GeoStrategies Inc.

MONITORING WELL INSTALLATION REPORT

STID 3714

Shell Service Station
350 Grand Avenue
Oakland, California 94610
WIC 204-5510-0204

766701-3

March 18, [redacted]
1991

GeoStrategies Inc.
2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545

(415) 352-4800

March 18, 1991

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

Attn: Mr. John Werfal

Re: MONITORING WELL INSTALLATION REPORT
Shell Service Station
350 Grand Avenue
Oakland, California

Gentlemen:

This report summarizes the field activities performed at the above referenced location on January 7, 1991 (Plate 1). In accordance with the scope of work outlined in the Work Plan prepared by GeoStrategies Inc. (GSI) dated September 24, 1990, three monitoring wells were installed at the site. These borings were drilled and monitoring wells subsequently installed to evaluate soil and ground-water quality beneath the site. The locations of the newly-installed monitoring wells are shown on Plate 2.

BACKGROUND

Five exploratory soil borings were drilled in the area of the underground storage tank complex by GSI in May 1990. Total Petroleum Hydrocarbons calculated as Gasoline (TPH-Gasoline) were detected in soil samples from three of the borings (S-A through S-C), with concentrations ranging from 21 to 2900 parts per million (ppm). Total Petroleum Hydrocarbons calculated as Diesel (TPH-Diesel) were detected in soils from borings S-A through S-D, at concentrations ranging from 20 to 2400 ppm. Benzene was detected in soil samples from four borings (S-A, S-B, S-C, and S-E), with concentrations ranging from 0.045 to 13 ppm. These results are presented in the GSI report dated July 5, 1990.

FIELD PROCEDURES

Monitoring wells S-1, S-2 and S-3 were installed on January 7, 1991 using a truck mounted hollow-stem auger drilling rig according to GSI Field Methods and Procedures (Appendix A). Soil samples were collected at five-foot depth intervals using a Modified California split-spoon sampler fitted with brass sample tube liners. A GSI geologist observed the drilling, described soil samples using the Unified Soil Classification System and Munsell Soil Color Chart, and prepared a lithologic log for each boring. Exploratory boring logs for the wells are presented in Appendix B.

Soil Sampling

A 4-inch long brass 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 analysis involved removing the soil from the brass liner into a clean glass jar and immediately 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 tested for total organic vapor, measured in parts per million (ppm) with an OVM photoionization detector. These field procedures are performed and recorded as reconnaissance data. Soil sample selection for chemical analysis is based upon site-specific geological conditions as they relate to potential contamination migration pathways and confining layers. Head-space analysis results are presented on each exploratory boring log (Appendix B).

Soil samples retained for laboratory 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, placed in a cooler with blue ice, and transported to International Technology Analytical Services (IT), a California State-certified laboratory in San Jose, California.

Two soil samples were collected for falling-head permeability and sieve analyses. The samples were collected and sealed in the manner described above, and transported to Terratech, Inc., a geotechnical laboratory in San Jose, California.

Monitoring Well Construction

The well completion details are presented with the exploratory boring logs in Appendix B. Borings S-1, S-2 and S-3 were drilled using 8-inch-diameter hollow stem augers to a total depth of 19.5, 17.5 and 14.5 feet below ground, respectively. Borings S-1 and S-2 were backfilled with bentonite to 17 and 15 feet, respectively. The borings were completed as monitoring wells S-1, S-2 and S-3 to depths of 17, 15 and 14.5 feet below ground, respectively, using 3-inch-diameter Schedule 40 PVC well casing with 0.020-inch factory-slotted well screen. The screens were placed from 7 to 16 feet in Well S-1, 7 to 15 feet in Well S-2, and 7 to 14.5 feet in Well S-3. Lonestar #2/12 graded sand was placed in the annular space adjacent to the entire screen interval and extends two feet above the top of the screen. A two-foot bentonite seal was placed on top of the sandpack. The cement-grout seal was placed from the top of the bentonite seal to approximately 1.5 feet below ground surface. The well was completed with a waterproof Christy box installed over the top of the well. A waterproof locking well cap and lock were placed on top of the well casing for security.

HYDROGEOLOGIC CONDITIONS

The site is approximately 800 feet north of Lake Merritt, 1½ miles north of Oakland Inner Harbor and approximately 3½ miles north of San Francisco Bay. Echo Creek flows intermittently from northwest of the study area into the northwest corner of Lake Merritt. Regional geology in the area consists of surficial deposits, which are undifferentiated beach sands, marine deposits, artificial fill, alluvium and landslides (Blake et al, 1985). The surficial deposits overlay the Temescal Formation which consists primarily of clayey gravel, sand, silty clay and sand-clay-silt mixtures (Radbruch, 1957).

Based on the available subsurface data collected from the drilling, soils comprising the uppermost water bearing zone are sand (SP), silty sand (SM), clayey sand (SC) and sandy silt (ML). These suspected aquifer materials were encountered in the three borings. First encountered groundwater in these borings ranged from 8.5 to 9.5 feet below ground. A clay (CL) and silt (ML), which is stiff to very stiff and damp may be the basal aquitard and appears to be continuous across the site. This suspected aquitard was encountered at approximately 12 to 14 feet below ground surface. The thickness of the suspected aquitard was not confirmed in Borings S-1 or S-3. The aquitard was penetrated in Boring S-2 and was observed to be about 4 feet thick at that location. Following drilling of S-2, a bentonite pellet seal was placed in the bottom of the boring to seal the aquitard from an underlying gravel unit.

Potentiometric data were collected from the monitoring wells by G-R on January 23, 1991. Groundwater levels were measured in Wells S-1, S-2 and S-3 at 9.73, 10.55, and 14.67 feet below ground surface, respectively, which corresponds to ground-water elevations at 11.11 feet, 10.69 feet, and 8.03 feet above Mean Sea Level (MSL), respectively. These data have been plotted on Plate 3, and are summarized in Table 1. An accurate ground-water flow direction could not be determined due to an insufficient amount (0.43 feet) of water in Well S-3.

CHEMICAL ANALYTICAL RESULTS

Soil and ground-water samples were analyzed for Total Petroleum Hydrocarbons, calculated as Gasoline (TPH-Gasoline) and calculated as Diesel (TPH-Diesel) according to EPA Method 8015 (Modified); and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) according to EPA Method 8020. All samples were analyzed by IT Analytical Services.

Soil Analytical Results

Table 1 summarizes soil chemical analytical data. Soil samples were submitted for chemical analyses from Well S-1 at 4.5 and 9.5 feet, Well S-2 at 4.5, 8.5, 14.5 and 17.5 feet and Well S-3 at 4.5 and 9.0 feet below ground surface. TPH-Gasoline was detected in soil samples S-2-8.5 and S-3-4.5 at 440 ppm and 20 ppm, respectively. Benzene was detected in soil samples S-2-4.5, S-2-8.5 and S-3-4.5 at concentrations of 0.031, 4.5 and 0.33 ppm, respectively. Soil samples S-1-4.5, S-1-9.5, S-2-14.5, S-2-17.5 and S-3-9.0 were ND for TPH-Gasoline and benzene. Soil samples S-2-4.5 was ND for TPH-Gasoline. Soil samples S-2-4.5, S-2-8.5 and S-3-4.5 contained TPH-Diesel concentrations at 2.9, 360, and 23 ppm, respectively. IT Analytical Services chemical analytical results for the soil samples are presented in Appendix C.

