



gettler — ryan inc.

89 DEC 13 PM
general contractors

December 12, 1989

Department of Environmental Health
Hazardous Materials Program
80 Swan Way, Room 200
Oakland, California 94621

Reference: ARCO Service Station #4931
731 West MacArthur Boulevard
Oakland, California

← 94610 94609

Gentlemen:

As requested by ARCO Products Company, we are forwarding a copy of the Quarterly Report, dated December 5, 1989, prepared by GeoStrategies, Inc. for the above referenced location. The report documents the quarterly groundwater sampling and site activities conducted between July-September 1989.

Please do not hesitate to call should you have any questions or comments.

Sincerely,

John P. Werfal
Project Manager

cc: Mr. Kyle Christie, ARCO Products Company
Mr. H. C. Winsor, ARCO Products Company
Mr. Tom Callaghan, Regional Water Quality Control Board



GeoStrategies Inc.

QUARTERLY REPORT

JULY - SEPTEMBER 1989

ARCO Service Station No. 4931
731 West MacArthur Boulevard
Oakland, California

Report No. 7909-3

December 5, 1989



GeoStrategies Inc.

2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545

(415) 352-4800

December 5, 1989

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

Attn: Mr. John Werfal

Re: QUARTERLY REPORT
ARCO Service Station No. 4931
731 West MacArthur Boulevard
Oakland, California

Gentlemen:

This quarterly report has been prepared for the above referenced site, for the July through September, 1989 quarter.

If you have any questions, please call.

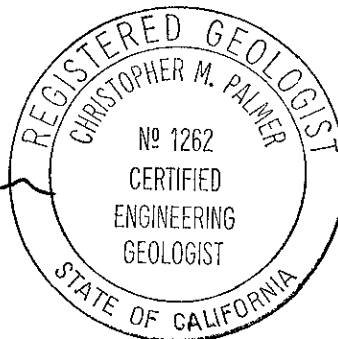
GeoStrategies Inc. by,

A handwritten signature in black ink, appearing to read "David A. Ferreira".

David A. Ferreira
Geologist

A handwritten signature in black ink, appearing to read "Christopher M. Palmer".

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



DAF/CMP/kjj

Report No. 7909-3

GeoStrategies Inc.

1.0 INTRODUCTION

This Quarterly Report has been prepared by GeoStrategies Inc. (GSI) for ARCO Service Station No. 4931 located at 731 West MacArthur Boulevard in Oakland, California (Plate 1).

This report describes the results of the third quarterly ground-water sampling for 1989 performed by Gettler-Ryan Inc. (G-R), in accordance with the current quarterly sampling plan for the site. Field work and laboratory analytical methods were performed in compliance with current State of California Water Resources Control Board (SWRCB) procedures for conducting environmental investigations related to leaking underground fuel tanks (See Appendix A). The Field and chemical analytical data discussed in this report were collected between July 1 and September 30, 1989.

2.0 SITE HISTORY

A petroleum hydrocarbon product loss reportedly occurred in November 1982. As a result, four ground-water monitoring wells (A-1 through A-4) were installed at the site in December 1982. Four additional ground-water monitoring wells (A-5 through A-8) were installed by Groundwater Technology, Inc. (GTI) in March 1983.

On June 18, 1986, EMCON Associates (EMCON) issued a report discussing ground-water quality conditions beneath the site. EMCON recommended the installation of four additional ground-water monitoring wells to further delineate the extent of lateral migration of petroleum hydrocarbons.

In December 1987, four additional ground-water monitoring wells (A-9 through A-12) were installed by Pacific Environmental Group, Inc. (PACIFIC). Ground-water analysis revealed 7 of the 9 wells contained detectable concentrations of Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX). The results of the investigation, along with a half-mile radius well survey, are presented in the PACIFIC report dated January 20, 1988.

A quarterly ground-water sampling program was initiated at the site in January, 1989.

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3.0 GROUNDWATER LEVEL MONITORING

3.1 Potentiometric Data

Prior to groundwater sampling, water levels were measured in each monitoring well using an electronic interface probe. Static water levels were measured from the surveyed top of the well box and recorded to the nearest ± 0.01 foot (Table 1). Plate 2 presents the location of each well at the site.

Ground-water elevation data for this quarter have been plotted and contoured and are presented on Plate 3. Potentiometric data indicates that shallow groundwater beneath the site flows to the southwest, with an approximate hydraulic gradient of 0.02. Water level data used to prepare the quarterly potentiometric map were taken from data collected on the same day that ground-water sampling occurred.

3.2 Floating Product Measurements

Measurements for separate-phase petroleum hydrocarbons (floating product) were made in each well using a calibrated portable oil-water interface probe. All wells were visually inspected with a clean, clear acrylic bailer to verify probe results. Floating product was observed in monitoring wells A-4 (0.01 feet in measured thickness) and A-8 (0.77 feet) during this quarter.

4.0 CHEMICAL ANALYTICAL DATA

Ground-water samples were collected from site monitoring wells on August 18, 1989. The ground-water samples were analyzed for Total Petroleum Hydrocarbons calculated as Gasoline (TPH-Gasoline) according to EPA Method 8015 (Modified) and BTEX according to EPA Method 8020 (See Appendix B). All analyses were performed by International Technology (IT) Analytical Services, a State-certified analytical laboratory located in San Jose, California.

A total of three wells at the site were found to contain aromatic fractions of petroleum hydrocarbon products at or above Regional Water Quality Control Board (RWQCB) Maximum Contaminant Levels (MCLs) or Department of Health Services (DHS) Action Levels. As shown on Table 1, benzene concentrations were identified in ground-water samples above RWQCB MCLs in monitoring wells A-2 (900 parts per billion (ppb)), A-6 (2.1 ppb) and A-9 (400 ppb). TPH-Gasoline and benzene chemical analytical data were used to prepare isoconcentration maps for this quarter (Plates 4 and 5).

Historical chemical analytical data have been tabulated and are presented in Appendix C.

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4.1 Quality Control

The Quality Control (QC) sample for this quarterly ground-water sampling was a trip blank. The trip blank was prepared in the IT laboratory using organic free water to evaluate laboratory handling and analytical procedures. QC procedures during field sampling are presented in the G-R Sampling Protocol (Appendix A). The G-R Groundwater Sampling Report, IT Analytical Services certified analytical report, and Chain-of-Custody form for this quarterly ground-water sampling are presented in Appendix B.

5.0 SUMMARY

A summary of activities and findings associated with this quarterly report are presented below:

- o Water levels were measured in selected monitoring wells. A potentiometric map was constructed from static water level elevation data.
- o Floating product was measured in monitoring wells A-4 (0.01 feet) and A-8 (0.77 feet) this quarter.
- o TPH-Gasoline concentrations detected in ground-water samples ranged from 180 to 14,000 ppb.
- o Benzene concentrations detected in ground-water samples ranged from 0.7 to 900 ppb.

