision (April, 1989)
State of California Water Resources Control Board	Title 23, (Register #85.#33-8-17-85), Subchapter 16: Underground Tank Regulations; Article 3, Sections 2632 and 2634; Article 4, Section 2647 (October, 1986)
Alameda County Water District	Groundwater Protection Program: Guidelines for Groundwater and Soil Investigations at Leaking Underground Fuel Tank Sites (November, 1988)
American Public Health Association	Standard Methods for the Examination of Water and Wastewaters, 16th Edition
Analytical Chemistry (journal)	Principles of Environmental Analysis, Volume 55, Pages 2212-2218 (December, 1983)
Santa Clara Valley Water District	Guidelines for Preparing or Reviewing Sampling Plans for Soil and Groundwater Investigation of Fuel Contamination Sites (January, 1989)
Santa Clara Valley Water District	Investigation and Remediation at Fuel Leak sites: Guidelines for Investigation and Technical Report Preparation (March 1989)
American Petroleum Institute	Groundwater Monitoring & Sample Bias; API Publication 4367, Environmental Affairs Department, June 1983
Site Specific (as needed)	General and specific regulatory documents as required.

Because ground-water samples collected by G-R are analyzed to the parts per billion (ppb) range for many compounds, extreme care is exercised to prevent contamination of samples. When volatile or semi-volatile organic compounds are included for analysis, G-R sampling crew members will adhere to the following precautions in the field:

1. A clean pair of new, disposable gloves are worn for each well being sampled.
2. When possible, samples are collected from known or suspected wells that are least contaminated (i.e. background) followed by wells in increasing order of contamination.

When known or potential organic compounds are being sampled for, the following additional precautions are taken:

1. All sample bottles and equipment are kept away from fuels and solvents. When possible, gasoline (used in generators) is stored away from bailers, sample bottles, purging pumps, etc.
2. Bailers are made of Teflon or Stainless Steel. Other materials such as plastic may contaminate samples with phthalate esters which interfere with many Gas Chromatography (GC) analyses.
3. Volatile organic ground-water samples are collected so that air passage through the sample does not occur or is minimal (to prevent volatiles from being stripped from the samples): sample bottles are filled by slowly running the sample down the side of the bottle until there is a positive convex meniscus over the neck of the bottle; the Teflon side of the septum (in cap) is positioned against the meniscus, and the cap screwed on tightly; the sample is inverted and the bottle lightly tapped. The absence of an air bubble indicates a successful seal; if a bubble is evident, the cap is removed, more sample is added, and the bottle is resealed.
4. Extra Teflon seals are brought into the field in case seals are difficult to handle and/or are dropped. Dropped seals are considered contaminated and are not used. When replacing seals or if seals become flipped, care is taken to assure that the Teflon seal faces down.

Sample analysis methods, containers, preservatives and holding times are shown on Table 1.

Laboratory and field handling procedures of samples are monitored by including QC samples for analysis with every submitted sample lot from a project site. QC samples may include any combination of the following:

- A. Trip Blank: Used for purgeable organic compounds only; QC samples are collected in 40 milliliter (ml) samples vials filled in the analytical laboratory with organic-free water. Trip blanks are sent to the project site, and travel with project site samples. Trip blanks are not opened, and are returned from a project site with the project site samples for analysis.
- B. Field Blank: Prepared in the field using organic-free water. These QC samples accompany project site samples to the laboratory and are analyzed for specific chemical parameters unique to the project site where they were prepared.
- C. Duplicates: Duplicated samples are collected "second samples" from a selected well and project site. They are collected as either split samples or second-run samples collected from the same well.
- D. Equipment Blank: Periodic QC sample collected from field equipment rinsate to verify decontamination procedures.

The number and types of QC samples are determined as follows:

- A. Up to 2 wells - Trip Blank Only
- B. 2 to 5 Wells - 1 Field Blank and 1 Trip Blank
- C. 5 to 10 Wells - 1 Field blank, 1 Trip Blank, and 1 Duplicate
- D. More than 10 Wells - 1 Field Blank, 1 Trip Blank, and 1 Duplicate per each 12 wells
- E. If sampling extends beyond one day, quality control samples will be collected for each day.

