gettler — ryan inc.
general contractors

February 7, 1990

County of Alameda
Department of Environmental Health
Hazardous Materials Division
80 Swan Way, Room 200
Oakland, California 94621

STP 814

Attention: Mr. Larry Seto

Reference: Shell Service Station
1800 Powell Street
Emeryville, California

Gentlemen:

As requested by Shell Oil Company, we are forwarding a copy of the Quarterly Report prepared for the above referenced location. The enclosed report documents the results of the groundwater sampling and site activities conducted during the October - December 1989 quarter.

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

Sincerely,

John P. Werfal
Project Manager

JPW/ch

enclosure

cc: Ms. Wendy Howell, Shell Oil Company
Ms. Diane Lundquist, Shell Oil Company
Mr. Tom Callaghan, Regional Water Quality Control Board

90 FEB -8 PM 1:34

1992 national avenue • hayward, california 94545-1787 • 783-7500

GeoStrategies Inc.

QUARTERLY REPORT

OCTOBER - DECEMBER 1989

Shell Service Station
1800 Powell Street
Emeryville, California

Report No. 7605-5

February 2, 1990

GeoStrategies Inc.
2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545
(415) 352-4800

February 2, 1990

Gettler-Ryan Inc.
2150 West Winton Avenue
Hayward, California 94545

Attn: Mr. John Werfal

Re: QUARTERLY REPORT
Shell Service Station
1800 Powell Street
Emeryville, California

Gentlemen:

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

If you have any questions, please call.

GeoStrategies Inc. by,

Melissa L. Wann for

David A. Ferreira
Geologist

Jeffrey L. Peterson
Senior Hydrogeologist
R.E.A. 1021

REGISTERED GEOLOGIST
CHRISTOPHER M. PALMER
No 1262
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

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

DAF/JLP/mlg

Report No. 7605-5

1.0 INTRODUCTION

This quarterly report has been prepared by GeoStrategies Inc. (GSI) for the Shell Service Station located at 1800 Powell Street in Emeryville, California (Plate 1).

This report describes the results of the fourth quarterly ground-water sampling for 1989 performed by Gettler-Ryan Inc. (G-R), on October 25, 1989, in accordance with the quarterly sampling plan for the site. G-R Sampling Protocol is presented in Appendix A. In addition, this report summarizes the installation and sampling of three ground-water monitoring wells (S-12, S-13, and S-14), and the abandonment of Wells S-6 and S-7 in accordance with the GSI Work Plan dated October 27, 1989. 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 relating to leaking underground fuel tanks. Field and chemical analytical data were collected between October 1, and December 31, 1989.

2.0 REGIONAL SETTING

The site is located on the fringe of the San Francisco Bay approximately 6 miles northeast of San Francisco and 2 miles north of downtown Oakland, California. The site is underlain by man-made fill and bay mud.

3.0 SITE HISTORY

Prior to August 1983, five tank backfill wells (A through E) and six ground-water monitoring wells (S-5 through S-10) were installed at the site. Boring logs and well construction details are not available for these wells.

In October 1988, monitoring wells S-5 through S-10 were sampled by G-R and analyzed for Total Petroleum Hydrocarbons calculated as Gasoline (TPH-Gasoline), and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX). TPH-Gasoline concentrations ranged from 0.05 to 700 parts per million (ppm). Benzene concentrations ranged from 0.0011 to 37 ppm. Well S-9 contained separate-phase petroleum hydrocarbons (floating product). The results of this sampling event are presented in the G-R report dated December 6, 1988. Bi-weekly monitoring of Well S-9 by G-R reveals a range of floating product thickness from approximately 1.20 to 1.30 feet in measured thickness, through January 1989. The floating product appears as a black highly viscous substance. This floating product may include dissolved constituents from the man-made fill material (e.g. tar paper).

In February, G-R conducted ground-water sampling for the first quarter of 1989. Wells S-5 and S-6 contained a sheen of floating product, and Well S-9 had 1.3 feet of floating product. TPH-Gasoline and Benzene were detected in all wells sampled. TPH-Gasoline concentrations ranged from 0.05 ppm to 6.5 ppm. Benzene concentrations ranged from 0.0009 ppm to 0.74 ppm. The results of this sampling event are presented in the GSI quarterly report dated April 14, 1989.

In April, G-R conducted ground-water sampling for the second quarter of 1989. Well S-9 contained 1.25 feet of floating product. Detectable concentrations of TPH-Gasoline, ranging from 2.7 ppm to 13 ppm, were reported in Wells S-5, S-6, S-8, and S-10. Benzene was detected in all wells sampled at concentrations ranging from 0.0010 ppm to 2.4 ppm. The results of this sampling event are presented in the GSI quarterly report dated July 13, 1989.

On October 10, 1989, GSI issued an interim ground-water sampling report summarizing the third quarterly sampling conducted by G-R in July, 1989. Well S-9 contained floating hydrocarbon product (1.20 feet in measured thickness). TPH-Gasoline and Benzene were detected in all wells sampled. Benzene concentrations ranged from 0.0022 ppm to 1.7 ppm.

On October 27, 1989, GSI issued a work plan proposing the installation of three additional ground-water monitoring wells and the abandonment of Wells S-6 and S-7. In addition, the work plan proposed that an in-situ ground-water sampling or a soil vapor survey be performed at the site to aid in the placement of future monitoring wells.

On October 25, 1989, G-R sampled all site monitoring wells. On November 8, and 9, 1989, GSI installed three ground-water monitoring wells. Wells S-6 and S-7 were abandoned on November 10, 1989. On November 17, 1989, G-R sampled the three newly installed wells. Data collected during these activities are presented below.

No additional site history data is available to GSI.

4.0 GROUNDWATER LEVEL MONITORING

4.1 Potentiometric Data

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

Ground-water elevation data for the November 17, 1989 sampling event have been plotted and contoured and are presented on Plate 3. Static ground-water elevation data for the newly installed wells (S-12, S-13 and S-14) were used to construct the potentiometric map due to uncertainty of well construction of previously installed wells, S-5 through S-10. Depth to groundwater in the uppermost water-bearing strata ranged from 7.01 to 9.25 feet below existing grade for the two sampling events this quarter. Potentiometric data indicate that shallow groundwater beneath the site flows to the south with an approximate hydraulic gradient of 0.004. The suspected effects of tidal fluctuations on ground-water flow are unknown.

4.2 Floating Product Measurements

Each well was monitored for floating product using an electronic oil-water interface probe. All wells were inspected with a clean, clear acrylic bailer to visually confirm interface probe results. The black viscous floating product was present in Well S-9 during the quarterly sampling on October 25, 1989. However, this well was vacuum pumped on November 28, 1989, to remove the floating product. Floating product was not observed in any of the monitoring wells during the December 7, 1989 monitoring event performed by G-R. The G-R monitoring data for 1989 are presented in Appendix B.

5.0 FIELD PROCEDURES

5.1 Well Abandonment

Wells S-6 and S-7 were abandoned on November 10, 1989, by G-R using 12-inch-diameter hollow-stem augers powered by a truck-mounted drill rig. The wells were drilled out to their measured total depth, the casings were pulled, and the boreholes were grouted with neat cement from the bottom of the borehole to ground surface using a tremie pipe.

5.2 Soil Borings

Three soil borings (S-12, S-13, and S-14) were drilled with a truck-mounted hollow-stem auger drilling rig using 8-inch-diameter auger flights on November 8 and 9, 1989. Borings S-12 and S-14 were reamed using 12-inch-diameter hollow-stem augers as a result of borehole instability and observed collapse. All three borings were subsequently completed as monitoring wells. Soil samples were collected at five-foot depth intervals as a minimum using a modified California split-spoon sampler fitted with brass tube liners. A GSI geologist supervised the drilling, described soil samples using the Unified Soils Classification System (ASTM D-2488-84) and Munsell Color Chart, and prepared a lithologic log for each boring. All field procedures follow the methods described in the GSI Field Methods and Procedures presented in Appendix A.

5.3 Soil Sampling

One 4-inch brass sample tube of soil from each sampled interval was used to perform head-space analysis in the field for the presence of Volatile Organic Compounds (VOCs). Head-space analyses involved immediately removing soil from the brass liner, placing it into a clean glass jar, and covering the jar with aluminum foil secured under a ring-type threaded lid. After approximately twenty minutes, the foil was pierced and the head-space within the jar was tested for VOCs measured in parts per million (ppm) with an OVM photoionization detector. Head-space analysis results are presented on the exploratory boring logs presented in Appendix C.

Selected soil samples retained for chemical analysis were collected in clean brass liners, covered on both ends with aluminum foil and sealed with plastic end caps. The samples were labeled, entered on a Chain-of-Custody form, and transported on blue ice in a cooler to IT Analytical Services for site-specific chemical analyses.

5.4 Monitoring Well Construction

Three monitoring wells (S-12, S-13, and S-14) were installed using 8- and 12-inch hollow-stem augers. Wells S-12 and S-14 were installed to a depth of 24 feet and Well S-13 to a depth of 20.5 feet. The wells were constructed using 3-inch-diameter, Schedule 40 PVC well casing and 0.020-inch factory slotted well screen. Well construction details for Wells S-12, S-13, and S-14 are presented in Appendix C.

6.0 HYDROGEOLOGIC CONDITIONS

Lithology beneath the site appears to consist primarily of man-made fill material (clayey sand and sandy clay), which overlie the highly plastic Bay Mud deposits. The fill material appears to extend to a depth of at least 10 feet and is probably continuous across the site based on available data. Due to the presence of refuse material observed in the fill, it is our opinion that both soil and ground-water analytical data results may be influenced by refuse composition as shown on the exploratory boring logs in Appendix C. Refuse was examined in the field during drilling. Incorporated materials included tar paper, wood, and construction debris.

First encountered groundwater was observed at depths of between 9 and 11 feet below ground surface in Wells S-12, S-13, and S-14. The water-bearing strata appears to be comprised primarily of fill consisting of clayey sand and sand. Equilibrated ground-water levels occur at approximately 9 feet below grade.

7.0 CHEMICAL ANALYTICAL DATA

7.1 Soil Analytical Results

Selected soil samples were analyzed by IT Analytical Services for Total Petroleum Hydrocarbons calculated as Oil (TPH-Oil), TPH-Gasoline, and TPH-Diesel according to EPA Method 8015 (Modified) and BTEX according to EPA Method 8020.

TPH-Gasoline was detected in soil samples collected from Borings S-12 at 5 feet (44 ppm) and 9.5 feet (33 ppm), S-13 at 6 feet (9,100 ppm) and 9 feet (250 ppm), and S-14 at 10 feet (34 ppm). Benzene concentrations were reported in soil samples from Borings S-12 at 5 feet (0.19 ppm) and 9.5 feet (0.14 ppm), S-13 at 6 feet (480 ppm) and 9 feet (10 ppm), and S-14 at 10 feet (0.61 ppm). TPH-Diesel was reported in soil samples from S-13 at 6 feet (3,300 ppm) and 9 feet (60 ppm). The soil sample from S-12 at 5 feet was reported as ND for TPH-Diesel. TPH-Oil was detected in soil samples from S-12 at 5 feet (4,000 ppm) and S-13 at 6 feet (11,000 ppm) and 9 feet (700 ppm). Conversations with IT Analytical Services indicate that tar paper present in samples submitted for analysis may have influenced chemical analytical results, particularly among high boiling petroleum hydrocarbons (i.e. Diesel and Oil). Soil analytical data are summarized on Table 2, and the IT Analytical Services certified analytical report is included in Appendix D.