6.0 PLANNED SITE ACTIVITIES

The following activities are planned for the fourth quarter, October to December 1989, at the site:

- o All scheduled wells will be sampled and analyzed for TPH-Gasoline according to EPA Method 8015 (Modified) and BTEX according to EPA Method 8020.
- o Water levels will be measured quarterly and selected data will be used to prepare a potentiometric map across the site. The local ground-water gradient will be calculated.
- o Chemical data will be used to construct isoconcentration maps for TPH-Gasoline and benzene.

TABLE 1

GROUND-WATER ANALYSIS DATA

WELL NO	SAMPLE DATE	ANALYSIS DATE	TPH (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)	WELL (ELEV (FT))	STATIC WATER ELEV (FT)	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
A-2	18-Aug-89	25-Aug-89	14,000.	900.	200.	ND	1,300.	55.38	44.56	----	10.82
A-3	18-Aug-89	25-Aug-89	180.	0.7	1.	ND	ND	54.48	42.88	----	11.60
A-4	18-Aug-89	----	----	----	----	----	----	54.62	42.72*	0.01	11.91
A-5	18-Aug-89	25-Aug-89	ND	ND	ND	ND	ND	54.15	42.57	----	11.58
A-6	18-Aug-89	25-Aug-89	ND	2.1	1.	ND	ND	55.13	45.03	----	10.10
A-7	18-Aug-89	25-Aug-89	ND	ND	ND	ND	ND	54.67	44.70	----	9.97
A-8	18-Aug-89	----	----	----	----	----	----	53.61	43.29*	0.77	10.88
A-9	18-Aug-89	29-Aug-89	14,000.	400.	800.	400.	2,000.	52.96	43.45	----	9.51
A-10	18-Aug-89	29-Aug-89	ND	ND	ND	ND	ND	54.16	42.34	----	11.82
A-11	18-Aug-89	25-Aug-89	ND	ND	ND	ND	ND	53.75	42.23	----	11.52

* Adjusted Static Water Elevation for separate phase product

TPH = Total Petroleum Hydrocarbons as Gasoline

PPB = parts per billion AF = Field Blank

ND = None Detected TB = Trip Blank

CURRENT DEPARTMENT OF HEALTH SERVICES ACTION LEVELS

Benzene 0.7 ppb

Xylenes 620 ppb

Toluene 100 ppb

Ethylbenzene 680 ppb

Note: 1. For chemical parameter detection limits, refer to I.T. laboratory reports in Appendix B

2. Water level elevations referenced to mean sea level (MSL)

3. Wells A-4 and A-8 contained separate phase product and were not sampled

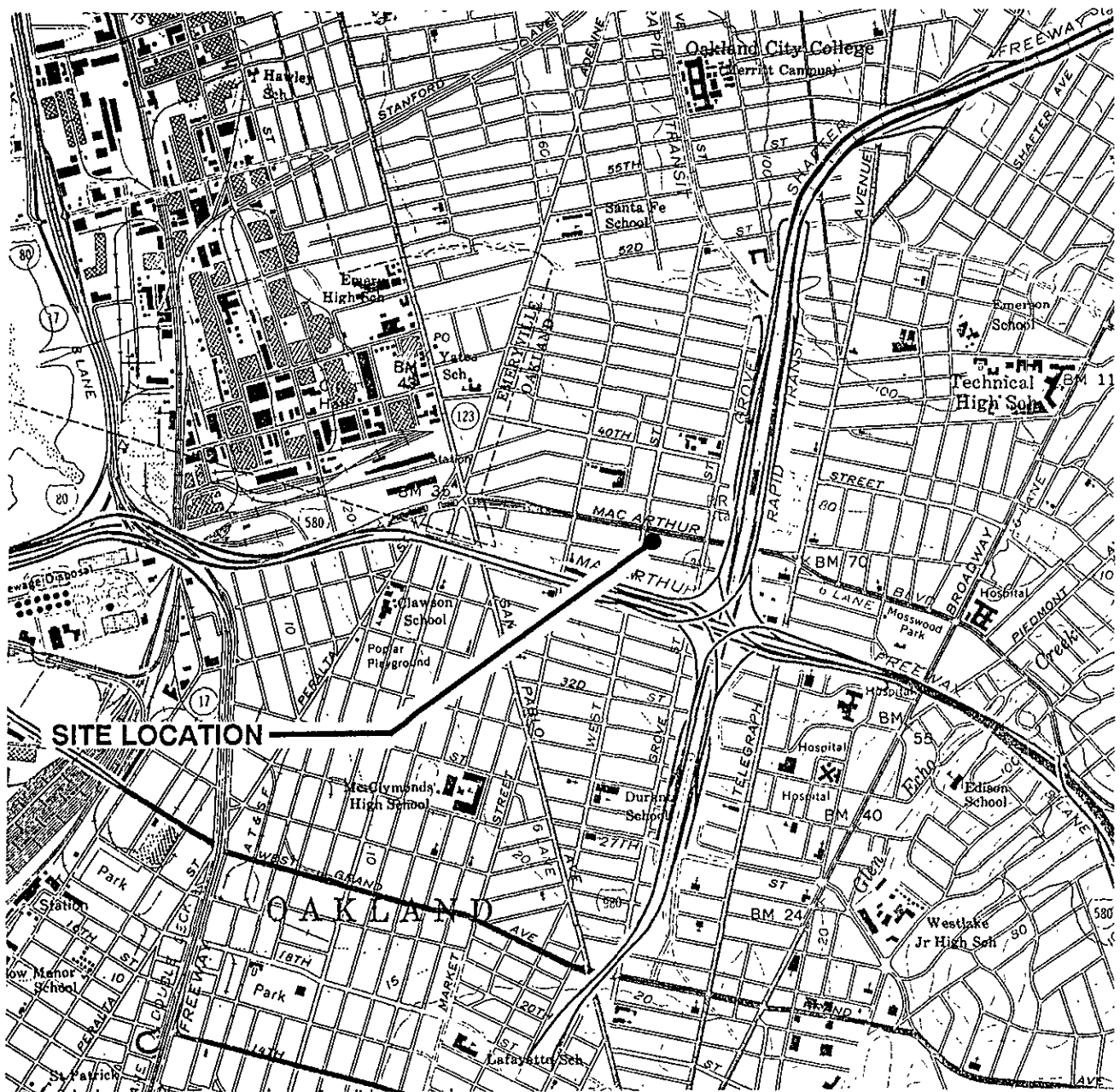
TABLE 1

GROUND-WATER ANALYSIS DATA

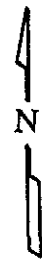
WELL NO	SAMPLE DATE	ANALYSIS DATE	TPH (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)	WELL (ELEV (FT))	STATIC WATER (ELEV (FT))	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
A-12	18-Aug-89	29-Sep-89	ND	ND	ND	ND	ND	52.05	41.30	----	10.75
TB	18-Aug-89	29-Aug-89	ND	ND	ND	ND	ND	----	----	----	----