Ground-water Analytical Results

Ground-water samples were collected by Gettler-Ryan Inc. (G-R) from wells S-1 and S-2 on January 23, 1991. TPH-Gasoline and benzene were not detected in the ground-water sample from Well S-1. TPH-Gasoline and benzene was detected in Well S-2 at 2.5 ppm and 0.55 ppm, respectively. TPH-Diesel was detected in Well S-2 at 1.2 ppm. The benzene concentration in Well S-2 is above the current Regional Water Quality Control Board (RWQCB) Maximum Contaminant Level (MCL).

Quality Control

Quality control (QC) samples for this quarter's ground-water sampling included one trip blank (TB). The trip blank was prepared in the IT Laboratory using organic-free water to evaluate laboratory handling and analytical procedures.

Chemical analytical results for the trip blank (ND) indicate that no hydrocarbons were introduced into the sample during sampling, transport, or from ambient field conditions.

Physical Test Results

Two soil samples from boring S-1 (9.5 and 14.5 feet below ground surface) were tested for permeability and sieve analysis. The permeability of samples S-1-9.5 and S-1-14.5 were $1.1x10^{-7}$ and $4.1x10^{-8}$ cm/s, respectively. Gradation test results for these samples were Clayey Sand and Fat Clay. These results are presented in Appendix E.

Well Survey Results

A well survey was conducted on January 11, 1991, to identify water-supply wells and their uses within a ½-mile radius of the site. This information was obtained from the California Department of Water Resources (DWR) Central District Office. As indicated on Plate 1, one well is located within a ½-mile radius of the site based on DWR records. Table 3 summarizes usage status, year of installation, and well ownership.

SUMMARY

A summary of activities and findings are presented below:

- Three monitoring wells (S-1, S-2 and S-3) were installed to evaluate soil and ground-water quality beneath the site.

- The lithology of the uppermost water-bearing zone consists primarily of sand (SP), silty sand (SM), clayey sand (SC) and sandy silt (ML). A suspected basal aquitard was encountered at approximately 12 to 14 feet below ground surface and appears continuous across the site. The suspected aquitard is comprised of a stiff to very stiff, damp clay (CL) and silt (ML).

- TPH-Gasoline was detected in soil samples S-2-8.5 (440 ppm) and S-3-4.5 (20 ppm). Soil samples S-1-4.5, S-1-9.5, S-2-4.5, S-2-14.5, S-2-17.5 and S-3-9.0 were ND for TPH-Gasoline.

- Benzene was detected in soil samples S-2-4.5 (0.031 ppm), S-2-8.5 (4.5 ppm) and S-3-4.5 (0.33 ppm). Soil samples S-1-4.5, S-1-9.5, S-2-14.5, S-2-17.5 and S-3-9.0 were ND for benzene.

- TPH-Gasoline and TPH-Diesel were detected in Well S-2 at 2.5 and 1.2 ppm, respectively. Benzene was detected in Well S-2 at 0.55 ppm. Benzene in Well S-2 is above the current RWQCB MCL.

- Well S-1 was ND for TPH-Gasoline and benzene.

- A well survey indicates only one well is located within ½-mile radius of this site.

- Physical test results from Boring S-1 indicate low permeabilities in both aquifer material and suspected aquitard material.

PLANNED SITE ACTIVITIES

The following activities are planned for this site during the second quarter of 1991:

- The monitoring well network will be monitored, sampled, and analyzed for TPH-Gasoline and TPH-Diesel according to EPA Method 8015 (Modified) and BTEX according to EPA Method 8020.

- Monitoring and chemical data will be used to construct potentiometric and chemical concentration maps on a quarterly basis.

If you have any questions, please call.

GeoStrategies Inc. by,

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Geologist

David H. Peterson
Senior Geologist
C.E.G. 1186

REGISTERED GEOLOGIST
DAVID H. PETERSON
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CERTIFIED
ENGINEERING
GEOLOGIST
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TJW/DHP/kjj

Plate 1. Vicinity Map with 1/2 mile radius well survey
Plate 2. Site Plan
Plate 3. Ground-water Elevation Map
Plate 4. TPH-G/Benzene Concentration Map

Appendix A: GeoStrategies Inc. Field Methods and Procedures
Appendix B: Exploratory Boring Logs and Well Completion Details
Appendix C: Soil Analytical Report
Appendix D: Gettler-Ryan Inc. Groundwater Sampling Report
Appendix E: Falling-Head Permeability and Gradation Test Results

QC Review: JFV

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References Cited

Blake, M.C. Jr., Bartow, J.A., Frizzell, V.A., Schlocker, D., Sorg, C.M., Wentworth, C.M., and Wright, R.H., 1974, reprinted 1985, Preliminary geologic map of Marin and San Francisco Counties and parts of Alameda, Contra Costa, and Sonoma Counties, California. U.S. Geological Survey Miscellaneous Field Studies Map MF-574.

GeoStrategies Inc., 1990, Soil Boring Report: Report No. 7667-1, dated July 5, 1990.

Radbruch, D.H., 1957, Areal and Engineering geology of the Oakland West Quadrangle, California U.S. Geological Survey Miscellaneous Geologic Investigations Map I-239.

TABLE 1

SOIL ANALYSIS DATA

SAMPLE NO	SAMPLE DATE	ANALYSIS DATE	TPH-G (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)	TPH-D (PPM)
S-1-4.5	07-Jan-91	17-Jan-91	<1.0	<0.005	0.005	<0.005	<0.005	<1.0
S-1-9.5	07-Jan-91	17-Jan-91	<1.0	<0.005	<0.005	<0.005	<0.005	<1.0
S-2-4.5	07-Jan-91	17-Jan-91	<1.0	0.031	0.006	<0.005	0.007	2.9 *
S-2-8.5	07-Jan-91	17-Jan-91	440	4.5	1.6	11	12	360 *
S-2-14.5	07-Jan-91	17-Jan-91	<1.0	<0.005	<0.005	<0.005	<0.005	<1.0
S-2-17.5	07-Jan-91	17-Jan-91	<1.0	<0.005	<0.005	<0.005	<0.005	<1.0
S-3-4.5	07-Jan-91	17-Jan-91	20	0.33	0.17	0.50	2.0	23 *
S-3-9.0	07-Jan-91	17-Jan-91	<1.0	<0.005	<0.005	<0.005	<0.005	<1.0

TPH-G = Total Petroleum Hydrocarbons as Gasoline
TPH-D = Total Petroleum Hydrocarbons as Diesel
PPM = Parts Per Million

NOTE: 1. All data shown as <x are reported as ND (none detected).