7.2 Ground-water Analytical Results

Ground-water samples were collected by G-R on October 25 and November 17, 1989. The ground-water samples were analyzed for TPH-Gasoline according to EPA Method 8015 (Modified) and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) according to EPA Method 8020. Chemical analyses were performed by International Technology (IT) Analytical Services, a State-certified environmental laboratory located in San Jose, California. The G-R Ground-water Sampling Reports, Chain-of-Custody forms, and the IT Analytical Services certified analytical reports for ground-water sampling performed during the fourth quarter of 1989 are presented in Appendix B.

Detectable concentrations of TPH-Gasoline were identified in Wells S-5 (2.1 ppm), S-7 (6.2 ppm), S-8 (2.0 ppm), S-10 (4.2 ppm), and S-13 (1.9 ppm). Benzene was identified in Wells S-5 (0.76 ppm), S-6 (0.023 ppm), S-7 (2.2 ppm), S-8 (1.1 ppm), S-10 (0.58 ppm), S-12 (0.018 ppm), S-13 (0.70 ppm) and S-14 (0.003 ppm). The benzene concentration levels are above current Maximum Contaminant Levels (MCLs) set by the Regional Water Quality Control Board (RWQCB). Total Petroleum Hydrocarbons calculated as Diesel (TPH-Diesel) were identified in Wells S-12 (1.4 ppm), and S-13 (2.0 ppm). Total Petroleum Hydrocarbons calculated as Oil (TPH-Oil) were identified in Wells S-13 (5.0 ppm) and S-14 (3.0 ppm). These data are presented in Table 1. A TPH-Gasoline/Benzene Concentration Map (Plate 4) has been prepared using the October 25, 1989, and November 17, 1989 ground-water analytical data.

As shown on Plate 4, the hydrocarbon plume has not been adequately delineated. Additional field investigations will be required to evaluate the areal extent of hydrocarbon migration from the site.

7.3 Quality Control

Quality Control (QC) samples for the quarterly ground-water sampling performed on October 25, 1989 consisted of a field blank and a trip blank. The QC sample for the November 17, 1989 ground-water sampling was a trip blank. The field blank was prepared in the field using organic-free water provided by the IT laboratory to evaluate field sampling procedures and ambient site conditions. The trip blanks (TBs) were prepared by the IT laboratory using organic-free water to evaluate field and laboratory handling procedures. QC procedures during field sampling are summarized in the G-R Sampling Protocol presented in Appendix A.

All QC samples were reported as none detected (ND) for each ground-water sampling performed during the fourth quarter of 1989. Chemical analyses performed on the field blank and the two trip blanks did not detect any measurable concentrations of the targeted chemical parameters. The chemical analytical results indicate that proper field and laboratory handling techniques were followed and that no hydrocarbons were introduced into the samples during sampling, from ambient site conditions, or transport to IT Analytical Services.

8.0 SUMMARY

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

- Water levels were measured in selected wells and the data were used to construct a potentiometric map. Potentiometric data indicate that the shallow groundwater beneath the site flows to the south with an approximate hydraulic gradient of 0.004.

- A black viscous product was detected in Well S-9 during the quarterly sampling. The well was vacuum-pumped on November 28, 1989 and floating product apparently has not reappeared in this well through December 7, 1989 monitoring.

- The composition of encountered debris incorporated in the man-made fill may have influenced chemical results of collected soil samples from Boring S-12 through S-14. The presence of tar paper in soil samples is suspected to have an impact on detected high boiling hydrocarbons (i.e. Diesel and Oil) presence in soil.

- Three ground-water monitoring wells (S-12, S-13, and S-14) were installed during this quarter.

- TPH-Gasoline concentrations were reported in soil samples from S-12 at 5 feet (44 ppm) and 9.5 feet (33 ppm), S-13 at 6 feet (9,100 ppm) and 9 feet (250 ppm), and S-14 at 10 feet (34 ppm).

- Benzene concentrations were reported in soil samples from S-12 at 5 feet (0.19 ppm) and 9.5 feet (0.14 ppm), S-13 at 6 feet (480 ppm) and 9 feet (10 ppm), and S-14 at 10 feet (0.61 ppm).

- TPH-Diesel concentrations were reported in soil samples from S-13 at 6 feet (3,300 ppm) and 9 feet (60 ppm). The soil sample from S-12 at 5 feet was reported as ND.

- TPH-Oil concentrations were reported in soil samples from S-12 at 5 feet (4,000 ppm), and S-13 at 6 feet (11,000 ppm) and 9 feet (700 ppm).

- TPH-Gasoline concentrations were reported as ND for ground-water samples from Wells S-6, S-12, and S-14. Detectable concentrations of TPH-Gasoline were reported in Wells S-5 (2.1 ppm), S-7 (6.2 ppm), S-8 (2.0 ppm), S-10 (4.2 ppm), and S-13 (1.9 ppm).

- Detectable concentrations of benzene were reported in Wells S-5 (0.76 ppm), S-6 (0.023 ppm), S-7 (2.2 ppm), S-8 (1.1 ppm), S-10 (0.58 ppm), S-12 (0.018 ppm), S-13 (0.70 ppm), and S-14 (0.003 ppm). These concentrations are above current RWQCB MCLs.

- TPH-Diesel concentrations were reported as ND for ground-water samples from Well S-14. Detectable concentrations of TPH-Diesel were reported in Wells S-12 (1.4 ppm) and S-13 (2.0 ppm).

- TPH-Oil concentrations were reported in Wells S-13 and S-14 at concentrations of 5.0 ppm and 3.0 ppm, respectively.

- The hydrocarbon plume has not been adequately delineated. Additional field investigations will be required to evaluate the vertical and areal extent of hydrocarbon migration from the site.

9.0 PLANNED SITE ACTIVITIES

The following activities are planned for the first quarter, January 1 to March 31, 1990:

- o Perform the in-situ groundwater sampling outlined in the October 27, 1989 work plan prepared by GSI, upon receipt of right-of-entry from adjacent property owners.

- o All scheduled wells will be sampled and analyzed for TPH-Gasoline and TPH-Diesel according to EPA Method 8015 (Modified) and BTEX according to EPA Method 8020.

- o Water levels will be measured monthly and selected data will be used to prepare a potentiometric map across the site. The local shallow ground-water gradient will be calculated.

- o Ground-water chemical data will be used to construct isoconcentration maps for TPH-Gasoline, benzene, and TPH-Diesel. The areal extent of hydrocarbons will be evaluated based on these data.

- o Conduct a review of historical land uses to identify potential contaminant sources possibly related to the fill material composition (i.e. incorporated refuse).

References Cited

Gettler-Ryan Inc., 1988, Groundwater Sampling Report: Report No. 83134-1, dated December 6, 1988.

GeoStrategies Inc., 1989, Quarterly Groundwater Sampling Report: Report No. 7605, dated April 14, 1989.

GeoStrategies Inc., 1989, Quarterly Groundwater Sampling Report: Report No. 7605-2, dated July 13, 1989.

GeoStrategies Inc., 1989, Interim Groundwater Sampling Report: Report No. 7605-3, dated October 10, 1989.

GeoStrategies Inc., 1989, Work Plan: Report No. 7605-4, October 27, 1989.

TABLE 1

GROUND-WATER ANALYSES DATA

WELL NO	SAMPLE DATE	ANALYSIS DATE	TPH (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)	TPH-D ** (PPM)	TPH-O ** (PPM)	WELL ELEV (FT)	STATIC WATER ELEV (FT)	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
S-5	25-Oct-89	01-Nov-89	2.1	0.76	0.01	0.04	0.05	N/A	N/A	11.72	4.10	----	7.62
S-6	25-Oct-89	01-Nov-89	<0.50	0.023	<0.005	<0.005	0.01	N/A	N/A	----	----	----	8.49
S-7	25-Oct-89	01-Nov-89	6.2	2.2	0.13	0.19	0.66	N/A	N/A	----	----	----	8.34
S-8	25-Oct-89	01-Nov-89	2.	1.1	0.017	0.005	0.07	N/A	N/A	12.76	4.50	----	8.26
S-9	25-Oct-89	----	----	----	----	----	----	N/A	N/A	12.75	----	---- *	---- *
S-10	25-Oct-89	03-Nov-89	4.2	0.58	0.034	0.044	0.44	N/A	N/A	12.58	5.57	----	7.01
S-12	17-Nov-89	22-Nov-89	<0.25	0.018	<0.002	<0.002	<0.005	1.4	N/A	12.84	3.71	----	9.13
S-13	17-Nov-89	22-Nov-89	1.9	0.70	0.16	0.07	0.34	2.0	5.	12.59	3.36	----	9.23

* Unable to measure depth and product thickness accurately

CURRENT REGIONAL WATER QUALITY CONTROL BOARD MAXIMUM CONTAMINANT LEVELS

Benzene 0.001 ppm Xylenes 1.750 ppm Ethylbenzene .680 ppm

CURRENT DHS ACTION LEVELS

Toluene 0.100 ppm

TPH-G = Total Petroleum Hydrocarbons as Gasoline
TPH-D = Total Petroleum Hydrocarbons as Diesel
PPM = Parts Per Million
SF = Field Blank
TB = Trip Blank
N/A = Not Analyzed
TPH-O = Total Petroleum Hydrocarbons as Oil

** See analytical reports for analysis dates

Note: 1. All data shown as <x are reported as ND (none detected)
2. Depth to Water measurements taken 25-Oct-89 and 17-Nov-89
3. Well S-9 contained floating product and was not sampled
4. Water level elevations referenced to mean sea level

Project No. 7605-5

TABLE 1

GROUND-WATER ANALYSES DATA

WELL NO	SAMPLE DATE	ANALYSIS DATE	TPH (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)	TPH-D ** (PPM)	TPH-O ** (PPM)	WELL ELEV (FT)	STATIC WATER ELEV (FT)	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
S-14	17-Nov-89	22-Nov-89	<0.25	0.003	<0.002	<0.002	<0.005	<0.4	3.	12.69	3.44	----	9.25
SF-8	25-Oct-89	01-Nov-89	<0.050	<0.0005	<0.0005	<0.0005	<0.001	N/A	N/A	----	----	----	----
TB	25-Oct-89	01-Nov-89	<0.050	<0.0005	<0.0005	<0.0005	<0.001	N/A	N/A	----	----	----	----
TB	17-Nov-89	22-Nov-89	<0.050	<0.0005	<0.0005	<0.0005	<0.001	<0.1	N/A	----	----	----	----

TABLE 2

SOIL ANALYSIS DATA

SAMPLE NO	SAMPLE DATE	ANALYSIS DATE	TPH-G (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)	TPH-D * (PPM)	TPH-O * (PPM)
S-12-5	08-Nov-89	16-Nov-89	44	0.19	0.042	<0.025	0.15	<200	4000
S-12-9.5	08-Nov-89	16-Nov-89	33	0.14	0.055	0.065	0.38	N/A	----
S-13-6	09-Nov-89	16-Nov-89	9100	480	200	230	900	3300	11000
S-13-9	09-Nov-89	16-Nov-89	250	10	5.6	6.5	25	60	700
S-14-10	08-Nov-89	16-Nov-89	34	0.61	0.033	<0.025	0.13	N/A	----