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ILLUSTRATIONS



SITE LOCATION



Base Map: USGS Topographic Map

Approx. Scale: 1"=2000'



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Vicinity Map
 ARCO Service Station #4931
 731 West MacArthur Boulevard
 Oakland, California

PLATE

1

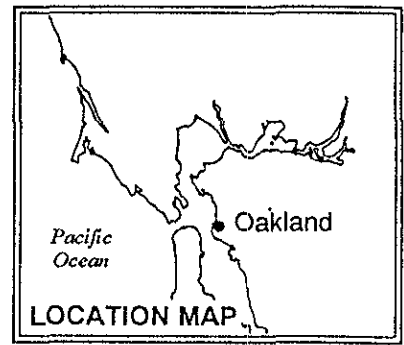
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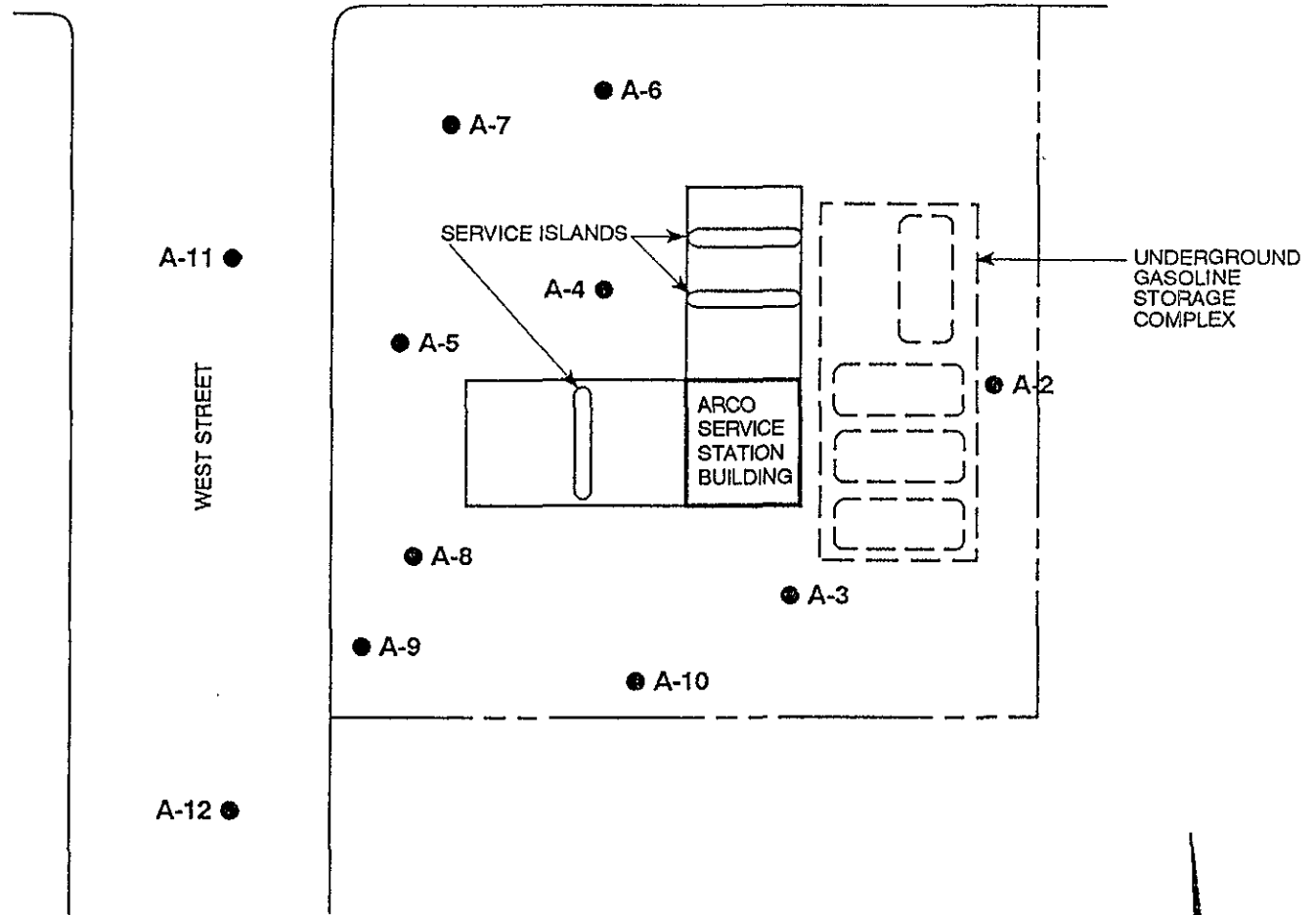
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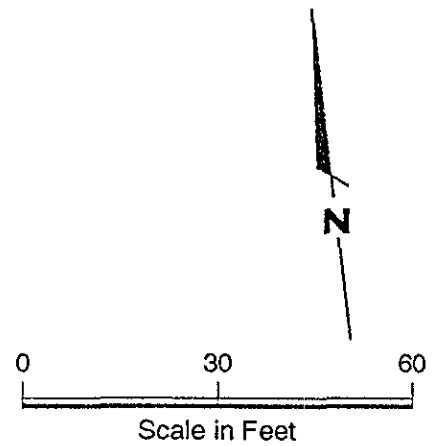


MACARTHUR BOULEVARD



EXPLANATION

- A-2 Groundwater monitoring well location



GeoStrategies Inc.

Site Plan
 Arco Service Station #4931
 MacArthur Boulevard and West Street
 Oakland, California