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

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TABLE 2

GROUND-WATER ANALYSIS DATA

WELL NO	SAMPLE DATE	ANALYSIS DATE	TPH-G (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)	TPH-D (PPM)	WELL ELEV (FT)	STATIC WATER ELEV (FT)	PRODUCT THICKNESS (FT)	DEPTH TO WATER (FT)
S-1	23-Jan-91	01-Feb-91	<0.05	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	20.84	11.11	----	9.73
S-2	23-Jan-91	01-Feb-91	2.5	0.55	0.015	0.033	0.042	1.2 *	21.24	10.69	----	10.55
S-3	23-Jan-91	----	----	----	----	----	----	----	22.70	8.03	----	14.67
TB	----	31-Jan-91	<0.05	<0.0005	<0.0005	<0.0005	<0.0005	----	----	----	----	----

CURRENT REGIONAL WATER QUALITY CONTROL BOARD MAXIMUM CONTAMINANT LEVELS
Benzene 0.001 ppm Xylenes 1.750 ppm Ethylbenzene 0.68 ppm

CURRENT DHS ACTION LEVELS
Toluene 0.100 ppm

TPH-G = Total Petroleum Hydrocarbons as Gasoline
TPH-D = Total Petroleum Hydrocarbons calculated as Diesel
PPM = Parts Per Million
TB = Trip Blank

Note: 1. For chemical parameter detection limits, refer to I.T. Laboratory reports.
2. Static Water Elevations referenced to mean sea level (MSL).
3. DHS Action Levels and MCLs are subject to change pending State review.

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

TABLE 3

SUMMARY OF ONE-HALF MILE RADIUS WELL SURVEY

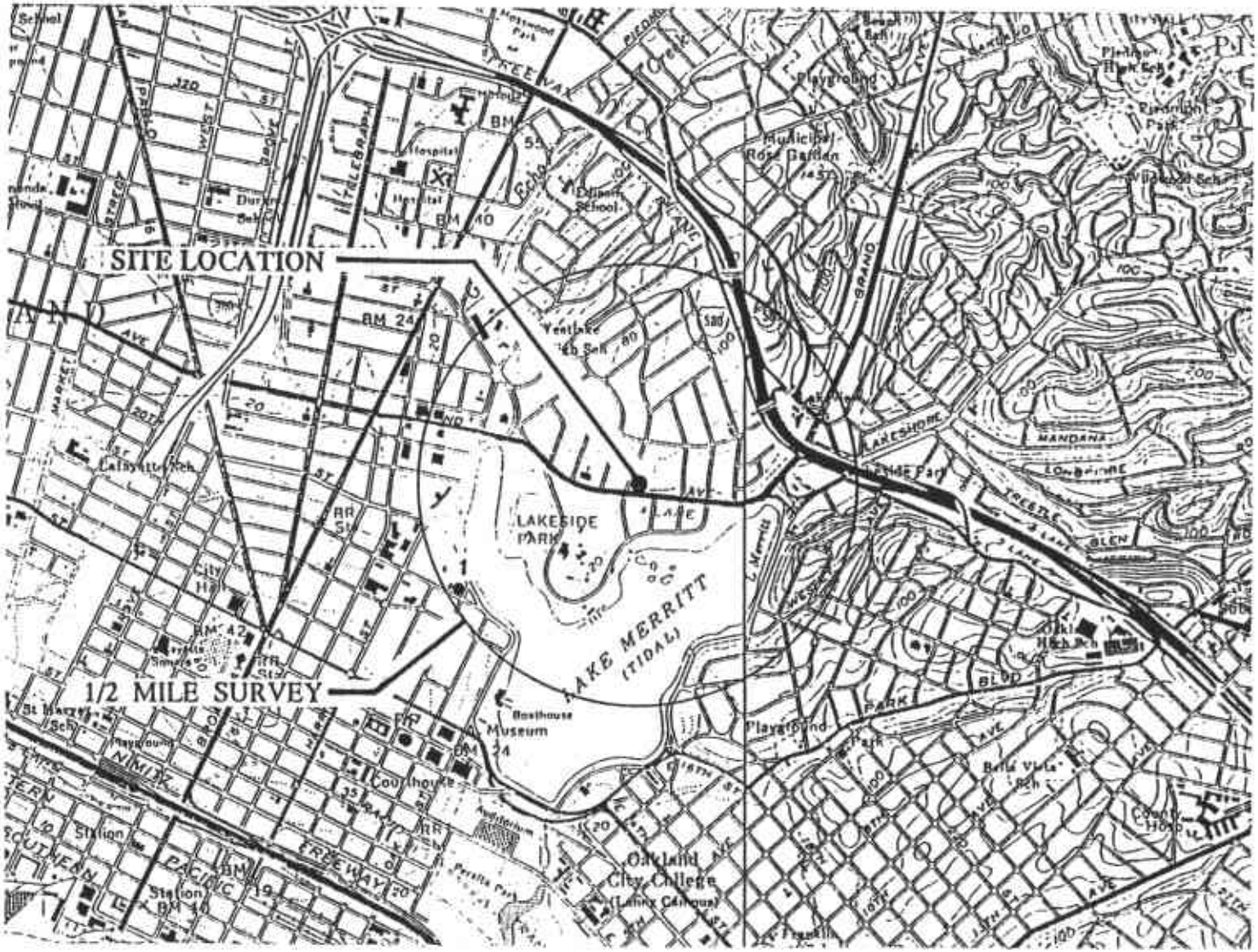
MAP ID	OWNER	STATE NUMBER	YEAR DRILLED	USAGE (STATUS)
1	LAKESIDE CORPORATION	154W35A2	1977	Irrigation

SOURCE: California Department of Water Resources Central District

NOTES: 1) This survey does not include monitoring wells or piezometers located at nearby sites where subsurface investigations are on-going as these are not considered water producing wells.

2) Information regarding type of and method used for sealing wells was not available.

ILLUSTRATIONS



Base Map: USGS Topographic Map

GeoStrategies Inc.

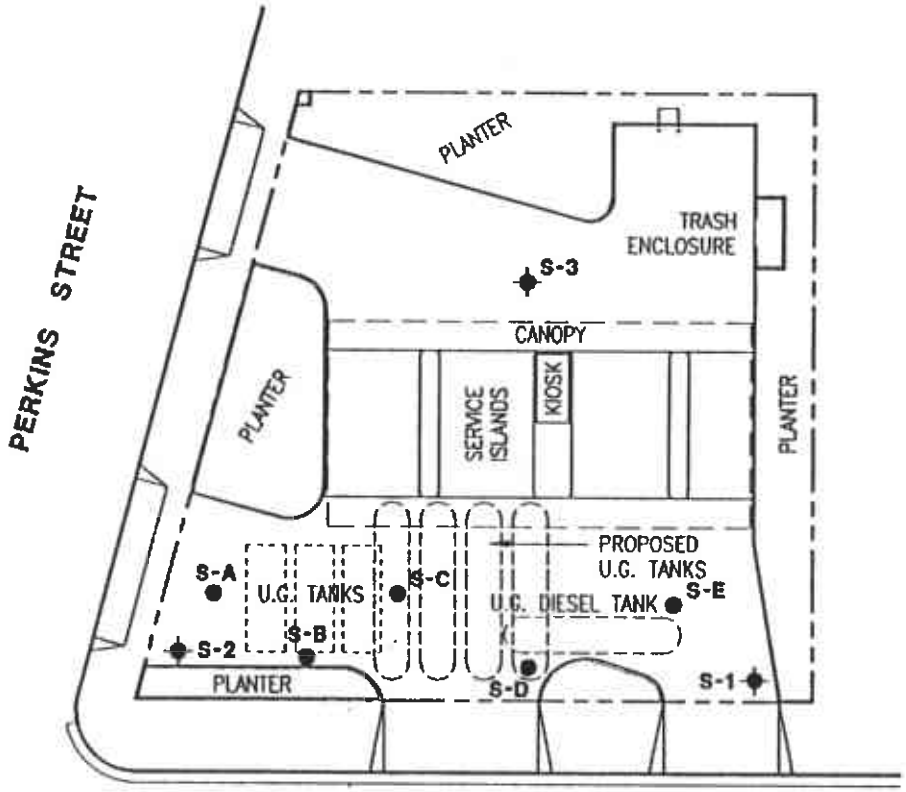
Vicinity Map with 1/2 Mile Well Survey
Shell Service Station
350 Grand Avenue
Oakland, California

PLATE
1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
7667		3/91	

EXPLANATION

- Ground-water monitoring well
- Soil boring



Base Map: Shell Site Plan dated 12-21-89

GeoStrategies Inc.