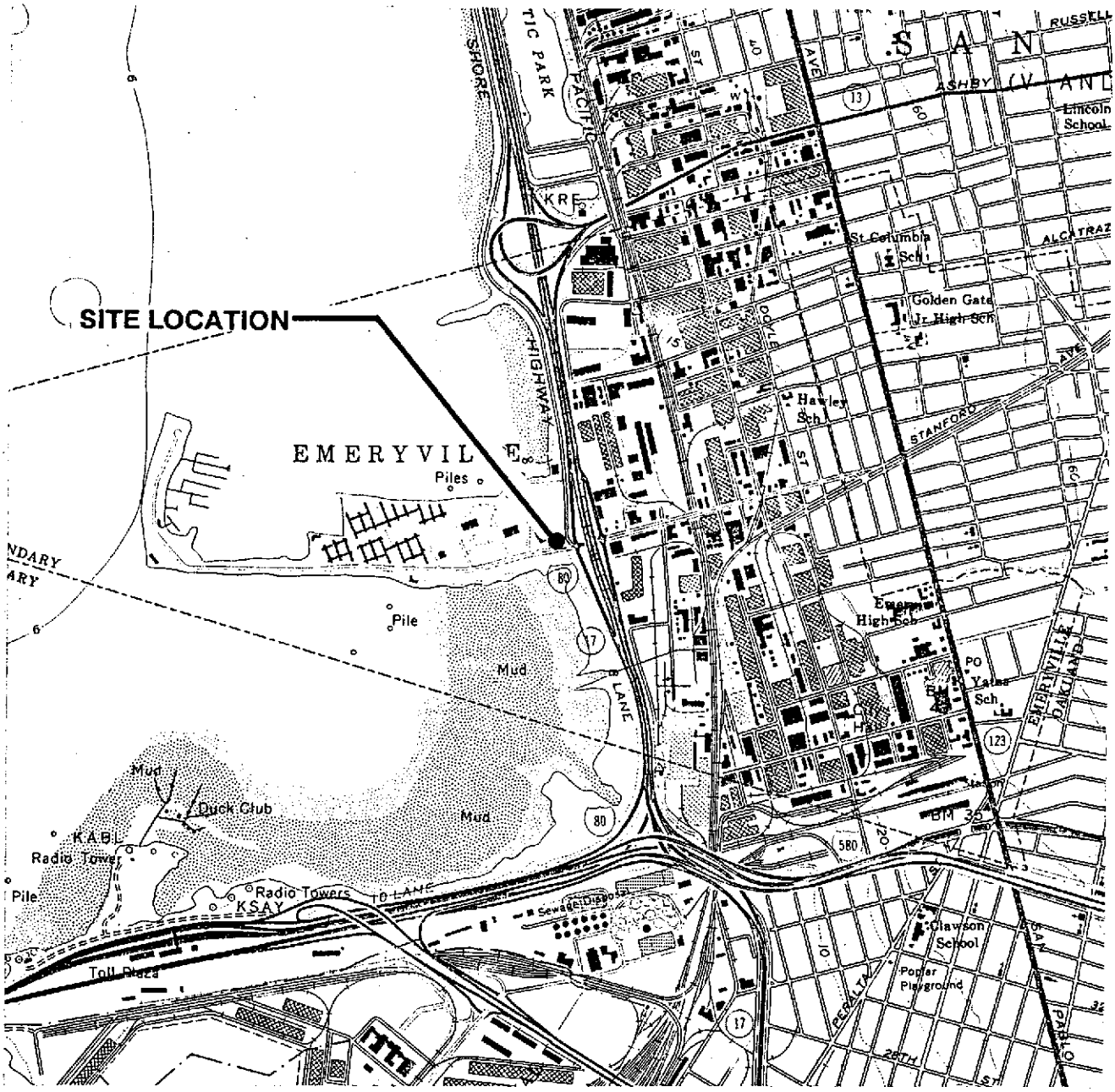
TPH-G = Total Petroleum Hydrocarbons as Gasoline
TPH-D = Total Petroleum Hydrocarbons as Diesel
TPH-O = Total Petroleum Hydrocarbons as Oil

PPM = Parts Per Million
N/A = Not Analyzed

* See Analytical Reports for analysis dates

Note: 1. All data shown as <x is reported as ND (none detected)

Project No. 7605-5



Base Map: USGS Topographic Map

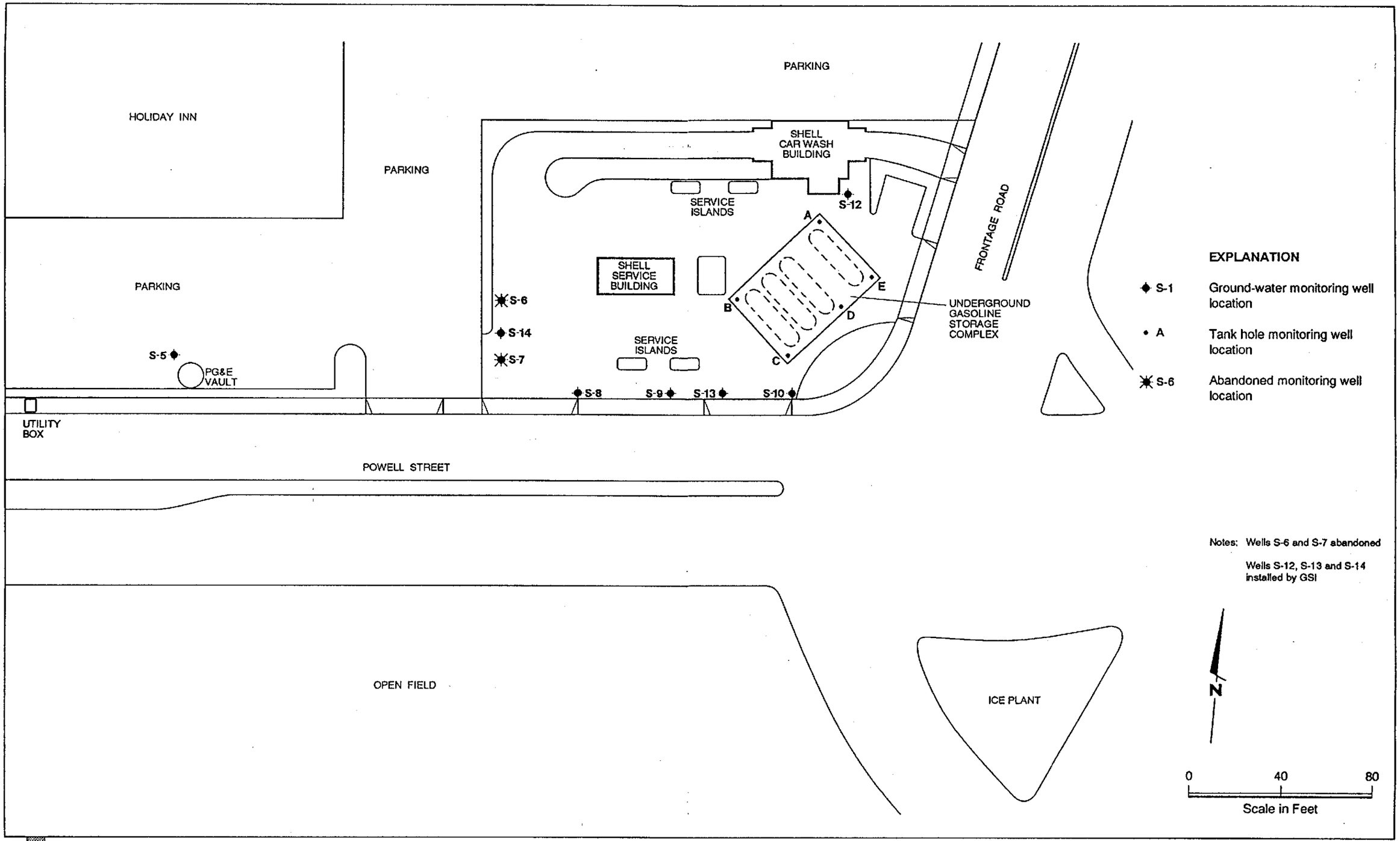
Approx. Scale: 1"=2000'

GeoStrategies Inc.

Vicinity Map
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE **1**

JOBNUMBER	REVIEWEDBYRG/CEG	DATE	REVISEDDATE	REVISEDDATE
7605		10/89		

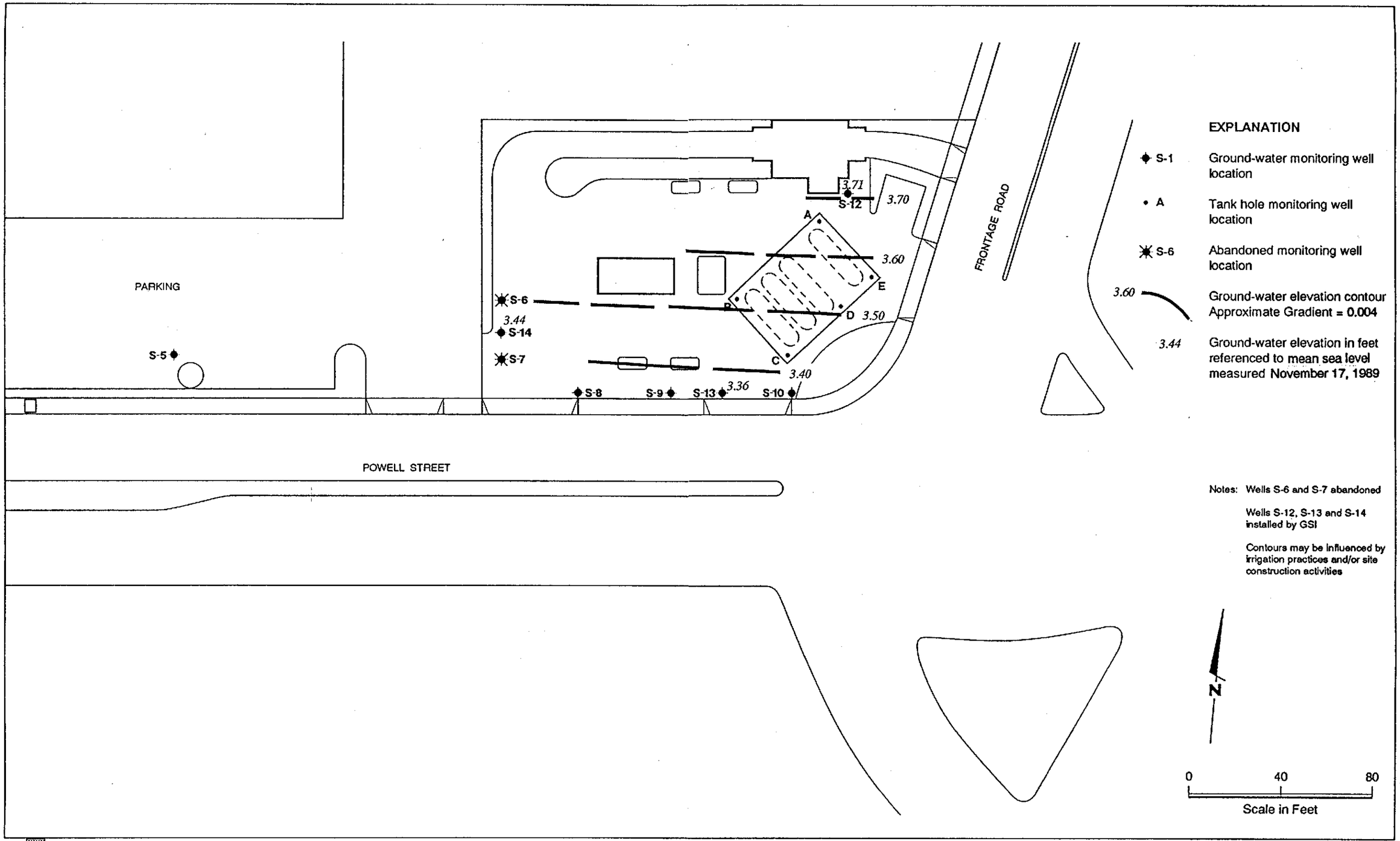


GeoStrategies Inc.