PLATE

2

JOB NUMBER
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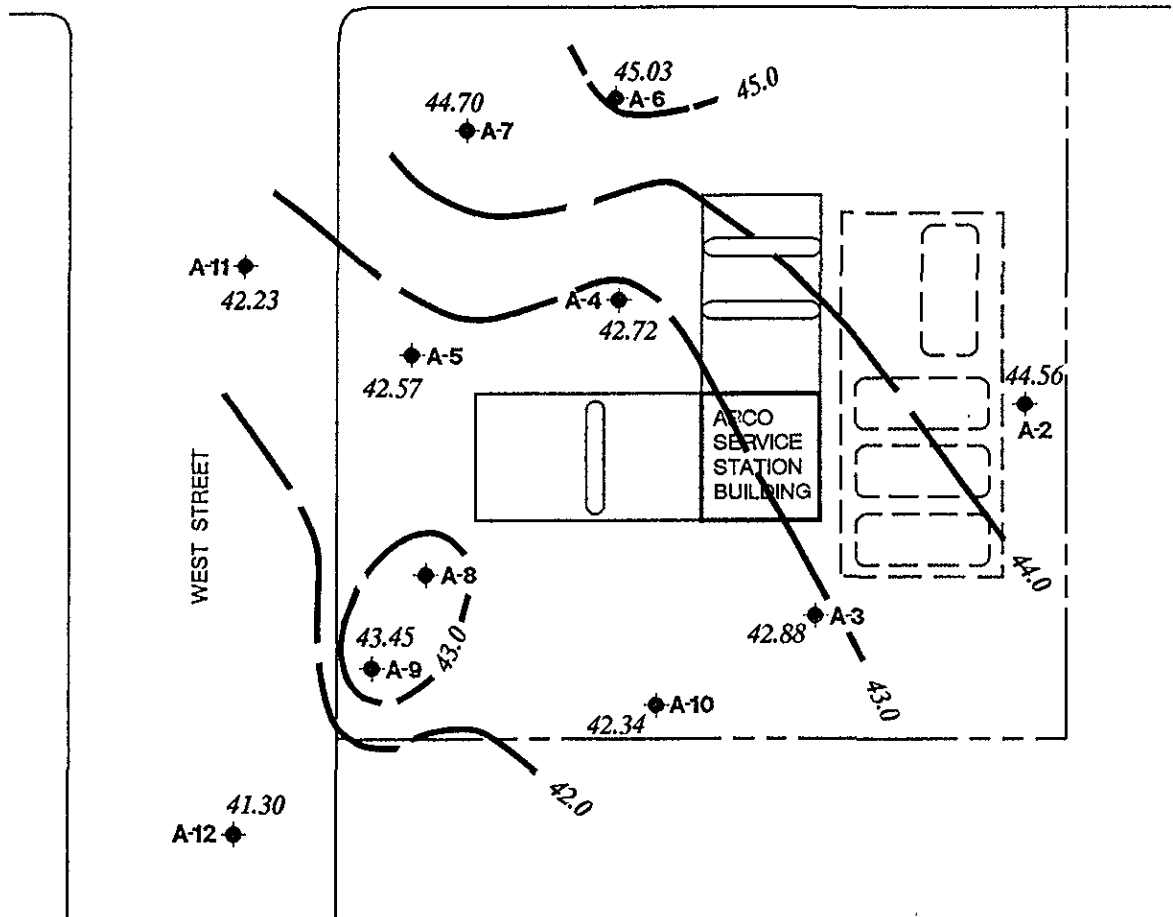
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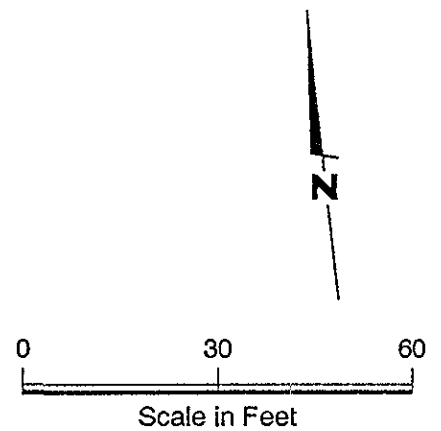
MACARTHUR BOULEVARD



EXPLANATION

- ◆ A-2 Ground-water monitoring well location
- Ground-water elevation contour
Approximate Gradient = 0.02
- Ground-water elevation measured on August 18, 1989
in feet referenced to mean sea level (MSL)

Note: Contours may be influenced by irrigation practices and/or site construction activities
Well A-8 not used in contouring



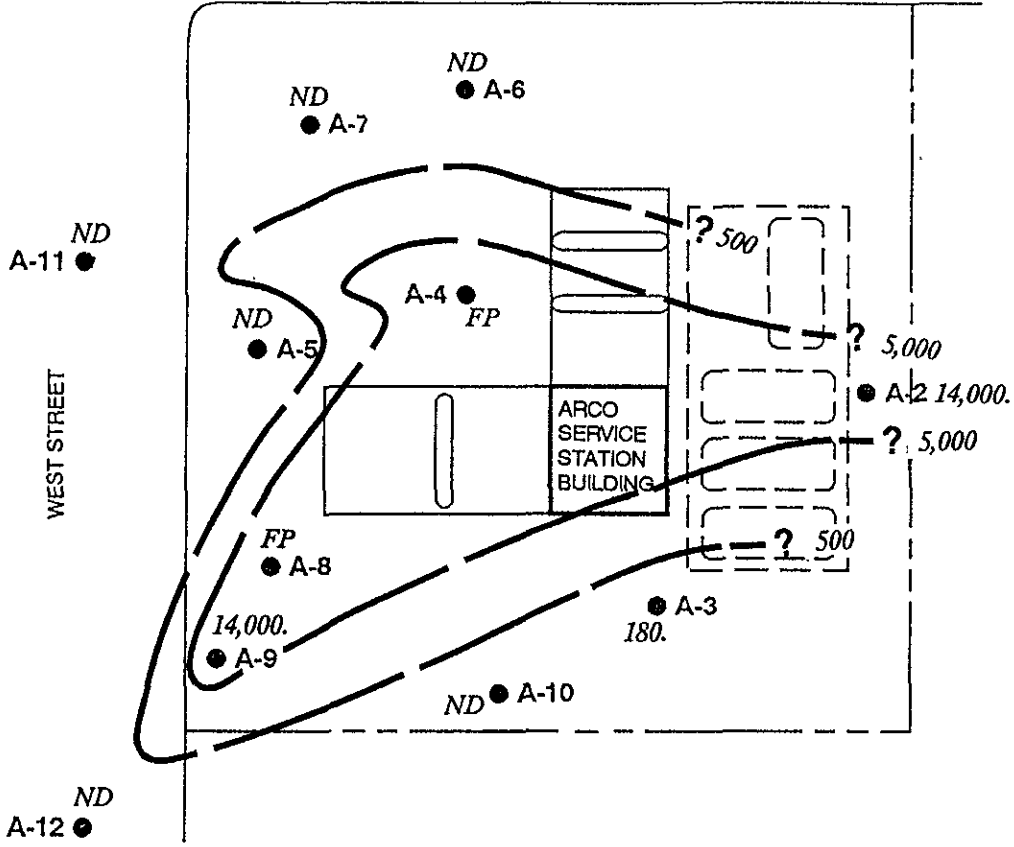
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Potentiometric Map
Arco Service Station #4931
731 West MacArthur Boulevard
Oakland, California

PLATE

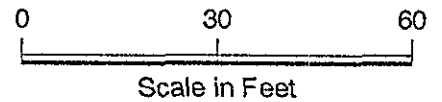
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MACARTHUR BOULEVARD



EXPLANATION

- A-2 Groundwater monitoring well location
- 180. TPH (Total Petroleum Hydrocarbon calculated as Gasoline) concentration in ppb
Sampled August 18, 1989
- 500 ——— TPH Isoconcentration contour
- ND Not Detected
(see laboratory reports for detection limits)
- FP Floating Product