SAMPLE COLLECTION

This section describes the routine procedures followed by G-R while collecting ground-water samples for chemical analysis. These procedures include decontamination, water-level measurements, well purging, physical parameter measurements, sample collection, sample preservation, sample handling, and sample documentation. Critical sampling objectives for G-R are to:

1. Collect ground-water samples that are representative of the sampled matrix and,
2. Maintain sample integrity from the time of sample collection to receipt by the analytical laboratory.

Sample analyses methods, containers, preservation, and holding times are presented in Table 1.

Decontamination Procedures

All physical parameter measuring and sampling equipment are decontaminated prior to sample collection using Alconox or equivalent detergent followed by steam cleaning with deionized water. Any sampling equipment surfaces or parts that might absorb specific contaminants, such as plastic pump valves, impellers, etc., are cleaned in the same manner.

Sample bottles, bottle caps, and septa used for sampling volatile organics are thoroughly cleaned and prepared in the laboratory. Sample bottles, bottle caps, and septa are protected from all potential chemical contact before actual usage at a sample location.

During field sampling, equipment placed in a well are decontaminated before purging or sampling the next well. The equipment are decontaminated by cleaning with Alconox or equivalent detergent followed by steam cleaning with deionized water.

Water-Level Measurements

Prior to purging and sampling a well, the static-water levels are measured in all wells at a project site using an electric sounder and/or calibrated portable oil-water interface probe (Figure 3). Both static water-level and separate-phase product thickness are measured to the nearest ± 0.01 foot. The presence of separate-phase product is confirmed using a clean, acrylic or polyvinylchloride (PVC) bailer, measured to the nearest ± 0.01 foot with a decimal scale tape.



Water-Level Measurements (continued)

The monofilament line used to lower the bailer is replaced between wells with new line to preclude the possibility of cross-contamination. Field observations (e.g. well integrity, product color, turbidity, water color, odors, etc.) are noted on the G-R Well Sampling Field Data Sheet shown in Figure 3. Before and after each use, the electric sounder, interface probe and bailer are decontaminated by washing with Alconox or equivalent detergent followed by rinsing with deionized water to prevent cross-contamination.

As mentioned previously, water-levels are measured in wells with known or suspected lowest dissolved chemical concentrations to the highest dissolved concentrations.

Well Purging

Before sampling occurs, well casing storage water and interstitial water in the artificial sand pack will be purged using (1) a positive displacement bladder pump constructed of inert, non-wetting, Teflon and stainless steel, (2) a pneumatic-airlift pumping system, (3) a centrifugal pumping system, or (4) a Teflon or Stainless steel bailer (Figure 4). Methods of purging will be assessed based on well size, location, accessibility, and known chemical conditions. Individual well purge volumes are calculated from borehole volumes which take into account the sand packed interval in the well annular space. As a general rule, a minimum of 3 and a maximum of 10 borehole volumes will be purged. Wells which dewater or demonstrate slow recharge periods (i.e. low-yield wells) during purging activities may be sampled after fewer purging cycles. If a low-yield (low recovery) well is to be sampled, sampling will not take place until at least 80 percent of the previously measured water column has been replaced by recharge, or as per local requirements. Physical parameter measurements (temperature, pH, and specific conductance) are closely monitored throughout the well purging process and are used by the G-R sampling crew as indicators for assessing sufficient purging. Purging is continued until all three physical parameters have stabilized. Specific conductance (conductivity) meters are read to the nearest ± 10 umhos/cm, and are calibrated daily. pH meters are read to the nearest ± 0.1 pH units and are calibrated daily. Temperature is read to the nearest 0.1 degree F. Calibration of physical parameter meters will follow manufacturers specifications. Monitoring wells will be purged according to the protocol presented in Figure 4. Collected field data during purging activities will be entered on the G-R Well Sampling Field Data Sheet shown in Figure 3. Copies of the G-R Field Data Sheets will be reviewed by the G-R Sampling Manager for accuracy and completeness.