Site Plan
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE
2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CEG 1762	1/90		

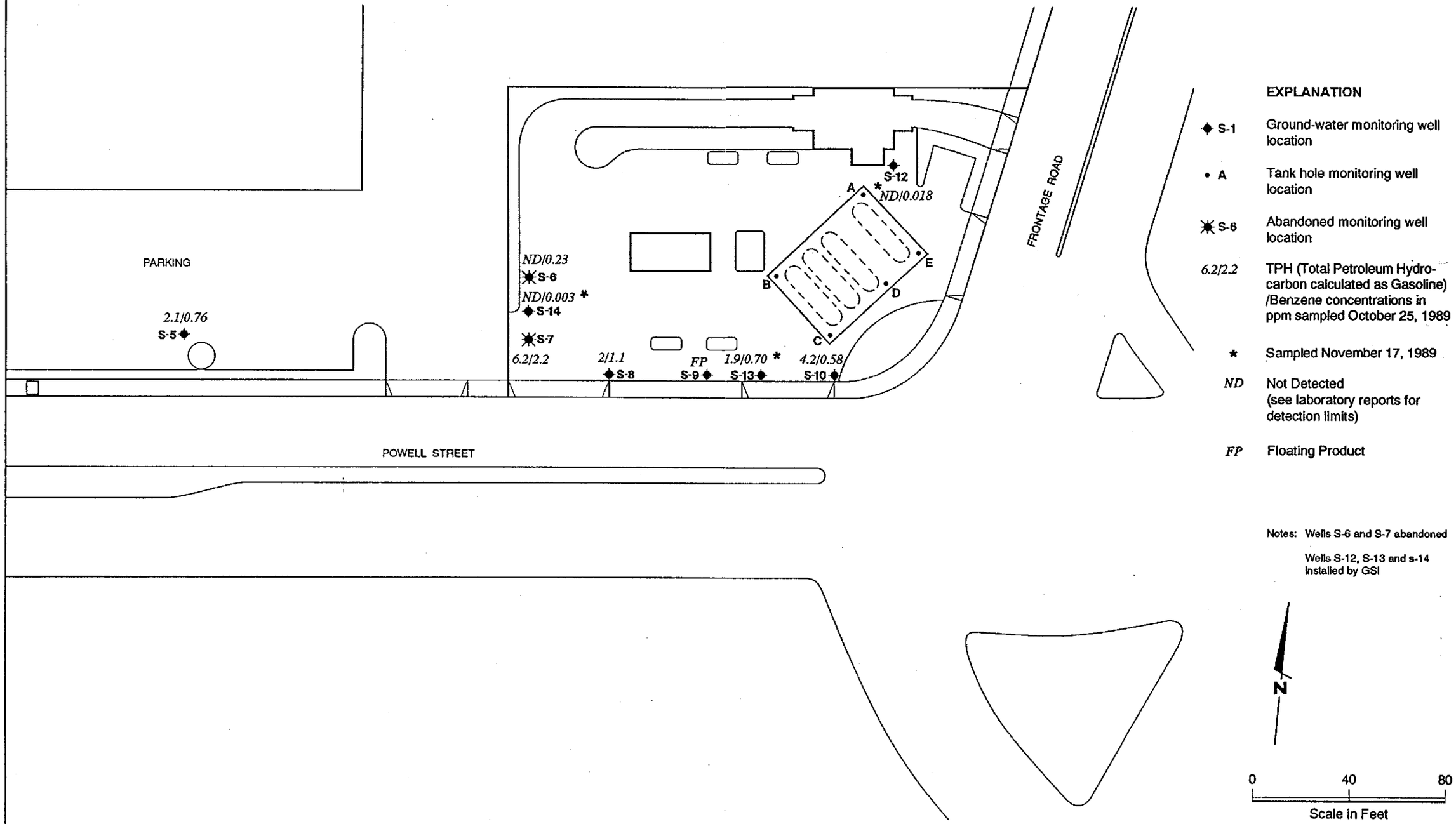


GeoStrategies Inc.

Potentiometric Map
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE **3**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CEG 1262	1/90		



GeoStrategies Inc.

TPH-G/Benzene Concentration Map
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE **4**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	RG CEG 1262	1/90		

APPENDIX A
FIELD METHODS AND PROCEDURES

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 ANALYSIS

Quality 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.

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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.

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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 centrifigal 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

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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.

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TABLE 1

SAMPLE ANALYSIS METHODS, CONTAINERS, PRESERVATIONS, AND HOLDING TIMES

Parameter	Analytical Method	Reporting Units	Container	Preservation	Maximum Holding Time
Total Petroleum Hydrocarbons (gasoline)	EPA 8015 (modified)	mg/l ug/l	40 ml. vial glass, Teflon	cool, 4 C HC1 to pH<2	14 days (maximum)
Benzene Toluene Ethylbenzene Xylenes (BTEX)	EPA 8020	mg/l ug/l mg/l	50 ml. vial glass, Teflon lined septum 1 l glass, Teflon	cool, 4 C HC1 to pH<2	7 days (w/o preservative) 14 days (w preservative)
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)
Halogented 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			

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FIELD EXPLORATORY BORING LOG

Field location of boring:

Project No.: | Date: | Boring No:

Client:

Location:

City: | Sheet

Logged by: | Driller: | of

Casing installation data:

Drilling method:

Hole diameter:

Top of Box Elevation: | Datum:

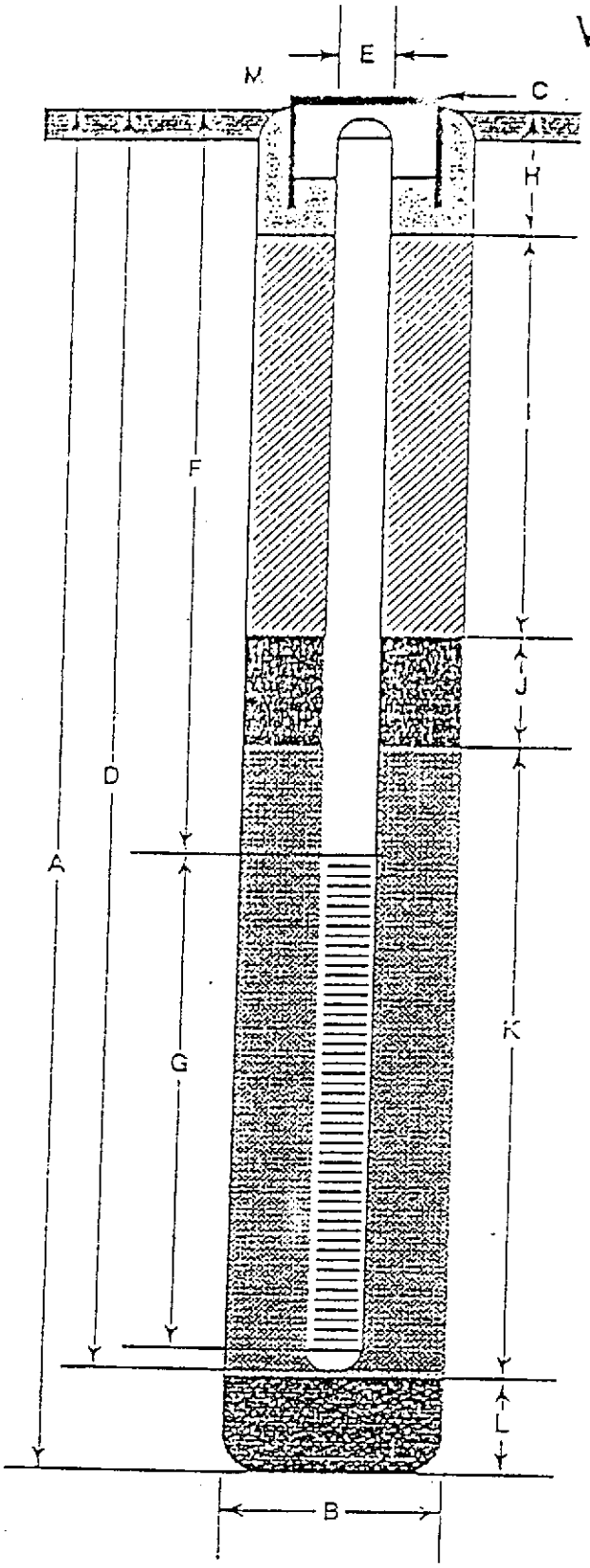
Water Level				
Time				
Date				

PID (ppm)	Blowct. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description

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

FIGURE 2

General and Environmental Contractors

WELL SAMPLING FIELD DATA SHEET

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 _____

FIGURE 3

Monitoring Well Sampling Protocol Schematic

Sampling Crew Reviews Project Sampling Requirments/Schedule

↓

Field Decontamination and Instrumentation Calibration

↓

Check Integrity of Well (Inspect for Well Damage)

↓

Measure and Record Depth to Water and Total Well Depth (Electric Well Sounder)

↓

Check for Floating Product (Oil/Water Interface Probe)

Floating Product Present

↓

Confirm Product Thickness (Acrylic or PVC Bailer)

↓

Collect Free-Product Sample

↓

Dissolved Product Sample Not Required

↓

Record Data on Field Data Form

Floating Product Not Present

↓

Purge Volume Calculation

$V = \pi(r/12)^2 h(\_\_\_\_ \text{ F vol})(7.48) = \_\_\_\_\_ \text{/gallons}$

V = Purge volume (gallons)
π = 3.14159
h = Height of Water Column (feet)
r = Borehole radius (inches)

↓

Evacuate water from well equal to the calculated purge volume while monitoring groundwater stabilization indicator parameters (pH, conductivity, temperature) at intervals of one casing volume.

Well Dewaters after One Purge Volume (Low yield well)

↓

Well Recharges to 80% of Initials Measured Water Column Height in Feet within 24 hrs. of Evacuation.

↓

Measure Groundwater Stability Indicator Parameters (pH, Temp., Conductivity)

↓

Collect Sample and Complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Anayltical Laboratory

Well Readily Recovers

↓

Record Groundwater Stability Indicator Paramters from each Additional Purge Volume

Stability indicated when the following criteria are met:

pH:	± 0.1 pH units
Conductivity:	± 10%
Temperature:	1.0 degree F

Groundwater Stability Achieved

↓

Collect Sample and Complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Analytical Laboratory

Groundwater Stability Not Achieved

↓

Continue Purging Until Stability is Achieved

↓

Collect Sample and Complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Analytical Laboratory

FIGURE 4

Gettler - Ryan Inc.
ENVIRONMENTAL DIVISION

Chain of Custod

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

ELINQUISHED BY: _____ RECEIVED BY: _____

ELINQUISHED BY: _____ RECEIVED BY: _____

ELINQUISHED BY: _____ RECEIVED BY LAB: _____

ESIGNATED LABORATORY: _____ DHS #: _____

MARKS: _____

TE COMPLETED _____ FOREMAN _____

FIGURE 5

APPENDIX B
GROUND-WATER SAMPLING REPORTS

November 10, 1989

GROUNDWATER SAMPLING REPORT

Referenced Site: Shell Service Station
1800 Powell Street
Emeryville, California

Sampling Date: October 25, 1989

This report presents the results of the quarterly groundwater sampling and analytical program conducted by Gettler-Ryan Inc. on October 25, 1989 at the referenced location. The site is occupied by an operating service station located on the northwest corner of Powell Street and I-80. The service station has underground storage tanks containing regular leaded, unleaded and super unleaded gasoline products and diesel.