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TPH Isoconcentration Map
 Arco Service Station #4931
 MacArthur Boulevard and West Street
 Oakland, California

PLATE

4

JOB NUMBER
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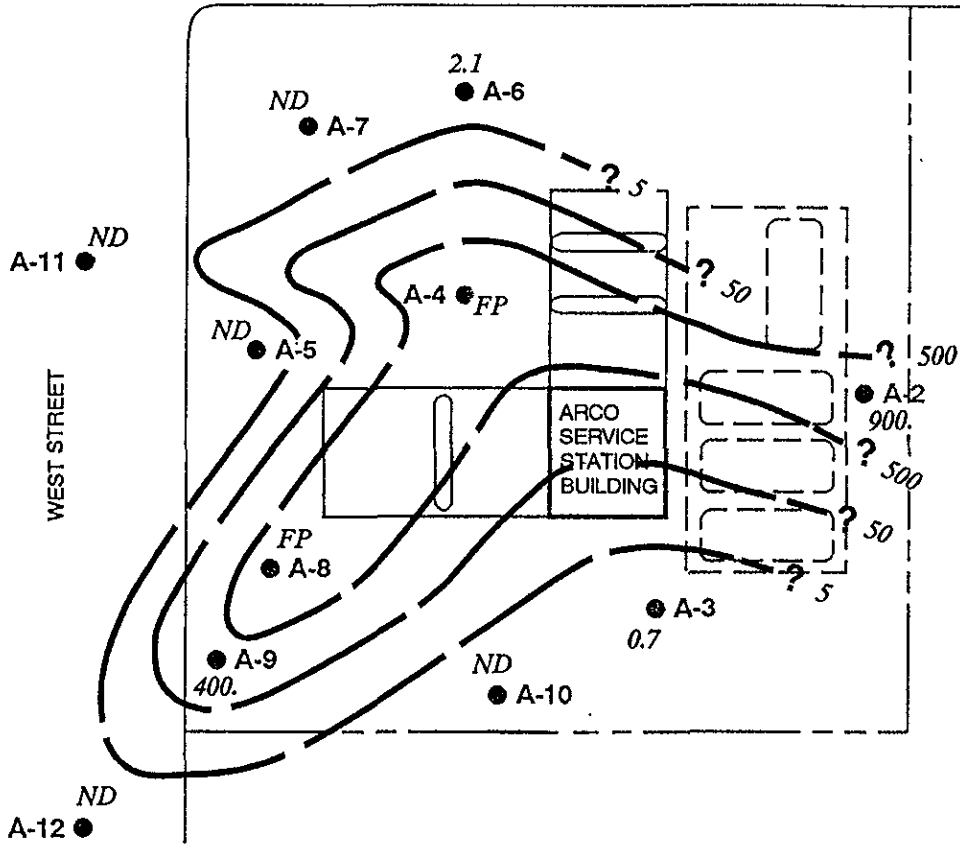
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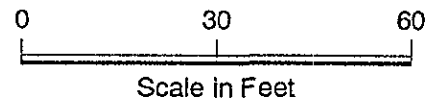
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MACARTHUR BOULEVARD



EXPLANATION

- A-2 Groundwater monitoring well location
- 2.1 Benzene concentration in ppb
Sampled August 18, 1989
- 50 — Benzene Isoconcentration contour
- ND Not Detected
(see laboratory reports for detection limits)
- FP Floating Product



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Benzene Isoconcentration Map

Arco Service Station #4931
MacArthur Boulevard and West Street
Oakland, California

PLATE

5

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CAMP CEG 1202

DATE
9/89

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REVISED DATE

GeoStrategies Inc.

APPENDIX A
METHODS AND PROCEDURES

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 I.

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 I.

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			

COMPANY _____ JOB # _____

LOCATION _____ DATE _____

CITY _____ TIME _____

Well ID. _____ Well Condition _____

Well Diameter _____ in. Hydrocarbon Thickness _____ ft.

Total Depth _____ ft.

Depth to Liquid- _____ ft.