DOCUMENTATION

Sample Container Labels

Each sample container will be labeled by an adhesive label, noted in permanent ink immediately after the sample is collected. Label information will include:

- Sample point designation (i.e. well number or code)
- Sampler's identification
- Project number
- Date and time of collection
- Type of preservation used

Well Sampling Data Forms

In the field, the G-R sampling crew will record the following information on the Well Sampling Data Sheet for each sample collected:

- Project number
- Client
- Location
- Source (i.e. well number)
- Time and date
- Well accessibility and integrity
- Pertinent well data (e.g. depth, product thickness, static water-level, pH, specific conductance, temperature)
- Calculated and actual purge volumes

Chain-of-Custody

A Chain-of-Custody record (Figure 5) shall be completed and accompany every sample and every shipment of samples to the analytical laboratory in order to establish the documentation necessary to trace sample possession from time of collections. The record will contain the following information:

- Sample or station number or sample identification (ID)
- Signature of collector, sampler, or recorder
- Date and time of collection
- Place of collection
- Sample type
- Signatures of persons involved in chain of possession
- Inclusive dates of possession

Samples shall always be accompanied by a Chain-of-Custody record. When transferring the samples, the individual relinquishing and receiving the samples will sign, date, and note the time on the Chain-of-Custody record. G-R will be responsible for notifying the laboratory coordinator when and how many samples will be sent to the laboratory for analysis, and what types of analyses shall be performed.



TABLE 1

SAMPLE ANALYSIS METHODS, CONTAINERS, PRESERVATIONS, AND HOLDING TIMES

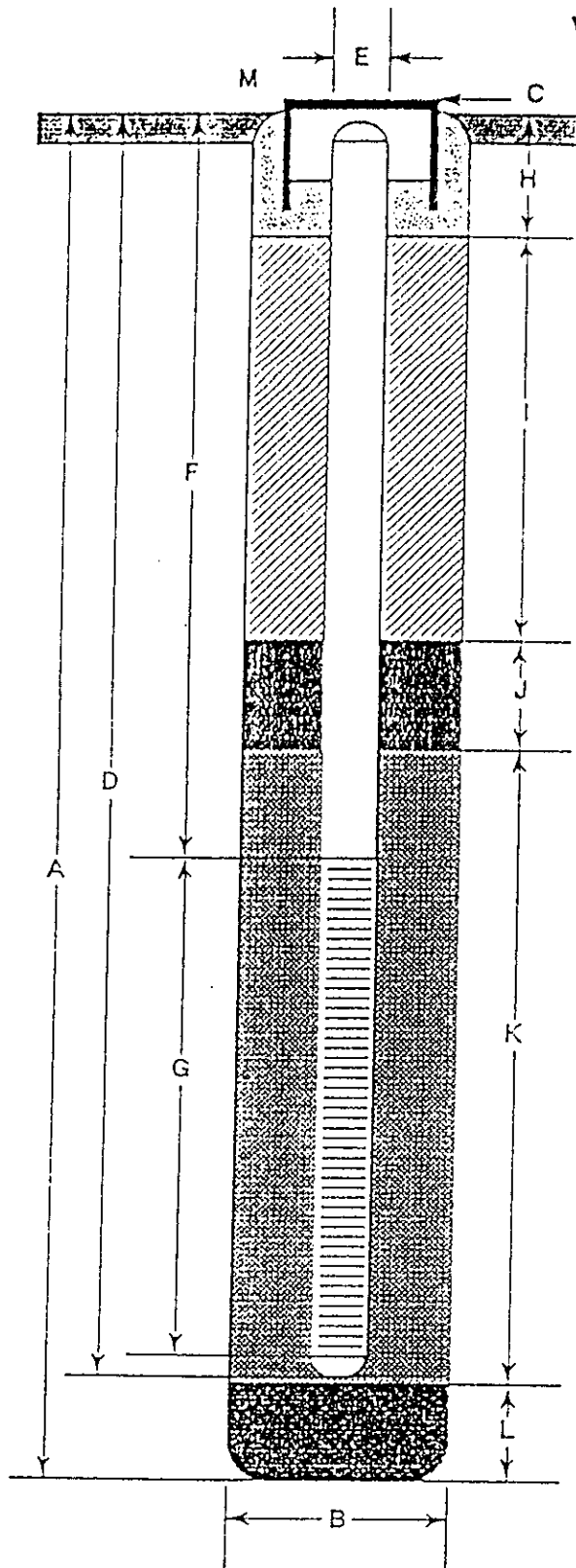
<u>Parameter</u>	<u>Analytical Method</u>	<u>Reporting Units</u>	<u>Container</u>	<u>Preservation</u>	<u>Maximum Holding Time</u>
Total Petroleum Hydrocarbons (gasoline)	EPA 8015 (modified)	mg/l ug/l	40 ml. vial glass, Teflon	cool, 4 C HCl to pH<2	14 days (maximum)
Benzene	EPA 8020	mg/l	50 ml. vial	cool, 4 C	7 days (w/o preservative)
Toluene		ug/l	glass, Teflon lined septum	HCl to pH<2	14 days (w preservative)
Ethylbenzene					
Xylenes (BTEX)		mg/l	1 l glass, Teflon		
Oil & Grease	SM 503E	ug/l	lined septum	H2SO4 to pH<2	28 days (maximum)
Total Petroleum Hydrocarbons (Diesel)	EPA 8015 (modified)	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C	14 days (maximum)
Halogenated Volatile Organics (chlorinated solvents)	8010	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C	14 days (maximum)
Non chlorinated solvents	8020	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C HCl to pH<2	14 days (maximum)
Volatile Organics	8240	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C	14 days (maximum)
Semi-Volatile Organics	8270	mg/l ug/l	40 ml. vial glass, Teflon lined septum	cool, 4 C	14 days (maximum)
Specific Conductance (Field test)		umhos/cm			
pH (Field test)		pH units			
Temperature (Field test)		Deg F			