There are currently six groundwater monitoring wells and five tank backfill wells on site at the locations shown on the attached site map. Groundwater samples were not collected from the tank backfill wells. Prior to sampling, all monitoring 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 7.01 to 8.49 feet below grade. Separate phase product was observed in well S-9.

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 field blank (SF-8) and trip blank, supplied by the laboratory, were included and analyzed to assess quality control. Analytical results for the blanks are included in the Certified Analytical Report (CAR's). Chain of custody records were established noting sample identification numbers, time, date, and custody signatures.

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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

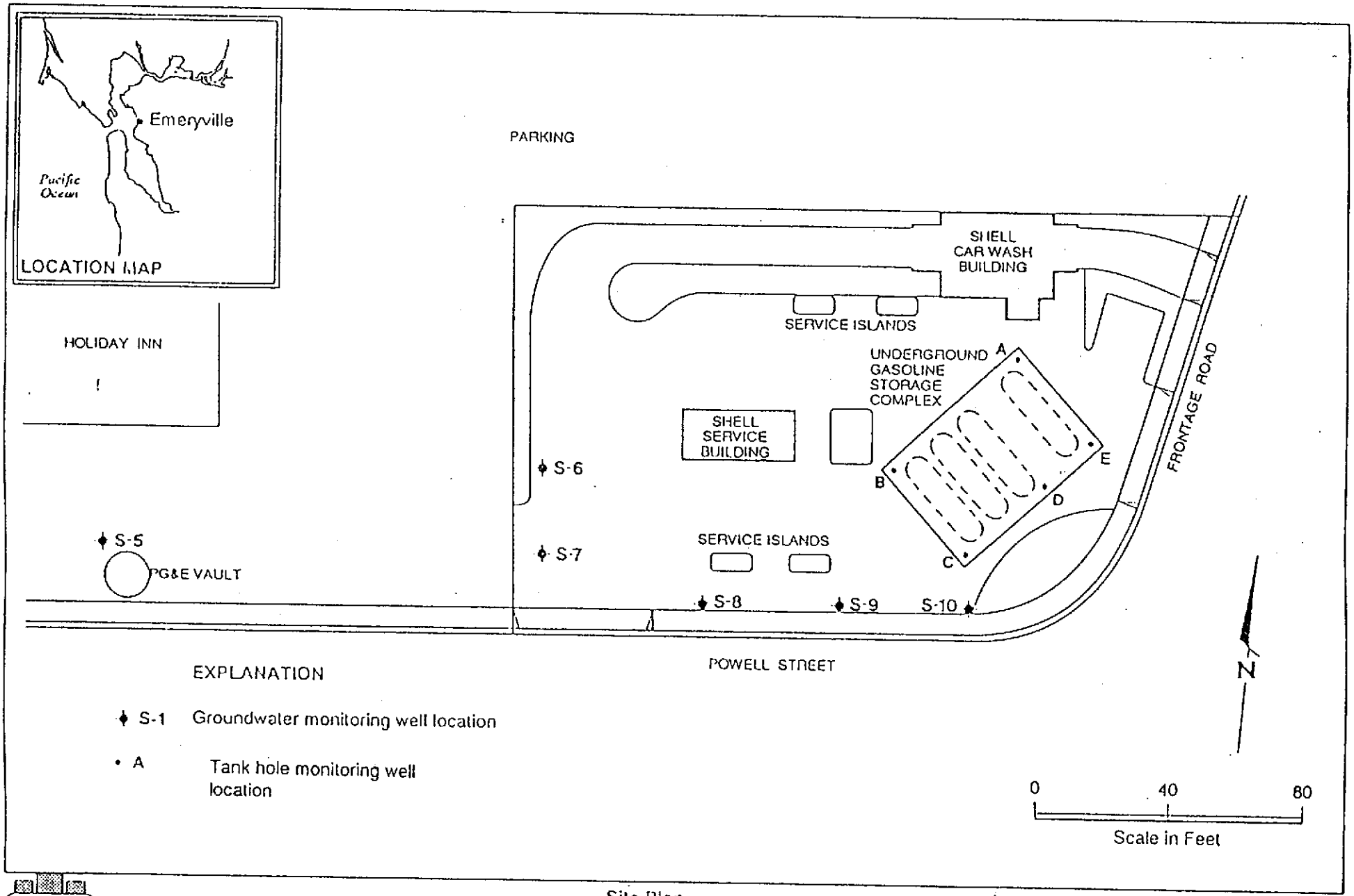
attachments

TABLE OF MONITORING DATA
GROUNDWATER WELL SAMPLING REPORT

WELL I.D.	S-5	S-6	S-7	S-8	S-9	S-10
Casing Diameter (inches)	6	6	6	3	----	6
Total Well Depth (feet)	12.2	16.3	11.9	19.4	----	19.4
Depth to Water (feet)	7.62	8.49	8.34	8.26	----**	7.01
Free Product (feet)	none	none	sheen	none	----**	none
Reason Not Sampled	----	----	----	----	free product	----
Calculated 4 Case Vol.(gal.)	27.6	46.4	21.2	16.8	----	74.3
Did Well Dewater?	no	no	no	yes	----	yes
Volume Evacuated (gal.)	37	61	29	19	----	21.0
Purging Device	Suction	Suction	Suction	Suction	----	Suction
Sampling Device	Bailer	Bailer	Bailer	Bailer	----	Bailer
Time	10:00	11:20	10:46	12:10	----	12:25
Temperature (F)*	74.4	69.3	74.1	75.2	----	71.2
pH*	6.61	6.47	6.46	6.92	----	6.83
Conductivity (umhos/cm)*	2780	3720	3280	7710	----	1404

* Indicates Stabilized Value

** Black tarry substance found in well, unable to measure accurately



GeoStrategies Inc.

Site Plan
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE 1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
605		7/89		

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

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

Date: November 7, 1989

Work Order Number: S9-10-333

P.O. Number: MOH 890501A

This is the Certificate of Analysis for the following samples:

Client Project ID:	GR #3605, Shell, 1800 Powell St., Emeryville, CA
Date Received by Lab:	10/27/89
Number of Samples:	7
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

Michael E. Dean
Project Manager

MED/tw
1 Page Following - Table of Results

Date: November 7, 1989
Client Project ID:GR #3605, Shell, 1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number:
S9-10-333

Lab Sample ID	Client Sample ID	Sample Date	Date Analysis Completed	Sample Condition on Receipt
S9-10-333-01	S-5	10/25/89	11/01/89	Cool, pH≤2
S9-10-333-02	S-6	10/25/89	11/01/89	Cool, pH≤2
S9-10-333-03	S-7	10/25/89	11/01/89	Cool, pH≤2
S9-10-333-04	S-8	10/25/89	11/01/89	Cool, pH≤2
S9-10-333-05	S-10	10/25/89	11/03/89	Cool, pH≤2
S9-10-333-06	SF-8	10/25/89	11/01/89	Cool, pH≤2
S9-10-333-07	Trip Blank	----	11/01/89	Cool, pH≤2

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

ND = None Detected

Results - Milligrams per Liter

Lab Sample ID	Client Sample ID	Low Boiling Hydrocarbons (calculated as Gasoline)	Benzene	Toluene	Ethyl Benzene	Xylenes (total)
S9-10-333-01*	S-5	2.1	0.76	0.01	0.04	0.05
Detection Limit		1.0	0.01	0.01	0.01	0.02
S9-10-333-02*	S-6	ND	0.023	ND	ND	0.01
Detection Limit		0.50	0.005	0.005	0.005	0.01
S9-10-333-03*	S-7	6.2	2.2	0.13	0.19	0.66
Detection Limit		0.50	0.005	0.005	0.005	0.01
S9-10-333-04*	S-8	2.0	1.1	0.017	0.005	0.07
Detection Limit		0.50	0.005	0.005	0.005	0.01
S9-10-333-05*	S-10	4.2	0.58	0.034	0.044	0.44
Detection Limit		0.50	0.005	0.005	0.005	0.01
S9-10-333-06	SF-8	ND	ND	ND	ND	ND
Detection Limit		0.050	0.0005	0.0005	0.0005	0.001
S9-10-333-07	Trip Blank	ND	ND	ND	ND	ND
Detection Limit		0.050	0.0005	0.0005	0.0005	0.001

*Sensitivity of analysis is limited by foamy matrix.

Geotler - Ryan Inc. ENVIRONMENTAL DIVISION — 0727 **Chain of Custody**

COMPANY Shell Oil Co. JOB NO.

JOB LOCATION 1800 Powell St-

CITY Emeryville CA PHONE NO (415) 787-7500

AUTHORIZED John Uterfal DATE 10-25-89 P.O. NO. 3605

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID
S-5	3	Liquid	10-25-89 / 10:00	TPH (Gas) BTXE	OK / cool
S-6			/ 11:20		
S-7			/ 10:46		
S-8			/ 12:10		
S-10			/ 12:25		
SF-8			/ 12:10		
trip blank	1		10-19-89 / —		

RELINQUISHED BY: Guadalupe Sandy 10-26-89

RECEIVED BY: 02:CC 10-26-89

RELINQUISHED BY: 10-27-89 17:00

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY LAB: 10/27/89 1300

DESIGNATED LABORATORY: IT SCV DHS #: 137

REMARKS:

Normal TAT Results due

DATE COMPLETED 10-25-89 Sampler FOREMAN G. Sanchez

ORIGINAL

gettler — ryan inc.

December 7, 1989

GROUNDWATER SAMPLING REPORT

Referenced Site: Shell Service Station
1800 Powell Street
Emeryville, California

Sampling Date: November 17, 1989

This report presents the results of the quarterly groundwater sampling and analytical program conducted by Gettler-Ryan Inc. on November 17, 1989 at the referenced location. The site is occupied by an operating service station located on the northwest corner of Powell Street and I-80. The service station has underground storage tanks containing regular leaded, unleaded and super unleaded gasoline products and diesel.

There are currently six groundwater monitoring wells and five tank backfill wells on site at the locations shown on the attached site map. Newly installed wells S-12, S-13 and S-14 were monitored, developed and sampled during this event. Prior to sampling, monitoring wells S-12, S-13 and S-14 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 9.13 to 9.25 feet below grade. Separate phase product was not observed in any monitoring wells.

The wells were then 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. 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.

1992 national avenue • hayward, california 94545-1787 • (415) 783-7500

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.