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

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

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

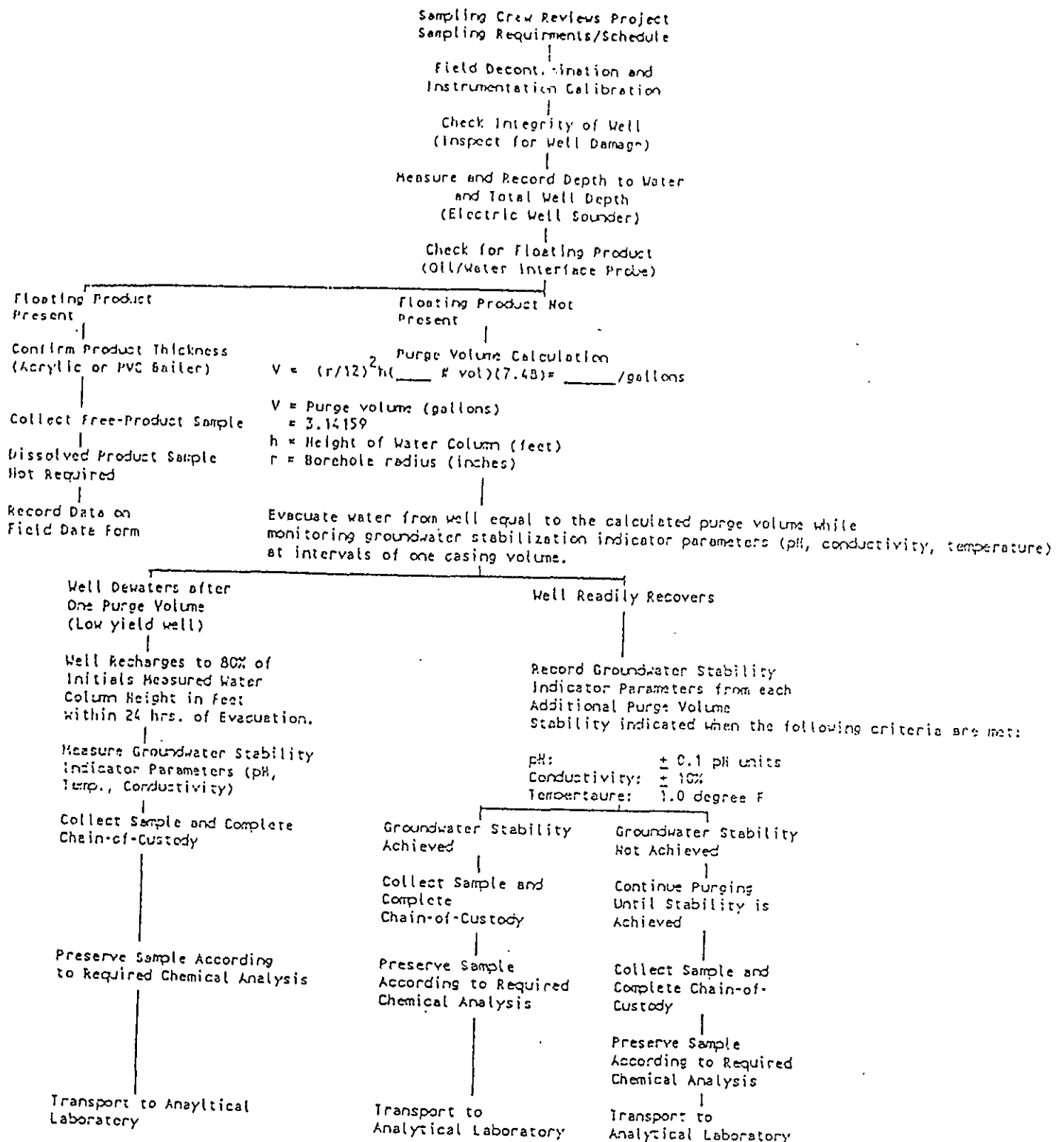


FIGURE 4

COMPANY _____ JOB NO. _____

JOB LOCATION _____

CITY _____ PHONE NO. _____

AUTHORIZED _____ DATE _____ P.O. NO. _____

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

RELINQUISHED BY: _____

RECEIVED BY: _____

RELINQUISHED BY: _____

RECEIVED BY: _____

RELINQUISHED BY: _____

RECEIVED BY LAB: _____

DESIGNATED LABORATORY: _____ DHS #: _____

REMARKS: _____

DATE COMPLETED _____ FOREMAN _____

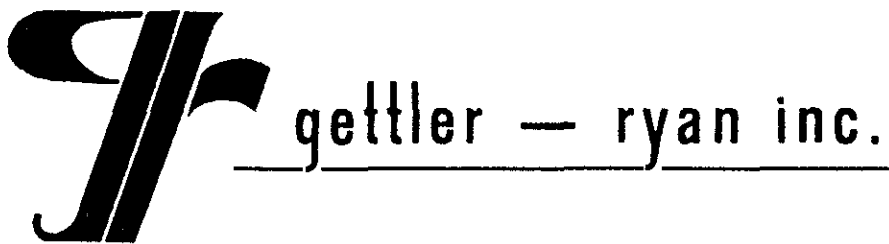
GeoStrategies Inc.

APPENDIX B

CHEMICAL ANALYTICAL REPORTS

GROUNDWATER SAMPLING REPORT

CHEMICAL ANALYTICAL REPORTS



September 8, 1989

GROUNDWATER SAMPLING REPORT

ARCO Products Company
Post Office Box 5811
San Mateo, California 94402

Referenced Site: ARCO Service Station #4931
731 W MacArthur Blvd./West St.
Oakland, California

Sampling Date: August 18, 1989

This report presents the results of the quarterly groundwater sampling and analytical program conducted by Gettler-Ryan Inc. on August 18, 1989 at the referenced location. The site is occupied by an operating service station located on the southeast corner of West MacArthur Boulevard and West Street. The service station has underground storage tanks containing regular leaded, unleaded and super unleaded gasoline products.

There are currently nine groundwater monitoring wells on site and two off site at the locations shown on the attached site map. Prior to sampling, all wells were inspected for total well depth, water levels, and presence of separate phase product using an electronic interface probe. A clean acrylic bailer was used to visually confirm the presence and thickness of separate phase product. Groundwater depths ranged from 9.51 to 11.82 feet below grade. Separate phase product was observed in wells A-4 and A-8.

Wells that did not contain separate phase product were purged and sampled. Standard sampling procedure calls for a minimum of four case volumes to be purged from each well. Each well was purged while pH, temperature, and conductivity measurements were monitored for stability. In cases where a well dewatered or less than four case volumes were purged, groundwater samples were obtained after the physical parameters had stabilized. The purge water was contained in drums for proper disposal. Details of the final well purging results are presented on the attached Table of Monitoring Data.

Samples were collected, using Teflon bailers, in properly cleaned and laboratory prepared containers. All sampling equipment was thoroughly cleaned after each well was sampled and steam cleaned upon completion of work at the site. The samples were labeled, stored on blue ice, and transported to the laboratory for analysis. A trip blank, supplied by the laboratory, was included and analyzed to assess quality control. Analytical results for the trip blank are included in the Certified Analytical Report (CAR's). Chain of custody records were established noting sample identification numbers, time, date, and custody signatures.

Report 3909-3

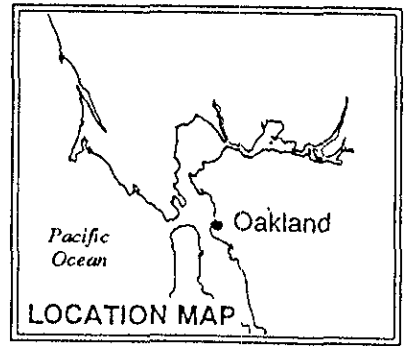
PAGE 1

The samples were analyzed at International Technology Corporation - Santa Clara Valley Laboratory located at 2055 Junction Avenue, San Jose, California. The laboratory is assigned a California DHS-HMTL Certification number of 137. The results are presented as a Certified Analytical Report, a copy of which is attached to this report.