SITE PLAN
Shell Service Station
350 Grand Avenue
Oakland, California

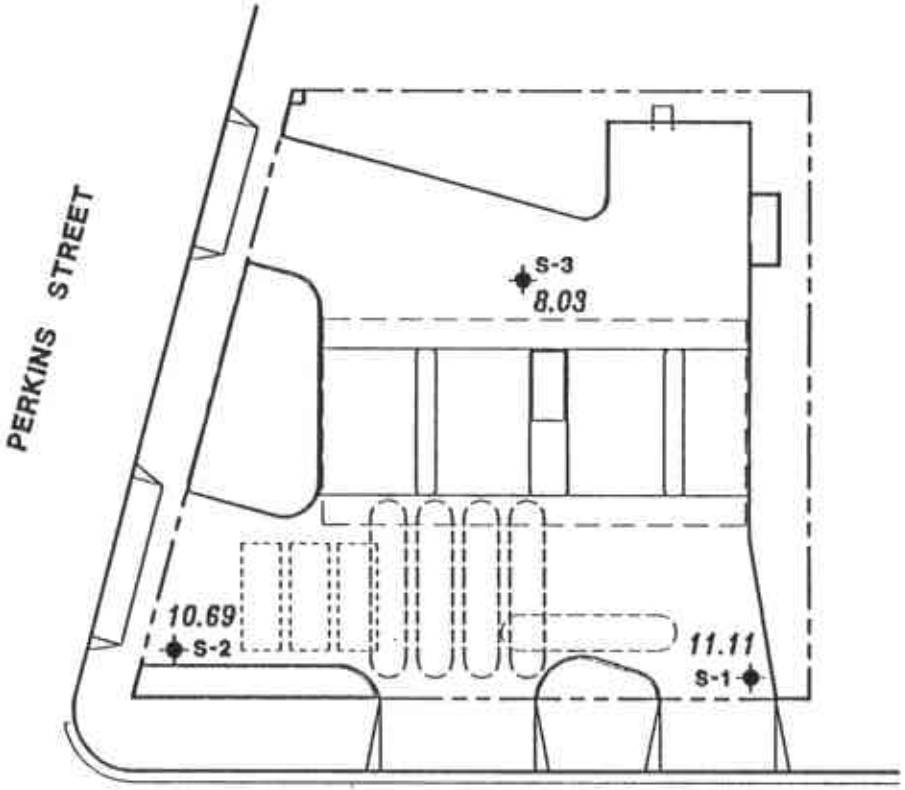
PLATE 2

JOB NUMBER 766701-3

REVIEWED BY

DATE 3/91

REVISED DATE



EXPLANATION

◆ Ground-water monitoring well

99.99 Ground-water elevation in feet referenced to Mean Sea Level (MSL) measured on January 23, 1991

Notes
1. Potentiometric surface cannot be calculated due to insufficient water in Well S-3.
2. Elevations may be influenced by irrigation practices and/or site construction activities.

N

0 40

Scale in Feet

Base Map: Shell Site Plan dated 12-21-89

GSI GeoStrategies Inc.

GROUND-WATER ELEVATION MAP
Shell Service Station
350 Grand Avenue
Oakland, California

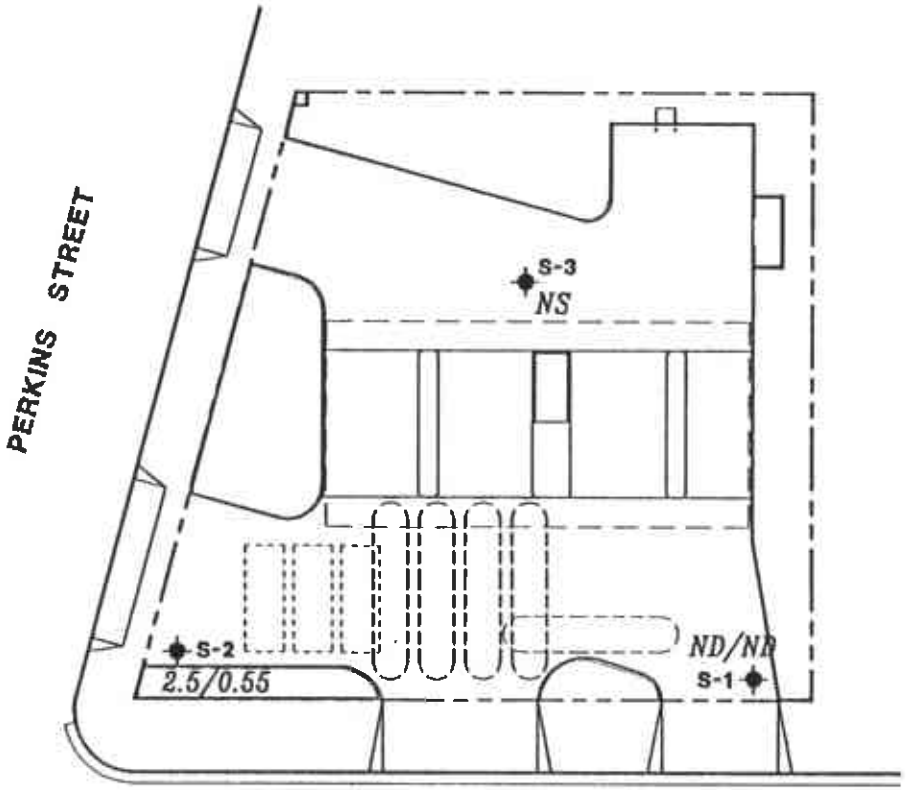
PLATE 3

JOB NUMBER 766701-3

REVIEWED BY

DATE 3/91

REVISED DATE



EXPLANATION

◆	Ground-water monitoring well
99/9.9	TPH-G (Total Petroleum Hydrocarbons calculated as Gasoline)/Benzene concentrations in ppm sampled on January 23, 1991
ND	Not Detected (See laboratory reports for detection limits)
NS	Not Sampled

N

0 40

Scale in Feet

Base Map: Shell Site Plan dated 12-21-89

GeoStrategies Inc.