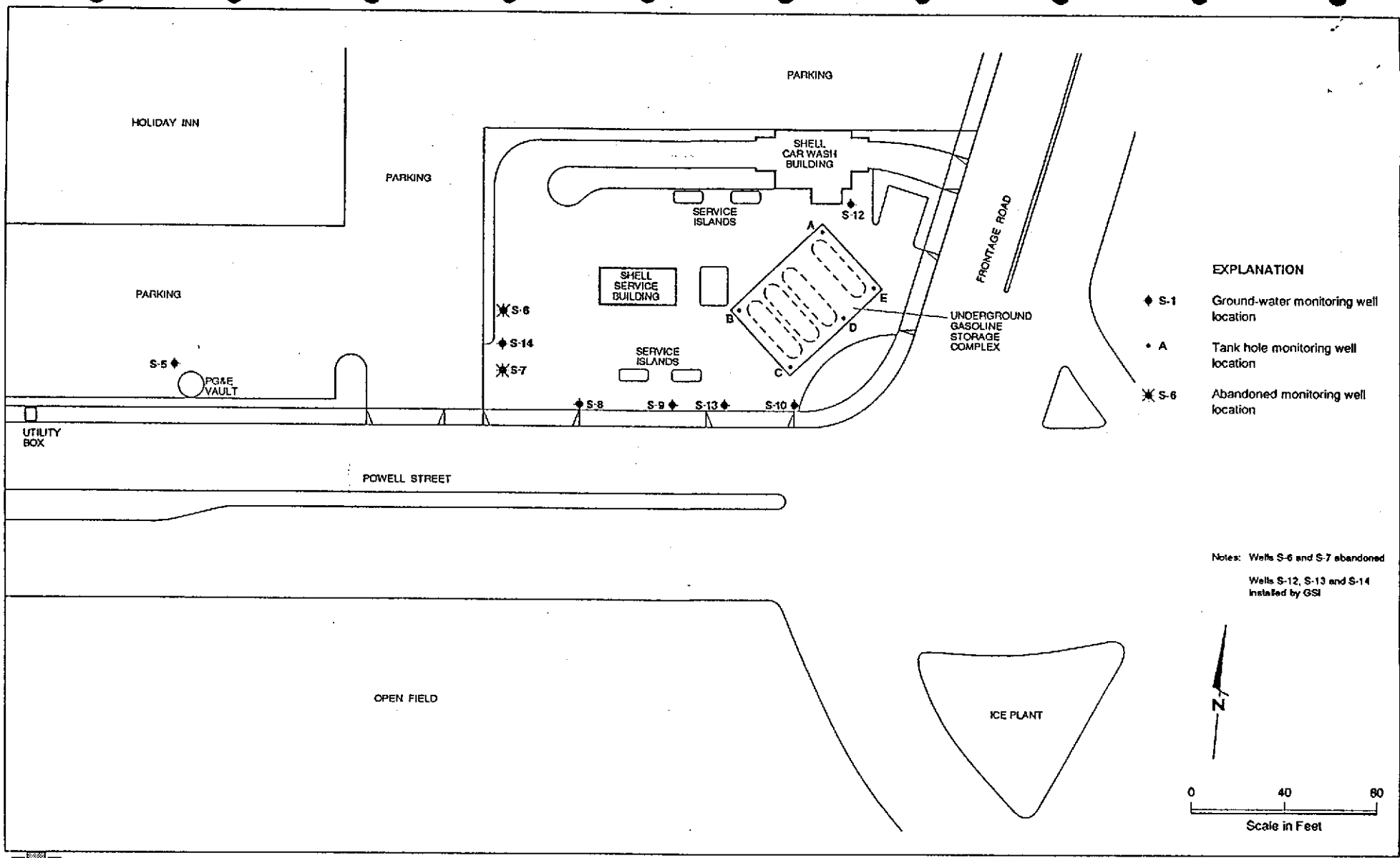
Tom Paulson
Sampling Manager

attachments

TABLE OF MONITORING DATA
GROUNDWATER WELL SAMPLING REPORT

WELL I.D.	S-12	S-13	S-14
Casing Diameter (inches)	3	3	3
Total Well Depth (feet)	24.4	19.5	23.9
Depth to Water (feet)	9.13	9.23	9.25
Free Product (feet)	none	none	none
Reason Not Sampled	----	----	----
Calculated 4 Case Vol.(gal.)	23.2	15.6	22.3
Did Well Dewater?	no	no	no
Volume Evacuated (gal.)	36	16	57
Purging Device	Suction	Suction	Suction
Sampling Device	Bailer	Bailer	Bailer
Time	10:28	11:30	12:35
Temperature (F)*	69.2	70.5	68.5
pH*	5.97	6.98	6.88
Conductivity (umhos/cm)*	8110	15050	12410

* Indicates Stabilized Value



GeoStrategies Inc.

Site Plan
Shell Service Station
1800 Powell Street
Emeryville, California

PLATE 2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
7605	RO/CEG	11/89		

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

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

Date: December 7, 1989

Work Order Number: S9-11-248

P.O. Number: MOH 890501A

This is the Certificate of Analysis for the following samples:

Client Project ID:	GR #3605, Shell, 1800 Powell St., Emeryville, CA
Date Received by Lab:	11/17/89
Number of Samples:	4
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.

The method of analysis for high boiling hydrocarbons involves extracting the samples with solvent and examining the extracts by gas chromatography using a flame ionization detector.

Reviewed and Approved

Michael E. Dean
Project Manager

MED/tw
4 Pages Following - Tables of Results

Date: December 7, 1989
Client Project ID: GR #3605, Shell, 1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number:
S9-11-248

Client Sample ID: S-12

Sample Date: 11/17/89
Lab Sample ID: S9-11-248-01
Receipt Condition: Cool, pH≤2
High Boiling Extraction Date: 11/21/89
Low Boiling Analysis Date: 11/22/89
High Boiling Analysis Date: 11/21/89

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

Results - Milligrams per Liter

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	0.25	None
Benzene	0.002	0.018
Toluene	0.002	None
Ethyl Benzene	0.002	None
Xylenes (total)	0.005	None
High Boiling Hydrocarbons, calculated as Diesel	0.1	1.4*

*Chromatographic pattern of compounds detected and calculated as diesel does not match that of the diesel standard used for calibration.

Date: December 7, 1989
Client Project ID: GR #3605, Shell, 1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number:
S9-11-248

Client Sample ID: S-13

Sample Date: 11/17/89
Lab Sample ID: S9-11-248-02
Receipt Condition: Cool, pH≤6
High Boiling Extraction Date: 11/21/89
Low Boiling Analysis Date: 11/22/89
High Boiling Analysis Date: 11/27/89

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

Results - Milligrams per Liter

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	1.0	1.9
Benzene	0.01	0.70
Toluene	0.01	0.16
Ethyl Benzene	0.01	0.07
Xylenes (total)	0.02	0.34
High Boiling Hydrocarbons, calculated as Diesel	0.3	2.0*
High Boiling Hydrocarbons, calculated as Oil	2.	5.

*Compounds detected and calculated as diesel appear to be the less volatile constituents of gasoline.

Date: December 7, 1989
Client Project ID: GR #3605, Shell, 1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number:
S9-11-248

Client Sample ID: S-14

Sample Date: 11/17/89
Lab Sample ID: S9-11-248-03
Receipt Condition: Cool, pH≤2
High Boiling Extraction Date: 11/21/89
Low Boiling Analysis Date: 11/22/89
High Boiling Analysis Date: 11/28/89

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

Results - Milligrams per Liter

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	0.25	None
Benzene	0.002	0.003
Toluene	0.002	None
Ethyl Benzene	0.002	None
Xylenes (total)	0.005	None
High Boiling Hydrocarbons, calculated as Diesel	0.4	None
High Boiling Hydrocarbons, calculated as Oil	1.	3.

Date: December 7, 1989
Client Project ID: GR #3605, Shell, 1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number:
S9-11-248

Client Sample ID: Trip Blank

Sample Date: ----
Lab Sample ID: S9-11-248-04
Receipt Condition: Cool, pH≤2
High Boiling Extraction Date: 11/21/89
Low Boiling Analysis Date: 11/22/89
High Boiling Analysis Date: 11/22/89

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

Results - Milligrams per Liter

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	0.050	None
Benzene	0.0005	None
Toluene	0.0005	None
Ethyl Benzene	0.0005	None
Xylenes (total)	0.001	None
High Boiling Hydrocarbons, calculated as Diesel	0.1	None

Gettler - Ryan Inc. ENVIRONMENTAL DIVISION 89-11-298 0881 Chain of Custody

COMPANY Shell Oil Co. JOB NO.

JOB LOCATION 1800 Powell St

CITY Emeryville, CA PHONE NO. 783-7500

AUTHORIZED John Werfal DATE 11-17-89 P.O. NO. 3605

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID
S-12	5	liquid	11-17-89 10:28	THC (gas) BTXE, TPH gas Diesel	OK/Buddos
S-13	5		11:30		
S-14	5		12:35		
Trip Blank	2		11-13-89 11-2-89		

RELINQUISHED BY: John P. Zwerneff 14:11 11-17-89 RECEIVED BY:

RELINQUISHED BY: RECEIVED BY:

RELINQUISHED BY: RECEIVED BY LAB: Julie Clifford 11/17/89 14:20

DESIGNATED LABORATORY: IT (SCV) DHS #: 137

REMARKS: Wic # 204-2495-0101 Afe # 986608

Exp Code 5440

DATE COMPLETED 11-17-89 FOREMAN John P. Zwerneff

ORIGINAL

APPENDIX C
EXPLORATORY BORING LOGS
WELL CONSTRUCTION DETAILS

Field location of boring:	Project No.: 7605	Date: 11/08/89	Boring No:
(See Plate 2)	Client: Shell Oil Company		S-12
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 1
	Logged by: J. Vargas	Driller: Bayland	of 2
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter: 8-Inches - Reamed to 12-Inches	Top of Box Elevation: 12.84		Datum: MSL

Water Level	9 feet			
Time	8:30			
Date	11/09/89			

PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 1.6 feet
				1				
				2				FILL - Clayey Sand with Gravel (SC) - very dark gray (5Y 3/1), loose, damp; 35% fine to coarse sand; 25% fine to
				3				coarse gravel; 40% clay; trace construction debris;
								cobbles; moderate chemical odor.
				4				
	100	S&H						
25	100	push	S12-5	5				Tar Paper at 4.5 feet
	150							Increased sand to 55%; moderate chemical odor.
				6				
				7				
				8				
	500	S&H *		9		▼		
	14							Refuse and tar paper at 9.0 feet; medium dense; weak
17	12		S12-9.5	10				chemical odor.
				11		▽		Faster drilling at 11.0 feet.
								Groundwater encountered at 11.0 feet.
				12				
				13				
				14				
14.5	5	S&H	S12-14					refuse; weak chemical odor.
	5			15				
	7							
				16				
								becoming loose at 16 feet.
				17				
				18				
				19				

Remarks: * Soil sample pushed first 6 inches, driven next 12 inches.

GeoStrategies Inc.

Log of Boring

BORING NO.

S-12

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	11/89		

Field location of boring:	Project No.: 7605	Date: 11/08/89	Boring No:
(See Plate 2)	Client: Shell Oil Company		S-12
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 2
	Logged by: J. Vargas	Driller: Bayland	of 2
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter: 8-Inches - Reamed to 12-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
NS	2	S&H	S12-19					
	2			20				CLAYEY SAND (SC) - dark gray (5Y 4/1), loose, saturated; 80% fine to medium sand; 20% clay; no chemical odor.
	4							
				21				
				22				
				23				CLAY with SAND (CL) - dark greenish gray (5G 4/1), stiff, damp; 80% clay; 20% fine to coarse sand; medium plasticity; no chemical odor.
				24				
	2	S&H						
	6			25				
1.3	6		S12-25					
				26				
				27				
	6	S&H		28				COLOR CHANGE to olive yellow (2.5Y 6/6), very stiff, damp; no chemical odor.
1.6	12		S12-					
	14		28.5	29				
								Bottom of boring at 29.0 feet.
				30				Bottom of sample at 29.0 feet.
				31				
				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				

Remarks:

GeoStrategies Inc.