Field location of boring:								Project No.:		Date:		Boring No:			
								Client:				Sheet			
Drilling method:								Location:				of			
								City:							
Hole diameter:								Logged by:		Driller:		Casing installation data:			
								Top of Box Elevation:				Datum:			
								Water Level							
								Time							
								Date							
PID (ppm)								Description							
Blows/ or Pressure (psf)															
Type of Sample															
Sample Number															
Depth (ft.)															
Sample															
Well Detail															
Soil Group Symbol (USCS)															
Remarks:															

FIGURE 1

WELL CONSTRUCTION DETAIL



- A Total Depth of Boring _____ ft.
- B Diameter of Boring _____ in.
Drilling Method _____
- C Top of Box Elevation _____ ft.
 Referenced to Mean Sea Level
 Referenced to Project Datum
- D Casing Length _____ ft.
Material _____
- E Casing Diameter _____ in.
- F Depth to Top Perforations _____ ft.
- G Perforated Length _____ ft.
Perforated Interval from _____ to _____ ft.
Perforation Type _____
Perforation Size _____ in.
- H Surface Seal from _____ to _____ ft.
Seal Material _____
- I Backfill from _____ to _____ ft.
Backfill Material _____
- J Seal from _____ to _____ ft.
Seal Material _____
- K Gravel Pack from _____ to _____ ft.
Pack Material _____
- L Bottom Seal _____ ft.
Seal Material _____
- M _____



GeoStrategies Inc.

Well Construction Detail

WELL NO.

JOB NUMBER

REVIEWED BY RG/CEG

DATE

REVISED DATE

REVISED DATE

COMPANY _____ JOB # _____

LOCATION _____ DATE _____

CITY _____ TIME _____

Well ID. _____ Well Condition _____

Well Diameter _____ in. Hydrocarbon Thickness _____ ft.

Total Depth _____ ft.

Depth to Liquid- _____ ft.

(# of casing volumes) _____ x _____ x(VF) _____ = (Estimated Purge Volume) _____ gal.

Volume Factor (VF)	2" = 0.17	6" = 1.50	12" = 5.80
	3" = 0.38	8" = 2.60	
	4" = 0.66	10" = 4.10	

Purging Equipment _____

Sampling Equipment _____

Starting Time _____ Purging Flow Rate _____ gpm.

(Estimated Purge Volume) _____ gal. / (Purging Flow Rate) _____ gpm. = (Anticipated Purging Time) _____ min.