TPH-G/BENZENE CONCENTRATION MAP
Shell Service Station
350 Grand Avenue
Oakland, California

PLATE 4

JOB NUMBER 766701-3

REVIEWED BY

DATE 3/91

REVISED DATE

APPENDIX A

FIELD METHODS AND PROCEDURES

FIELD METHODS AND PROCEDURES

EXPLORATION DRILLING

Mobilization

Prior to any drilling activities, GeoStrategies Inc. (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 groundwater. 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 tremie 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

All newly installed wells will be properly developed within 48 hours of completion. No well will be developed until the well seal has set a minimum of 12 hours. Development procedures will include one or more of the methods described below:

Bailing

Bailing will be used to remove suspended sediments and drilling fluids from the well, where applicable. The bailer will be raised and lowered through the column of water in the well so as to create a gentle surging action in the screened interval. This technique may be used in conjunction with other techniques, such as pumping, and may be used alone if the well is of low yield.

Pumping

Pumping will be used in conjunction with bailing or surging. The pump will be operated in such a manner as to gently surge the entire screened interval of the well. This may involve operating the pump with a packer type mechanism attached and slowly raising and lowering the pump, or by cycling the pump off and on to allow water to move in and out of the screened interval. Care will be used not to overpump a well.

Surging

Surging will be performed on wells that are screened in known or suspected high yield formations and/or on larger diameter (recovery) wells. A surge block will be raised and lowered through the entire screened interval, forcing water in and out of the well screen and sand pack. Pumping or air lifting will be used in conjunction with this method of development to remove any sediment brought into the well during surging.

Air Lifting

Air lifting will be used to remove sediment from wells as an alternative to pumping under certain conditions. When appropriate, a surge block designed for use with air lifting will be used to agitate the entire screened interval and water will be lifted out of the well using forced air. When air lifting is performed, the air source will be either nitrogen or filtered air and the procedure will be performed gently to prevent any damage to the well screen or casing and to insure that discharged water is contained.

Well Development - cont.

All well developing equipment will be thoroughly decontaminated prior to development using a steam cleaner and/or Alconox detergent wash and clean water rinse. During development procedures, field parameters (temperature, specific conductance and pH) will be monitored and recorded on well development forms (Figure 3). Equilibration requirements consist of a minimum of three readings with the following accuracy standards:

pH	± 0.1 pH units
Specific Conductance	± 10% of full scale reading
Temperature	± 0.5 degrees Celsius

The wells will be developed until water is visibly clear and free of sediment, and well purging parameters stabilized. A minimum of 8 to 10 well volumes will be purged from each well, if feasible. If well purging parameters have not stabilized before 10 casing volumes have been removed, well development will continue until purging parameters have stabilized and formation water is being drawn into the well. The adequacy of well development will be judged by the field technician performing the well development and based on known formation conditions.

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.

Guidance and Reference Documents Used to Collect Groundwater Samples

These documents are used to verify G-R sampling procedures and are consistent with current regulatory guidance. If site specific work and sampling plans are required, those plans will be developed from these documents, and newly received applicable 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, Sections 2645, 2646, 2647, and 2648; Article 7, Sections 2670, 2671, and 2672 (October, 1986: including 1988 Amendments)
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)
Napa County	Napa County Underground Storage Tank Program: Guidelines for Site Investigations; February 1989.
Santa Clara Valley Water District	Guidelines for Preparing or Reviewing Sampling Plans for Soil and Groundwater Investigation of Fuel Contamination Sites (January, 1989)

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

Santa Clara Valley Water District	Investigation and Remediation at Fuel Leak sites: Guidelines for Investigation and Technical Report Preparation (March 1989)
Santa Clara Valley Water District	Revised Well Standards for Santa Clara County (July 18, 1989)
American Petroleum Institute	Groundwater Monitoring & Sample Bias; API Publication 4367, Environmental Affairs Department, June 1983
American Petroleum Institute	A Guide to the Assessment and Remediation of Underground Petroleum Releases; API Publication 1628, February 1989
American Petroleum Institute	Literature Summary: Hydrocarbon Solubilities and Attenuations Mechanisms, API Publication 4414, August 1985
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.

3. Ambient conditions are continually monitored to maintain sample integrity.

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) sample 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.

Additional QC is performed through ongoing and random reviews of duplicate samples to evaluate the precision of the field sampling procedures and analytical laboratory. Precision of QC data is accomplished by calculating the Relative Percent Difference (RPD). The RPD is evaluated to assess whether values are within an acceptable range (typically ± 20% of duplicate sample).

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 4). 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 4. 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 5). 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 5. Collected field data during purging activities will be entered on the G-R Well Sampling Field Data Sheet shown in Figure 4. 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 6) 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

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 HCl to pH<2	14 days (maximum)
Benzene Toluene Ethylbenzene Xylenes (BTEX	EPA 8020	mg/l ug/l	50 ml. vial glass, Teflon lined septum	cool, 4 C HCl to pH<2	7 days (w/o preservative) 14 days (w preservative)
Oil & Grease	SM 503E	mg/l ug/l	1 l glass, Teflon lined septum	H2SO4 or HCl 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 HCl to pH<2	14 days (maximum)
Semi-Volatile Organics	8270	mg/l ug/l	1 l amber glass, Teflon lined septum	cool, 4 C	7 days extract 40 days (maximum to analyze)
Specific Conductance (Field test)		umhos/cm			
pH (Field test)		pH units			
Temperature (Field test)		Deg F			

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FIELD EXPLORATORY BORING LOG

FIGURE 1

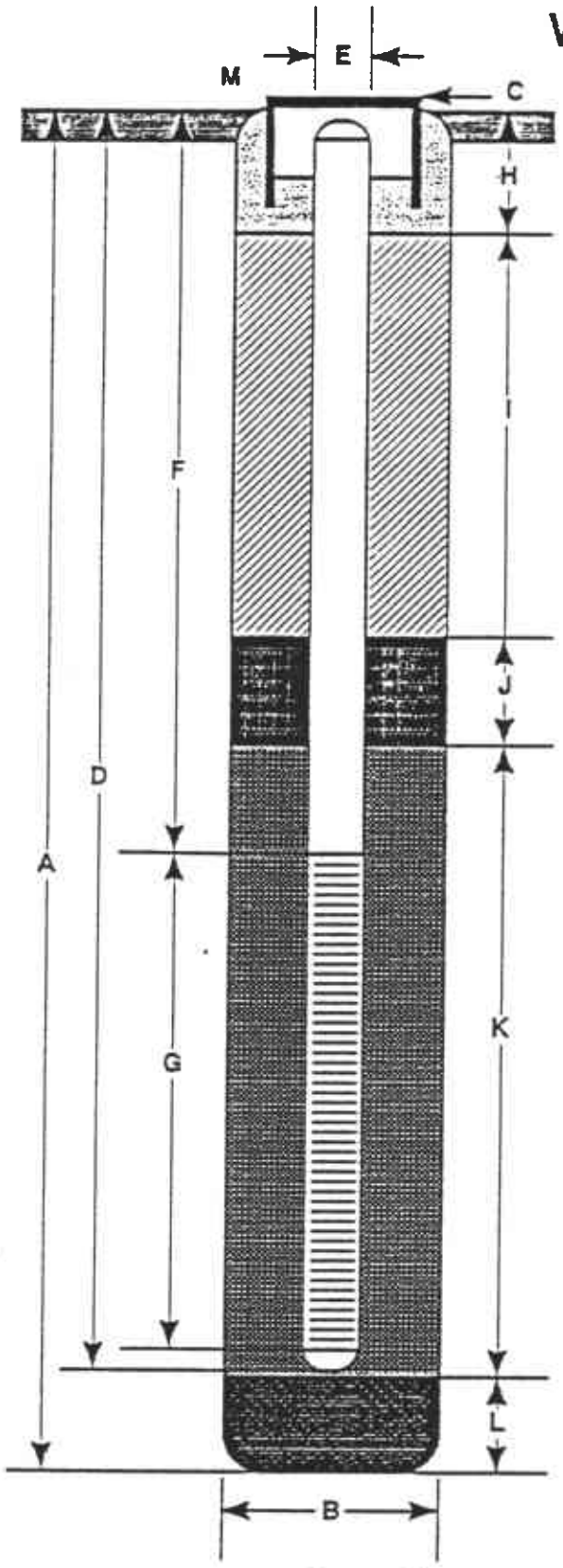
Field location of boring:	Project No.:	Date:	Boring No:
	Client:		
	Location:		
	City:		Sheet
	Logged by:	Driller:	of
Drilling method:	Casing installation data:		
Hole diameter:	Top of Box Elevation:		Datum:

								Water Level				
PID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Time				
								Date				
								Description				

Remarks:

WELL CONSTRUCTION DETAIL

FIGURE 2



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 _____
_____

Note: Depths measured from initial ground surface

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Well Construction Detail

WELL NO.

JOB NUMBER | REVIEWED BY RG/CEG | DATE | REVISED DATE | REVISED DATE

WELL DEVELOPMENT FORM FIGURE 3

Page_____ of_____

(to be filled out in office)

Client_____ SS#_____ Job#_____

Name_____ Location_____

Well#_____ Screened Interval_____ Depth_____

Aquifer Material_____ Installation Date _____

Drilling Method_____ Borehole Diameter_____

Comments regarding well installation:_____

(to be filled out in the field) Name_____

Date_____ Development Method_____

Total Depth_____ - Depth to liquid_____ = WaterColumn_____

Product thickness_____

_____ x _____ x _____ x 0.0408 = _____gals
Water Column Diameter (in.) #Vol

Purge Start_____ Stop_____ Rate_____ gpm

Gallons	Time	Clarity	Temp.	pH	Conductivity
0					

Total gallons removed_____ Development stop time_____

Depth to liquid _____at_____(time)

Odor of water_____ Water discharged to_____

Comments_____

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General and Environmental Contractors

WELL SAMPLING FIELD DATA SHEET

FIGURE 4

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 5

Monitoring Well Sampling Protocol Schematic

Sampling Crew Reviews Project Sampling Requirements/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

$V = \pi (r/12)^2 h(\_\%\ vol)(7.48) = \_\_\_$ /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 Initial Measured Water Column Height in Feet within 24 hrs. of Evacuation.

↓

Measure Groundwater Stability Indicator Parameters (pH, Temperature, Conductivity)

↓

Collect Sample and Complete Chain-of-Custody

↓

Preserve Sample According to Required Chemical Analysis

↓

Transport to Analytical Laboratory

Well Readily Recovers

↓

Record Groundwater Stability Indicator Parameters from each Additional Purge Volume

Stability indicated when the following Criteria are met:

pH :	± 0.1 pH units
Conductivity:	± 10%
Temperature:	1.0 degrees 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

Gettler - Ryan Inc. ENVIRONMENTAL DIVISION

Chain of Custo
FIGURE

COMPANY _____ JOB NO. _____

JOB LOCATION _____

CITY _____ PHONE NO. _____

AUTHORIZED _____ DATE _____ P.O. NO. _____

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

RELINQUISHED BY: _____ RECEIVED BY: _____

RELINQUISHED BY: _____ RECEIVED BY: _____

RELINQUISHED BY: _____ RECEIVED BY LAB: _____

DESIGNATED LABORATORY: _____ DHS #: _____

REMARKS: _____

DATE COMPLETED _____ FOREMAN _____

APPENDIX B

EXPLORATORY BORING LOG

WELL CONSTRUCTION DETAIL

Field location of boring: (See Plate 2)	Project No.: 766701	Date: 01/07/91	Boring No.: S-1
	Client: Shell Oil Company		
	Location: 350 Grand Avenue		
	City: Oakland, California		Sheet 1 of 1
	Logged by: T.J.W.	Driller: Bayland	
Drilling method: Hollow Stem Auger	Casing installation data: (See Well Construction Detail)		
Hole diameter: 8-Inches	Top of Box Elevation: 20.84		Datum: MSL

	Water Level	9.5'	11.0'		
	Time	10:00	15:30		
	Date	01/07/91	01/07/91		

PID (ppm)	Blows/ft. * or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 0.333 feet
				1				
								FILL - Gravel and Sand (GP) - dark yellowish brown
				2				(10YR 4/4), dense, damp; 60% medium gravel; 35% fine
				3				to coarse sand; 5% fines.
				4				
0	500	S&H	S-1-					
	500	push	4.5	5				CLAYEY SAND (SC) - olive gray (5Y 4/2), very dense,
		(psi)						damp; 80% fine to medium sand; 15% clay; 5% silt.
				6				
				7		← Screen		
				8				
	500	S&H		9				
	500	push	S-1-					COLOR CHANGE to gray (5Y 5/1), saturated at 9.5 feet.
0	500		9.5	10				
	(psi)							
				11				
				12				
				13				
		S&H		14				
			S-1-					CLAY (CL) - light olive brown (2.5Y 5/6), stiff, damp; 80%
0	15		15.0	15				clay; moderately silty; minor iron and manganese
								staining in rootholes.
				16				
				17				SANDY SILT (ML) - light olive brown (2.5 5/6), stiff,
								damp; 55% silt; 35% fine sand; slightly clayey;
				18				manganese staining.
			S-1-	19				Bottom of sample at 19.5 feet.
	15	S&H	19.5					Bottom of boring at 19.5 feet.
				20				01/07/91

Remarks:

* Converted to equivalent Standard Penetration blows/ft.

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Log of Boring

BORING NO. S-1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
766701	DKP	01/91		

Field location of boring:

(See Plate 2)

Project No.:	766701	Date: 01/07/91	Boring No.: S-2
Client:	Shell Oil Company		
Location:	350 Grand Avenue		
City:	Oakland, California		Sheet 1 of 1
Logged by:	T.J.W.	Driller: Bayland	

Drilling method: Hollow Stem Auger

Hole diameter: 8-Inches

Casing installation data: (See Well Construction Detail)

Top of Box Elevation: 21.24 Datum: MSL

Water Level	8.5'	11.1'		
Time	11:30	15:35		
Date	01/07/91	01/07/91		

PID (ppm)	Blows/ft. * or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 0.5 feet
				1				
								FILL - Silt and Sand (SW) - light olive brown (2.5Y 5/4),
				2				dense, damp.
				3				
	500	S&H						SILTY SAND (SM) - greenish brown (5G 5/1), dense,
85.6	500	push	S-2-	4				damp; 65% fine sand; 30% silt; slightly clayey.
	500		4.5					
	(psi)			5				SILT (ML) - black (5Y 2.5/1), stiff, damp; 85% silt;
								moderately clayey.
				6				
				7				
				8				
988	500	S&H	S-2-					SANDY SILT (ML) - black (5Y 2.5/1), stiff, saturated; 60%
	500	push	8.0	9				silt; 35% fine sand; 5% clay; rootholes present.
	500							
	(psi)			10				
				11				
				12				
				13				
		S&H						SILT (ML) - olive gray (5Y 5/2), stiff, damp; 60% silt; 35%
			S-2-	14				clay; 5% fine sand.
6.8	11		14.5					
				15				
				16				
		S&H						GRAVEL with SAND (GP) - olive (5Y 5/3), medium dense,
			S-2-	17				saturated; 70% fine to medium gravel; 30% fine to coarse
17.8	24		17.5					sand.
				18				
								Bottom of sample at 17.5 feet.
				19				Bottom of boring at 17.5 feet.
								01/07/91
				20				

Remarks:

* Converted to equivalent Standard Penetration blows/ft.