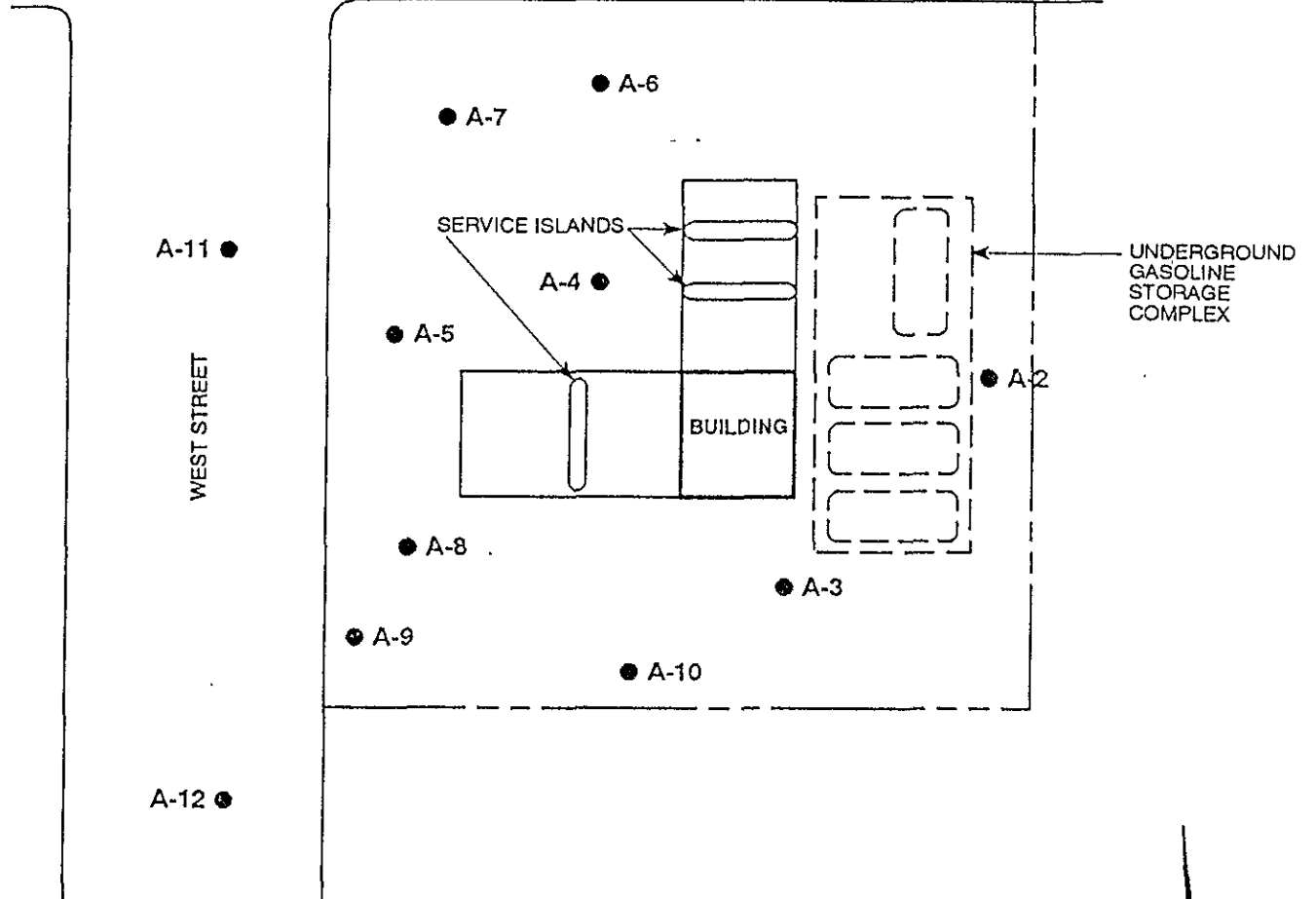


Tom Paulson
Sampling Manager

attachments

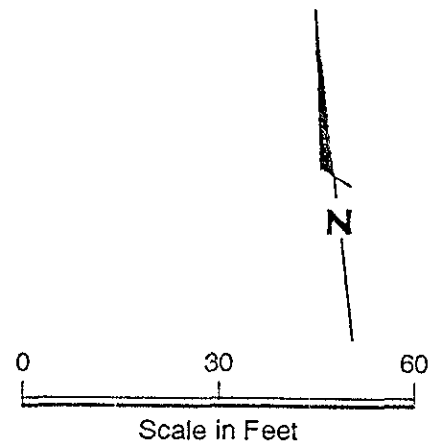


MACARTHUR BOULEVARD



EXPLANATION

- A-2 Groundwater monitoring well location



GeoStrategies Inc.

Site Plan
 Arco Service Station
 MacArthur Boulevard and West Street
 Oakland, California

PLATE

1

CERTIFICATE OF ANALYSIS

Gettler-Ryan
1992 National Avenue
Hayward, CA 94545
ATTN: John Werfal

Date: August 31, 1989

Work Order Number: S9-08-330

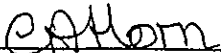
P.O. Number: 3909

This is the Certificate of Analysis for the following samples:

Client Project ID: GR #3909, ARCO, 731 W. MacArthur Blvd./
West Street, Oakland, CA
Date Received by Lab: 8/21/89
Number of Samples: 10
Sample Type: Water

The method of analysis for low boiling hydrocarbons is taken from EPA Methods 8015, 8020 and 5030. The sample is examined using the purge and trap technique. Final detection is by gas chromatography using a flame ionization detector as well as a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline and includes benzene, toluene, ethyl benzene and xylenes.

Reviewed and Approved


Christine Horn
Operations Manager

CH/an
2 Pages Following - Tables of Results

American Council of Independent Laboratories
International Association of Environmental Testing Laboratories
American Association for Laboratory Accreditation

Page: 2 of 2
 Date: August 31, 1989
 Client Project ID: GR #3909, ARCO,
 731 W. MacArthur Blvd./West St., Oakland

IT ANALYTICAL SERVICES
 SAN JOSE, CA

Work Order Number: S9-08-330

Lab Sample ID	Client Sample ID	Sample Date	Date Analysis Completed	Sample Condition on Receipt
S9-08-330-06	A-9	8/18/89	8/29/89	cool pH ≤ 2
S9-08-330-07	A-10	8/18/89	8/29/89	cool pH ≤ 2
S9-08-330-08	A-11	8/18/89	8/25/89	cool pH ≤ 2
S9-08-330-09	A-12	8/18/89	8/29/89	cool pH ≤ 2
S9-08-330-10	Trip Blank	8/18/89	8/29/89	cool pH ≤ 2

Total Petroleum Hydrocarbons - Modified E.P.A. Methods 8015, 8020

ND = None Detected

Results - Micrograms per Liter

Lab Sample ID	Client Sample ID	Low Boiling Hydrocarbons (calculated as Gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes (total)
S9-08-330-06	A-9	14,000.	400.	800.	400.	2,000.
Detection Limit		10,000.	100.	200.	200.	600.
S9-08-330-07	A-10	ND	ND	ND	ND	ND
Detection Limit		50.	0.5	1.	1.	3.
S9-08-330-08	A-11	ND	ND	ND	ND	ND
Detection Limit		50.	0.5	1.	1.	3.
S9-08-330-09	A-12	ND	ND	ND	ND	ND
Detection Limit		50.	0.5	1.	1.	3.
S9-08-330-10	Trip Blank	ND	ND	ND	ND	ND
Detection Limit		50.	0.5	1.	1.	3.

Page: 1 of 2
 Date: August 31, 1989
 Client Project ID: GR #3909, ARCO,
 731 W. MacArthur Blvd./West St., Oakland

IT ANALYTICAL SERVICES
 SAN JOSE, CA

Work Order Number: S9-08-330

Lab Sample ID	Client Sample ID	Sample Date	Date Analysis Completed	Sample Condition on Receipt
S9-08-330-01	A-2	8/18/89	8/25/89	cool pH \leq 2
S9-08-330-02	A-3	8/18/89	8/25/89	cool pH \leq 2
S9-08-330-03	A-5	8/18/89	8/25/89	cool pH \leq 2
S9-08-330-04	A-6	8/18/89	8/25/89	cool pH \leq 2
S9-08-330-05	A-7	8/18/89	8/25/89	cool pH \leq 2

Total Petroleum Hydrocarbons - Modified E.P.A. Methods 8015, 8020

ND = None Detected

Results - Micrograms per Liter

Lab Sample ID	Client Sample ID	Low Boiling Hydrocarbons (calculated as Gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes (total)
S9-08-330-01	A-2	14,000.	900.	200.	ND	1,300.
Detection Limit		10,000.	100.	200.	200.	600.
S9-08-330-02	A-3	180.	0.7	1.	ND	ND
Detection Limit		50.	0.5	1.	1.	3.
S9-08-330-03	A-5	ND	ND	ND	ND	ND
Detection Limit		50.	0.5	1.	1.	3.
S9-08-330-04	A-6	ND	2.1	1.	ND	ND
Detection Limit		50.	0.5	1.	1.	3.
S9-08-330-05	A-7	ND	ND	ND	ND	ND
Detection Limit		50.	0.5	1.	1.	3.