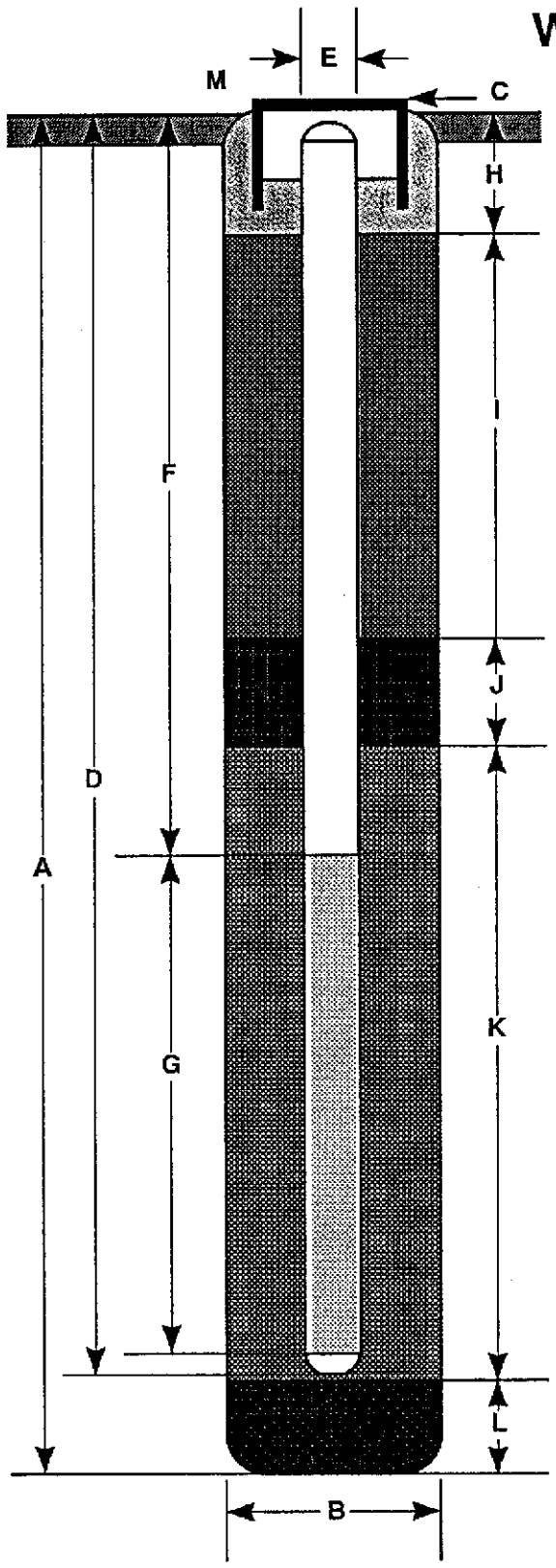
Log of Boring

BORING NO.

S-12

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	RMP CEG 1262	11/89		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 29.0 ft.

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

C Top of Box Elevation 12.84 ft.
[X] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length 24 ft.
Material Schedule 40 PVC

E Casing Diameter 3 in.

F Depth to Top Perforations 9 ft.

G Perforated Length 15 ft.
Perforated Interval from 9 to 24 ft.
Perforation Type Machine Slot
Perforation Size 0.02 in.

H Surface Seal from 0 to 0.5 ft.
Seal Material Concrete

I Backfill from 0.5 to 5 ft.
Backfill Material Cement Grout

J Seal from 5 to 7 ft.
Seal Material Bentonite

K Gravel Pack from 7 to 24 ft.
Pack Material Lonestar 2/12 Sand

L Bottom Seal 5 ft.
Seal Material Native Soil

M Christy Box with locking well cap and lock.

Note: Depths measured from initial ground surface.

GeoStrategies Inc.

Well Construction Detail

WELL NO.
S-12

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	11/89		

Field location of boring:

(See Plate 2)

Project No.: 7605	Date: 11/09/89	Boring No: S-13	
Client: Shell Oil Company			
Location: 1800 Powell Street			
City: Emeryville, California		Sheet 1 of 2	
Logged by: J. Vargas	Driller: Bayland		

Drilling method: Hollow-Stem Auger

Hole diameter: 8-Inches

Casing installation data:

Top of Box Elevation: 12.59 Datum: MSL

Water Level	7.25 feet			
Time	11:30			
Date	11/09/89			

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 - 1.7 feet
				2				FILL - Clayey Sand with Gravel (SC) - olive gray (5Y 4/3), loose, damp; 45% fine to coarse sand; 25% clay; 20% fine to coarse gravel; trace cobbles and boulders; construction debris; moderate chemical odor.
				3				
				4				
				5				
	100	S&H		6				refuse and tar paper at 6.0 feet
78	150	push	S13-					
	150		6.0	7				SAND (SP) - olive (5Y 4/3), loose, damp; 100% fine sand; moderate chemical odor.
				8				
	100	S&H	S13-	9				
93	100	push	9.0					color change to black (5Y 2.5/2), saturated at 9.0 feet; strong chemical odor.
				10				
				11				sample refusal at 9.5 feet. concrete boulder at 9.5 feet.
				12				
				13				
				14				CLAYEY SAND (SC) - dark olive gray (5Y 3/2), loose, saturated; 60% fine to medium sand; 40% clay; weak chemical odor.
	4	S&H		15				
90	2		S13-					
	2		15	16				
				17				
				18				SAND (SP) - dark olive gray (5Y 3/2), loose, saturated; 95% fine sand; 5% clay; trace shells; no chemical odor.
				19				

Remarks:

GeoStrategies Inc.

Log of Boring

BORING NO. S-13

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CWP CEG 1262	11/89		

Field location of boring:

(See Plate 2)

Project No.:	7605	Date: 11/09/89	Boring No: S-13
Client:	Shell Oil Company		
Location:	1800 Powell Street		
City:	Emeryville, California		Sheet 2 of 2
Logged by:	J. Vargas	Driller: Bayland	

Drilling method: Hollow-Stem Auger

Hole diameter: 8-Inches

Casing installation data:

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
	1	S&H	S13-					
	2		19.5	20				
3.9	1		S13-20					CLAY (CH) - dark greenish gray (5BG 4/1), very soft, damp; trace roots; black organics; strong organic odor; no chemical odor.
				21				
				22				
								Bottom of boring at 20.5 feet.
				23				Bottom of sample at 20.5 feet.
				24				
				25				
				26				
				27				
				28				
				29				
				30				
				31				
				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				

Remarks:

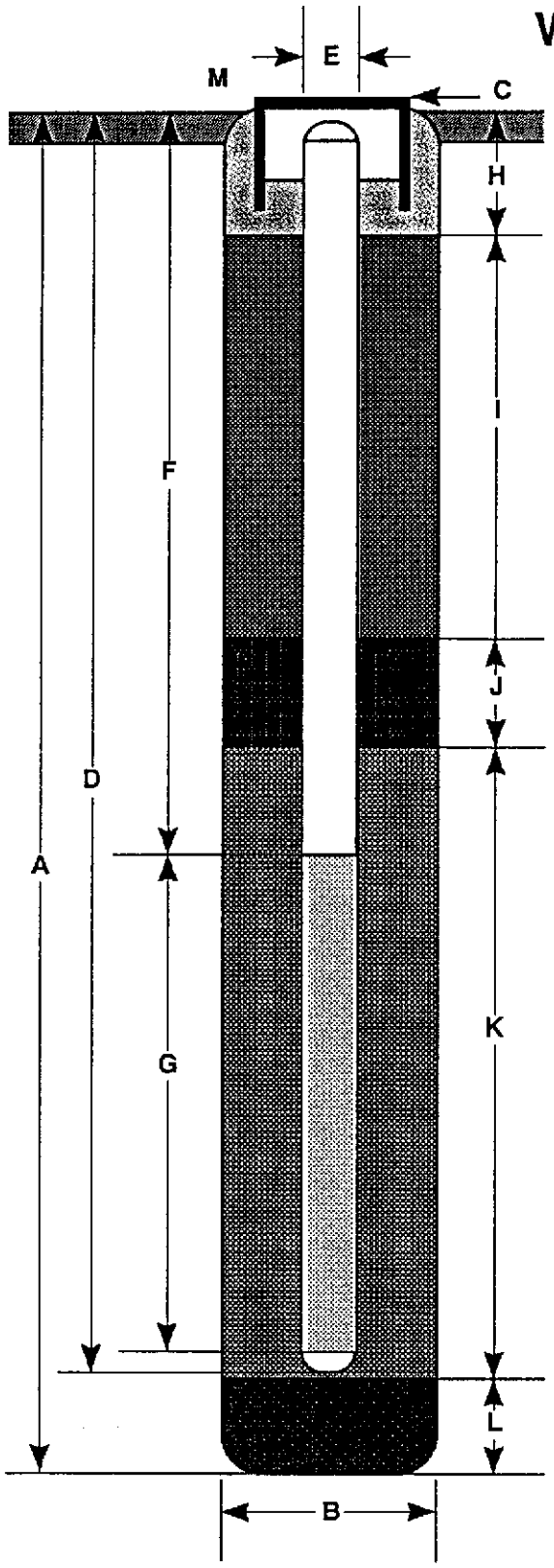
GeoStrategies Inc.

Log of Boring

BORING NO. S-13

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CWP CEG 1262	11/89		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring: 20.5 ft.

B Diameter of Boring: 8 in.
Drilling Method: Hollow-Stem Auger

C Top of Box Elevation: 12.59 ft.
[X] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length: 20.5 ft.
Material: Schedule 40 PVC

E Casing Diameter: 3 in.

F Depth to Top Perforations: 7 ft.

G Perforated Length: 13.5 ft.
Perforated Interval from 7 to 20.5 ft.
Perforation Type: Machine Slot
Perforation Size: 0.02 in.

H Surface Seal from 0 to 0.5 ft.
Seal Material: Concrete

I Backfill from 0.5 to 4 ft.
Backfill Material: Cement Grout

J Seal from 4 to 5 ft.
Seal Material: Bentonite

K Gravel Pack from 5 to 20.5 ft.
Pack Material: Lonestar 2/12 Sand

L Bottom Seal: N/A ft.
Seal Material: N/A

M Christy Box with locking well cap and lock.

Note: Depths measured from initial ground surface.

GeoStrategies Inc.

Well Construction Detail

WELL NO. S-13

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CWP CEG 1262	11/89		

Field location of boring: (See Plate 2)	Project No.: 7605	Date: 11/08/89	Boring No: S-14
	Client: Shell Oil Company		
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 1 of 2
	Logged by: J. Vargas	Driller: Bayland	
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter: 8-Inches - Reamed with 12-Inches	Top of Box Elevation: 12.69		Datum: MSL

Water Level	9.25 feet	
Time	8:30	
Date	11/09/89	

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 - 2 feet
5.6				2				
1.6				3				Perched water at 2.0 feet (saturated)
				4				FILL - Clayey Sand with Gravel (SC) - olive (5Y 4/3), loose, saturated; 40% fine to coarse gravel; 20% clay; trace boulders; moderate chemical odor.
NS	NS	S&H push		5				
				6				
				7				
				8				
	11	S&H		9				
	21							refuse and tar paper; damp at 9.0 feet; moderate chemical odor.
25.5	22		S14-10	10				
				11				
				12				
				13				
				14				
	13	S&H	S14-					
	15		14.5	15				saturated; weak chemical odor.
4.9	13		S14-15					
				16				
				17				
				18				
				19				

Remarks:

GeoStrategies Inc.