No clay

GSI GeoStrategies Inc.

Log of Boring

BORING NO. S-2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
766701	DHP	01/91		

Field location of boring:

(See Plate 2)

Project No.: 766701	Date: 01/07/91	Boring No.: S-3	
Client: Shell Oil Company			
Location: 350 Grand Avenue			
City: Oakland, California		Sheet 1 of 1	
Logged by: T.J.W.	Driller: Bayland		

Casing installation data: (See Well Construction Detail)

Drilling method: Hollow Stem Auger

Hole diameter: 8-inches

Top of Box Elevation: 22.70 Datum: MSL

Water Level	8.5'	14.0'	
Time	13:30	15:38	
Date	01/07/91	01/07/91	

PID (ppm)	Blows/ft. * or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 0.5 feet.
				1				
				2				FILL - Sand and Gravel (SW) - concrete blocks, red bricks - PIPE ENCOUNTERED AT 2.0 feet. MOVED HOLE 12" NORTH
				3				
	325	S&H		4				SILT with SAND (ML) - olive (5Y 5/3), stiff, damp.
336	325	push	S-3-					
	325		4.5					
	(psi)			5				
				6				
				7				
				8				
0.5		S&H						SAND (SP) - olive (5Y 4/4), loose to medium dense, saturated; 85% fine to coarse sand; 10% gravel; slightly silty.
	10		S-3-	9				
			9.0					
				10				
				11				
				12				
				13				SILTY SAND (SM) - light olive brown (2.5Y 5/4), dense, moist; 75% medium sand; 25% silt and clay; trace gravel.
0		S&H	S-3-	14				CLAY (CL) - mottled light olive brown (2.5 5/4) to pale olive (5Y 6/3), very stiff, damp; minor rootholes.
	18		14.5					
				15				
				16				Bottom of sample at 14.5 feet.
								Bottomof boring at 14.5 feet.
				17				01/07/91
				18				
				19				
				20				

Remarks:

* Converted to equivalent Standard Penetration blows/ft.

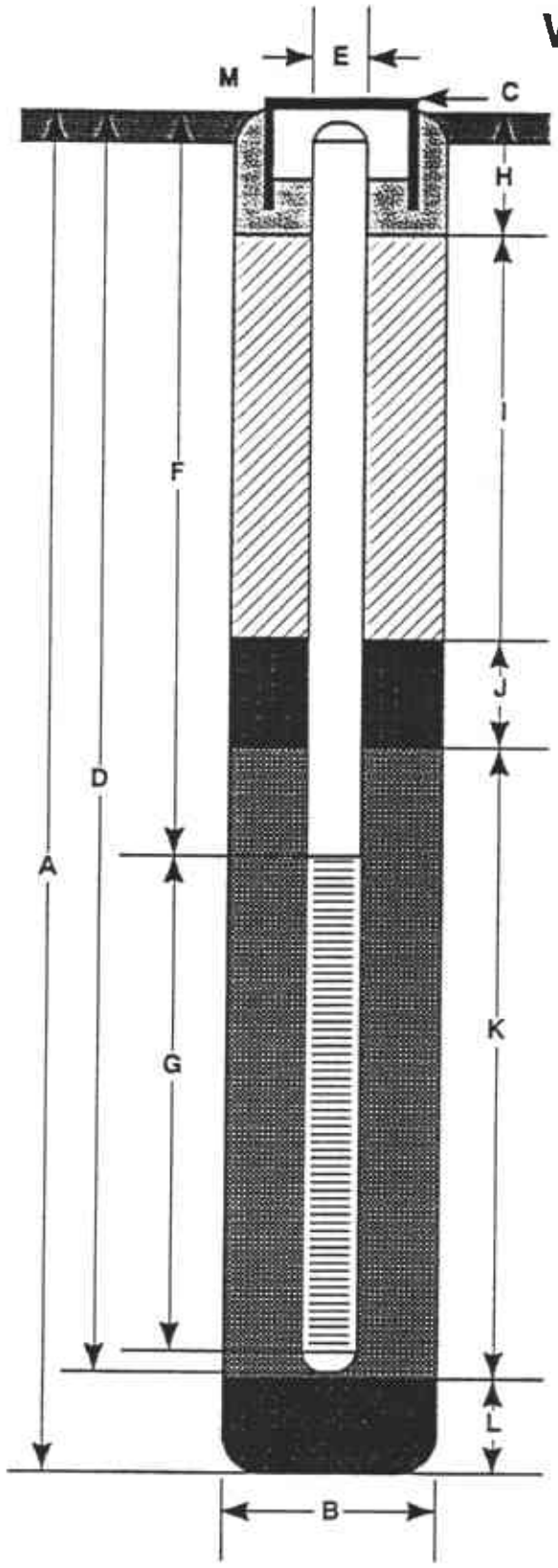
GeoStrategies Inc.

Log of Boring

BORING NO. S-3

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
766701	DHP	01/91		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 19.5 ft.

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

C Top of Box Elevation 20.84 ft.
[X] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length 17 ft.
Material Schedule 40 PVC

E Casing Diameter 3 in.

F Depth to Top Perforations 7 ft.

G Perforated Length 9 ft.
Perforated Interval from 7 to 16 ft.
Perforation Type Machine Slot
Perforation Size 0.020 in.

H Surface Seal from 0 to 1.5 ft.
Seal Material Concrete

I Backfill from 1.5 to 4 ft.
Backfill Material Cement Grout

J Seal from 4 to 5 ft.
Seal Material Bentonite

K Gravel Pack from 5 to 17 ft.
Pack Material Lonestar #2/12

L Bottom Seal 2.5 ft.
Seal Material Bentonite Pellets

M Traffic-rated Christy box with locking cap and lock.

Note: Depths measured from initial ground surface.