COMPANY: Arco Products Co. #4931

JOB NO. 00478

JOB LOCATION: 731 W. MacArthur West

CITY: Oakland, CA

PHONE NO. (415) 783-7500

AUTHORIZED: John Wenzel

DATE: 8/18/89

P.O. NO. 3909

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID			
A-2	3	Liquid	8-18-89/10:10	THC(gas), BTEX	OK/COOL			
A-3	3		8-18-89/10:30	↓	↓			
A-5	3		8-17-89/12:00					
A-6	3		8-17-89/11:30					
A-7	3		8-17-89/11:24					
A-9	3		8-18-89/11:19					
A-10	3		8-18-89/10:51					
A-11	3		8-17-89/11:00					
A-12	3		8-17-89/10:33					
Top blank	2		Liquid			8-14-89/-		

RELINQUISHED BY: John P. Zwerger 8/19/89 0700

RECEIVED BY: Phillip J. Pyle 8/18/89 0700

RELINQUISHED BY: Phillip J. Pyle 8/21/89 1605

RECEIVED BY: _____

RELINQUISHED BY: _____

RECEIVED BY LAB: Julie Clifford 8-18-89 17:15

DESIGNATED LABORATORY: I T SCV

DHS #: 37

REMARKS: Normal TAT Results due 9/5/89

DATE COMPLETED: 8-18-89

FOREMAN: John P. Zwerger

GeoStrategies Inc.

APPENDIX C
HISTORICAL DATABASE
CHEMICAL DATA

=====
 ANALYTICAL LOG

SAMPLE DATE	SAMPLE POINT	TVHC (PPB)	BENZENE (PPB)	TOLUENE (PPB)	E.B. (PPB)	XYLENES * (PPB)
21-Mar-86	A-2	31,000.00				
07-Jan-88	A-2	12,000.00	920.00	1,500.00		4,000.00
20-Mar-89	A-2	22,000.00	1,200.00	1,800.00	1,200.00	7,700.00
24-May-89	A-2	9,000.00	460.00	260.00	250.00	2,400.00
18-Aug-89	A-2	14,000.00	900.00	200.00	<200.00	1,300.00
21-Mar-86	A-3	1,000.00				
07-Jan-88	A-3	250.00	2.30	8.00		21.00
20-Mar-89	A-3	230.00	1.60	<1.00	3.00	3.00
24-May-89	A-3	170.00	0.90	2.00	1.00	<3.00
18-Aug-89	A-3	180.00	0.70	1.00	<1.00	<3.00
20-Mar-89	A-4	360,000.00	1,500.00	3,700.00	6,500.00	35,000.00
24-May-89	A-4	1,500,000.00	1,000.00	2,000.00	6,000.00	23,000.00
21-Mar-86	A-5	88.00				
07-Jan-88	A-5	<50.00	0.50	1.00		4.00
20-Mar-89	A-5	60.00	0.50	1.00	2.00	10.00
24-May-89	A-5	<50.00	0.50	<1.00	<1.00	<3.00
18-Aug-89	A-5	<50.00	<0.50	<1.00	<1.00	<3.00
21-Mar-86	A-6	<10.				
07-Jan-88	A-6	390.00	54.00	89.00		110.00
20-Mar-89	A-6	220.00	33.00	21.00	9.00	39.00
24-May-89	A-6	110.00	13.00	6.00	3.00	13.00
18-Aug-89	A-6	<50.00	2.10	1.00	<1.00	<3.00
21-Mar-86	A-7	<10.				
07-Jan-88	A-7	<50.00	<0.50	1.00		4.00
20-Mar-89	A-7	<50.00	0.90	<1.00	<1.00	<3.00
24-May-89	A-7	<50.00	<0.50	<1.00	<1.00	<3.00
18-Aug-89	A-7	<50.00	<0.50	<1.00	<1.00	<3.00
07-Jan-88	A-9	300.00	45.00	14.00		43.00
20-Mar-89	A-9	50.00	2.80	1.00	1.00	3.00
24-May-89	A-9	120.00	26.00	12.00	4.00	79.00
18-Aug-89	A-9	14,000.00	400.00	800.00	400.00	2,000.00

=====
 ANALYTICAL LOG

SAMPLE DATE	SAMPLE POINT	TVHC (PPB)	BENZENE (PPB)	TOLUENE (PPB)	E.B. (PPB)	XYLENES * (PPB)
07-Jan-88	A-10	<50.00	0.60	11.00		4.00
20-Mar-89	A-10	<50.00	<0.50	<1.00	<1.00	<3.00
24-May-89	A-10	<50.00	<0.50	<1.00	<1.00	<3.00
18-Aug-89	A-10	<50.00	<0.50	<1.00	<1.00	<3.00
07-Jan-88	A-11	<50.00	1.10	2.00		5.00
20-Mar-89	A-11	<50.00	<0.50	<1.00	<1.00	<3.00
24-May-89	A-11	<50.00	<0.50	<1.00	<1.00	<3.00
18-Aug-89	A-11	<50.00	<0.50	<1.00	<1.00	<3.00
07-Jan-88	A-12	<50.00	<0.50	<1.00		<4.00
20-Mar-89	A-12	<50.00	<0.50	<1.00	<1.00	<3.00
24-May-89	A-12	<50.00	<0.50	<1.00	<1.00	<3.00
18-Aug-89	A-12	<50.00	<0.50	<1.00	<1.00	<3.00
20-Mar-89	AF-6	<50.00	<0.50	<1.00	<1.00	<3.00
24-May-89	AF-2	<50.00	<0.50	<1.00	<1.00	<3.00
24-May-89	AF-4	<50.00	<0.50	<1.00	<1.00	<3.00
20-Mar-89	TB	<50.00	<0.50	<1.00	<1.00	<3.00
24-May-89	TB	<50.00	<0.50	<1.00	<1.00	<3.00
18-Aug-89	TB	<50.00	<0.50	<1.00	<1.00	<3.00

* ETHYLBENZENE & XYLENES COMBINED IN 1986 AND 1988