Time	pH	Conductivity	Temperature	Volume
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Did well dewater? _____ If yes, time _____ Volume _____

Sampling Time _____ Weather Conditions _____

Analysis _____ Bottles Used _____

Chain of Custody Number _____

COMMENTS _____

FOREMAN _____ ASSISTANT _____

Monitoring Well Sampling Protocol Schematic

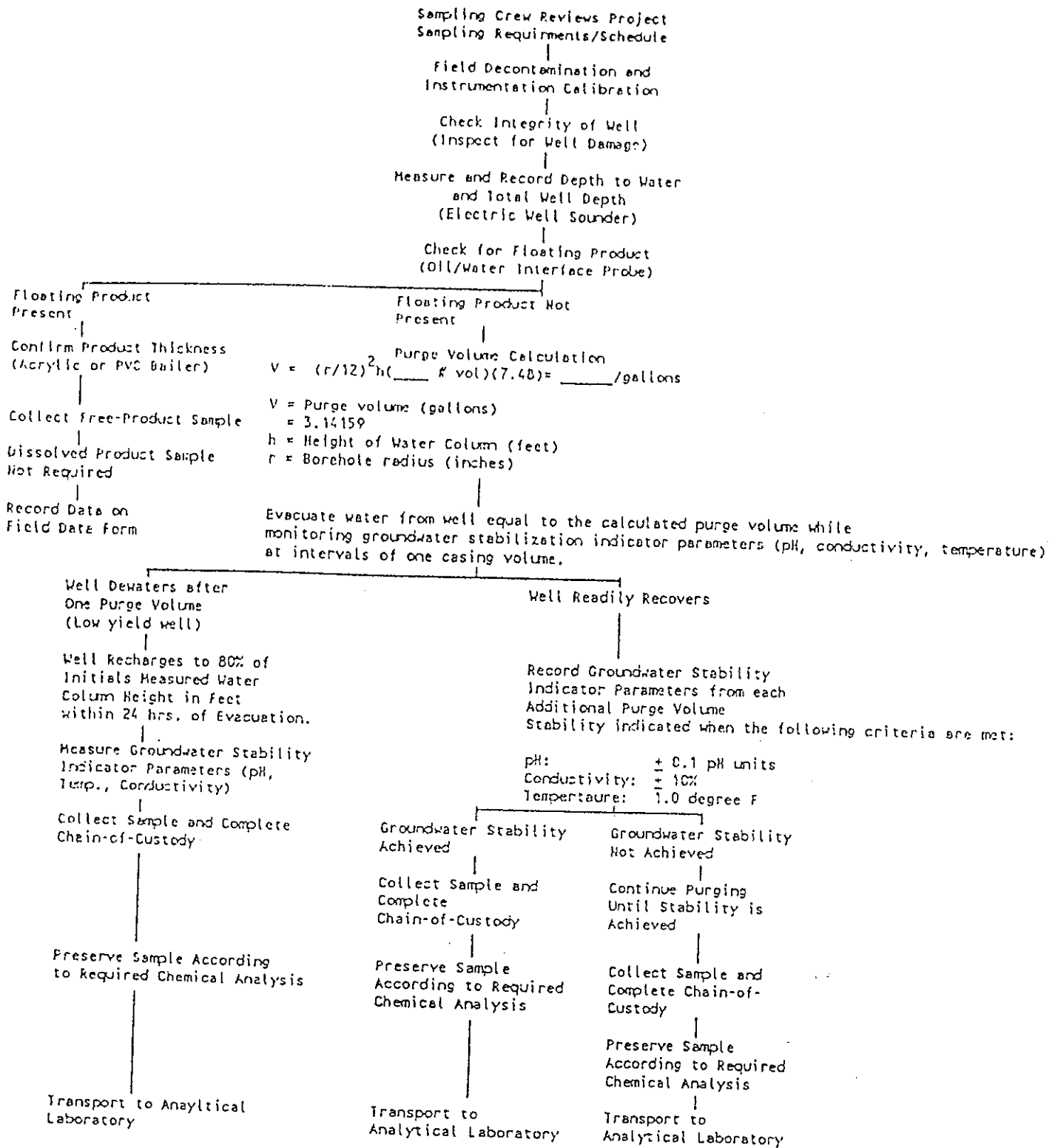


FIGURE 4

COMPANY _____ JOB NO. _____

JOB LOCATION _____

CITY _____ PHONE NO. _____

AUTHORIZED _____ DATE _____ P.O. NO. _____

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID

RELINQUISHED BY: _____

RECEIVED BY: _____

RELINQUISHED BY: _____

RECEIVED BY: _____

RELINQUISHED BY: _____

RECEIVED BY LAB: _____

DESIGNATED LABORATORY: _____ DHS #: _____

REMARKS: _____

DATE COMPLETED _____ FOREMAN _____