Log of Boring

BORING NO. **S-14**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	11/89		

Field location of boring:	Project No.: 7605	Date: 11/08/89	Boring No:
(See Plate 2)	Client: Shell Oil Company		S-14
	Location: 1800 Powell Street		
	City: Emeryville, California		Sheet 2
	Logged by: J. Vargas	Driller: Bayland	of 2
	Casing installation data:		
Drilling method: Hollow-Stem Auger			
Hole diameter: 8-Inches - Reamed with 12-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
	2	S&H						SAND (SP) - dark olive gray (5Y 3/2), loose, saturated;
	3			20				95% fine sand; 5% clay; no chemical odor.
0.3	4		S14-20					
				21				
				22				
								becoming stiff at 22.0 feet.
				23				
				24				CLAY (CH) - dark greenish gray (5BG 4/1), very soft,
	0	S&H						damp, high plasticity; trace roots and black organics;
	0			25				strong organic odor; no chemical odor.
0	1		S14-25					
				26				Bottom of boring at 25.5 feet.
								Bottom of sample at 25.5 feet.
				27				
				28				
				29				
				30				
				31				
				32				
				33				
				34				
				35				
				36				
				37				
				38				
				39				

Remarks:

GeoStrategies Inc.

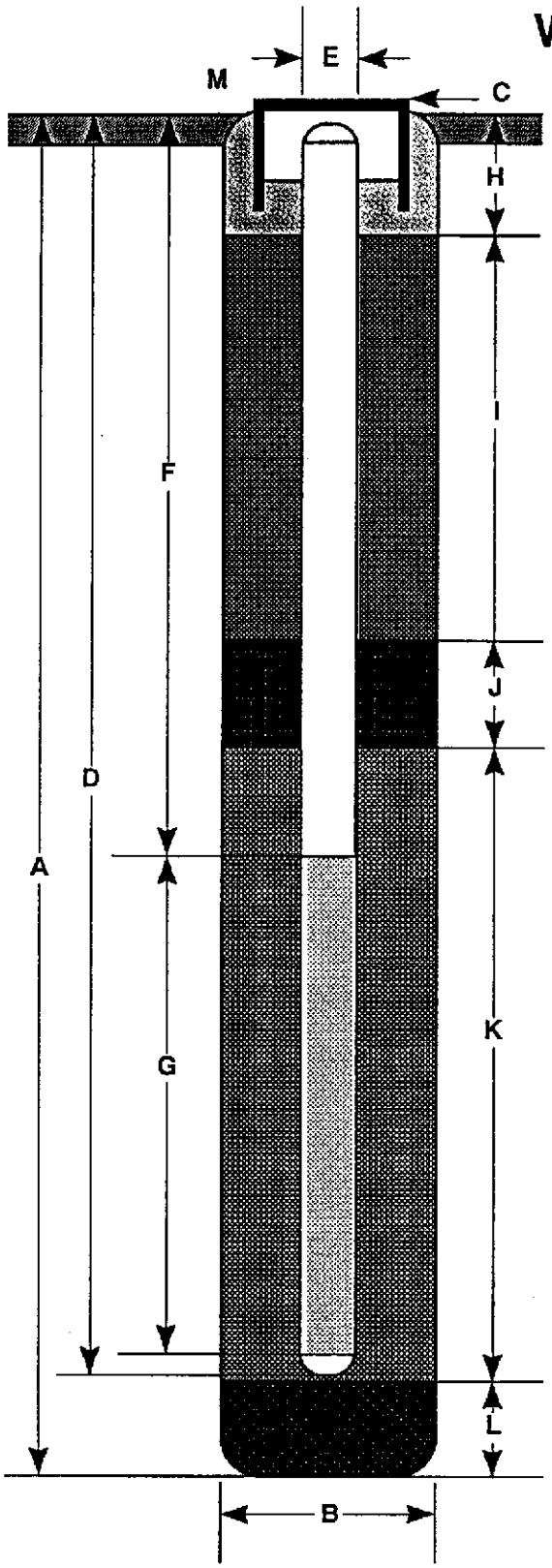
Log of Boring

BORING NO.

S-14

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CEG 1062	11/89		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 25.5 ft.

B Diameter of Boring 8 in.
Drilling Method Hollow-Stem Auger

C Top of Box Elevation 12.69 ft.
[X] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length 24 ft.
Material Schedule 40 PVC

E Casing Diameter 3 in.

F Depth to Top Perforations 7 ft.

G Perforated Length 17 ft.
Perforated Interval from 7 to 24 ft.
Perforation Type Machine Slot
Perforation Size 0.02 in.

H Surface Seal from 0 to 0.5 ft.
Seal Material Concrete

I Backfill from 0.5 to 4 ft.
Backfill Material Cement Grout

J Seal from 4 to 5 ft.
Seal Material Bentonite

K Gravel Pack from 5 to 24 ft.
Pack Material Lonestar 2/12 Sand

L Bottom Seal 1.5 ft.
Seal Material Native Soil

M Christy Box with locking well cap and lock.

Note: Depths measured from initial ground surface.

GeoStrategies Inc.

Well Construction Detail

WELL NO.
S-14

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7605	CMP CEG 1262	11/89		

APPENDIX D
SOIL ANALYTICAL REPORT

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

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

Date: December 7, 1989

Work Order Number: S9-11-153

P.O. Number: MOH 890501A

This is the Certificate of Analysis for the following samples:

Client Project ID:	GR #7605, Shell, 1800 Powell St., Emeryville, CA
Date Received by Lab:	11/10/89
Number of Samples:	5
Sample Type:	Soil

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.

The method of analysis for high boiling hydrocarbons involves extracting the samples with solvent and examining the extracts by gas chromatography using a flame ionization detector.

Reviewed and Approved

Michael E. Dean
Project Manager

MED/an
5 Pages Following - Tables of Results

Date: December 7, 1989
Client Project ID: GR #7605, Shell,
1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number: S9-11-153

Client Sample ID: S12-5
Sample Date: 11/8/89
Lab Sample ID: S9-11-153-01
Receipt Condition: Cool

Low Boiling Hydrocarbons Extraction Date: 11/14/89
Low Boiling Hydrocarbons Analysis Date: 11/16/89

High Boiling Hydrocarbons Extraction Date: 11/15/89
High Boiling Hydrocarbons Analysis Date: 11/17/89

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

Results - Milligrams per Kilogram

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	2.5	44.
Benzene	0.025	0.19
Toluene	0.025	0.042
Ethyl Benzene	0.025	None
Xylenes (total)	0.05	0.15
High Boiling Hydrocarbons, calculated as Diesel	200.	None
High Boiling Hydrocarbons, calculated as Oil	1,000.	4,000.

Date: December 7, 1989
Client Project ID: GR #7605, Shell,
1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number: S9-11-153

Client Sample ID: S12-9.5
Sample Date: 11/8/89
Lab Sample ID: S9-11-153-02
Receipt Condition: Cool

Low Boiling Hydrocarbons Extraction Date: 11/14/89
Low Boiling Hydrocarbons Analysis Date: 11/16/89

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

Results - Milligrams per Kilogram

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	2.6	33.
Benzene	0.026	0.14
Toluene	0.026	0.055
Ethyl Benzene	0.026	0.065
Xylenes (total)	0.05	0.38

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number: S9-11-153

Client Sample ID: S13-6
Sample Date: 11/9/89
Lab Sample ID: S9-11-153-02
Receipt Condition: Cool

Low Boiling Hydrocarbons Extraction Date: 11/14/89
Low Boiling Hydrocarbons Analysis Date: 11/16/89

High Boiling Hydrocarbons Extraction Date: 11/15/89
High Boiling Hydrocarbons Analysis Date: 11/17/89

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

Results - Milligrams per Kilogram

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	480.	9,100.
Benzene	5.	480.
Toluene	5.	200.
Ethyl Benzene	5.	230.
Xylenes (total)	10.	900.
High Boiling Hydrocarbons, calculated as Diesel	100.	3,300.*
High Boiling Hydrocarbons, calculated as Oil	3,000.	11,000.

*Compounds detected and calculated as diesel appear to be the less volatile constituents of gasoline.

Date: December 7, 1989
Client Project ID: GR #7605, Shell,
1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number: S9-11-153

Client Sample ID: S13-9
Sample Date: 11/9/89
Lab Sample ID: S9-11-153-04
Receipt Condition: Cool

Low Boiling Hydrocarbons Extraction Date: 11/14/89
Low Boiling Hydrocarbons Analysis Date: 11/16/89

High Boiling Hydrocarbons Extraction Date: 11/15/89
High Boiling Hydrocarbons Analysis Date: 11/21/89

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

Results - Milligrams per Kilogram

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	18.	250.
Benzene	0.2	10.
Toluene	0.2	5.6
Ethyl Benzene	0.2	6.5
Xylenes (total)	0.4	25.
High Boiling Hydrocarbons, calculated as Diesel	30.	60.*
High Boiling Hydrocarbons, calculated as Oil	200.	700.

*Compounds detected and calculated as diesel appear to be the less volatile constituents of gasoline.

Date: December 7, 1989
Client Project ID: GR #7605, Shell,
1800 Powell St., Emeryville, CA

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order Number: S9-11-153

Client Sample ID: S14-10
Sample Date: 11/8/89
Lab Sample ID: S9-11-153-05
Receipt Condition: Cool

Low Boiling Hydrocarbons Extraction Date: 11/14/89
Low Boiling Hydrocarbons Analysis Date: 11/16/89

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

Results - Milligrams per Kilogram

Parameter	Detection Limit	Detected
Low Boiling Hydrocarbons, calculated as Gasoline	2.5	34.
Benzene	0.025	0.61
Toluene	0.025	0.033
Ethyl Benzene	0.025	None
Xylenes (total)	0.05	0.13

Geltler - Ryan Inc. ENVIRONMENTAL DIVISION — 89-11-153 — 1326 Chain of Custody

COMPANY Shell oil company JOB NO. 7605

JOB LOCATION 1960 Powell Street

CITY Emeryville PHONE NO.

AUTHORIZED John Wenfal DATE 11/9/89 P.O. NO.

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID
S12-5	1	Soil	11/8/89	TPH (Gasoline) - BTEX TPH (Hvy's Boiling Point)	OK/cool
S12-9.5	1	↓	11/8/89	↓	↓
S13-6	1		11/9/89		
S13-9	1		11/9/89		
S14-10	1		11/8/89		
WIC 204-2495-0101					
~~AFE~~ 986608					
EXP 6540					
ENG DML					

RELINQUISHED BY: John Vargas 11/9/89

RECEIVED BY: 11/10/89 0840

RELINQUISHED BY: 11/10/89 15:35

RECEIVED BY:

RELINQUISHED BY:

RECEIVED BY LAB: Julie Clifford 11/10/89 15:40

DESIGNATED LABORATORY: IT DHS #:

REMARKS: Normal TAT - Results due 11/20

DATE COMPLETED 11/10/89 FOREMAN Bob Lucas

ORIGINAL