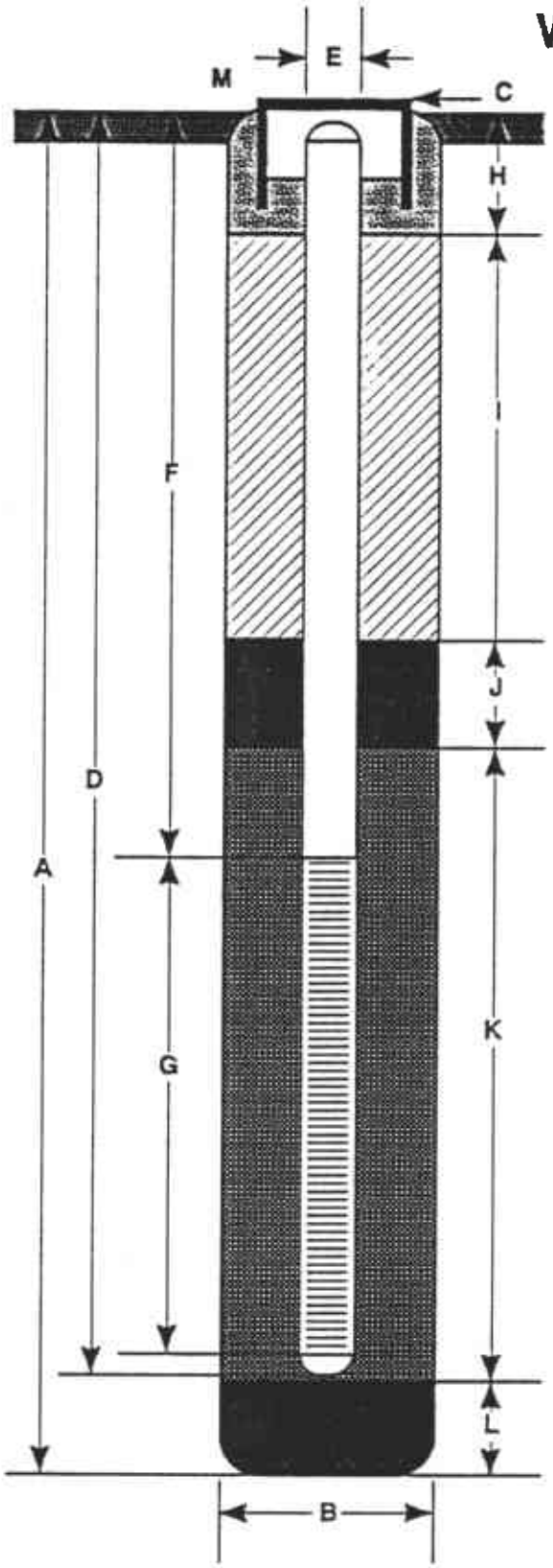
GeoStrategies Inc.

Well Construction Detail

WELL NO.
S-1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
766701	DHP	01/91		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 17.5 ft.

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

C Top of Box Elevation 21.24 ft.
[X] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length 15 ft.
Material Schedule 40 PVC

E Casing Diameter 3 in.

F Depth to Top Perforations 7 ft.

G Perforated Length 8 ft.
Perforated Interval from 7 to 15 ft.
Perforation Type Machine Slot
Perforation Size 0.020 in.

H Surface Seal from 0 to 1.5 ft.
Seal Material Concrete

I Backfill from 1.5 to 4 ft.
Backfill Material Cement Grout

J Seal from 4 to 5 ft.
Seal Material Bentonite

K Gravel Pack from 5 to 15 ft.
Pack Material Lonestar #2/12

L Bottom Seal 2.5 ft.
Seal Material Bentonite Pellets

M Traffic-rated Christy box with locking cap and lock.

Note: Depths measured from initial ground surface.

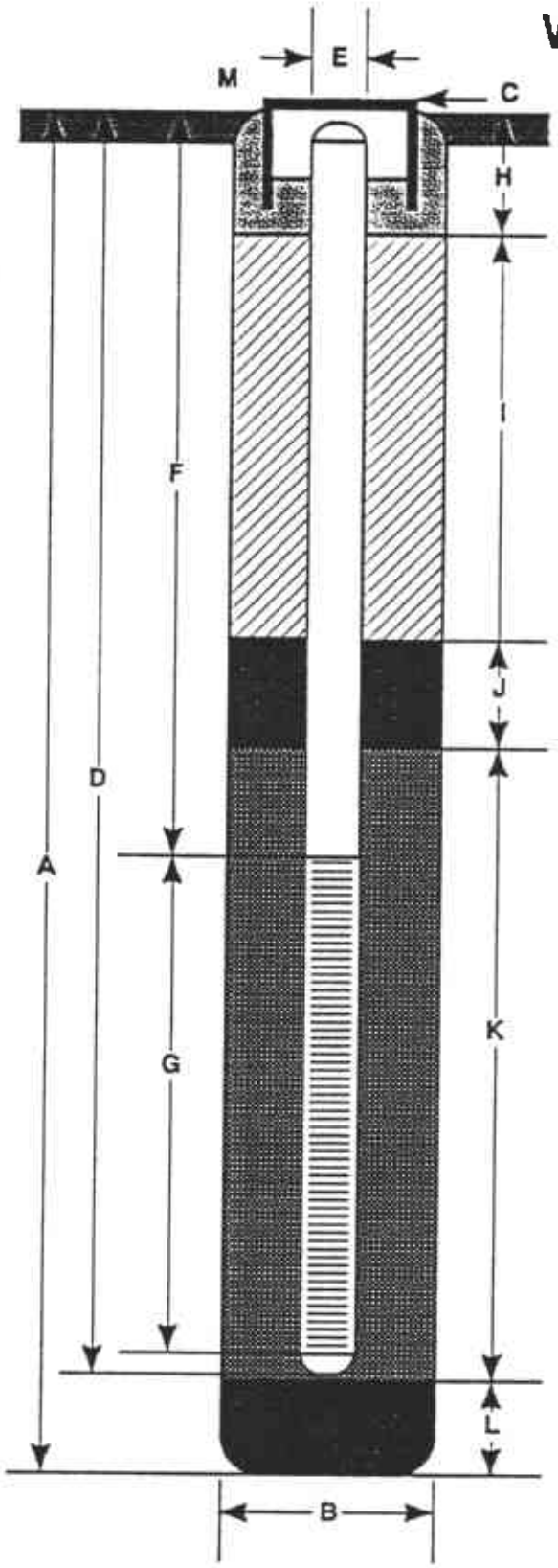
GeoStrategies Inc.

Well Construction Detail

WELL NO.
S-2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
766701	D HP	01/91		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 14.5 ft.

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

C Top of Box Elevation 22.70 ft.
[X] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length 14.5 ft.
Material Schedule 40 PVC

E Casing Diameter 3 in.

F Depth to Top Perforations 7 ft.

G Perforated Length 7.5 ft.
Perforated Interval from 7 to 14.5 ft.
Perforation Type Machine Slot
Perforation Size 0.020 in.

H Surface Seal from 0 to 1.5 ft.
Seal Material Concrete

I Backfill from 1.5 to 4 ft.
Backfill Material Cement Grout

J Seal from 4 to 5 ft.
Seal Material Bentonite

K Gravel Pack from 5 to 14.5 ft.
Pack Material Lonestar #2/12

L Bottom Seal N/A ft.
Seal Material

M Traffic-rated Christy box with locking cap and lock.

Note: Depths measured from initial ground surface.

GeoStrategies Inc.

Well Construction Detail

WELL NO. S-3

JOB NUMBER	REVIEWED BY PG/CEG	DATE	REVISED DATE	REVISED DATE
766701	DWP	01/91		

APPENDIX C

SOIL ANALYTICAL REPORT

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

RECEIVED
JAN 25 1991
GETTLER-RYAN INC.

CERTIFICATE OF ANALYSIS

Shell Oil Company
Gettler-Ryan
2150 West Winton
Hayward, CA 94545
John Werfal

Date: 01/24/91

Work Order: T1-01-055 P.O. Number: MOB 880-021 Vendor #I0002402

This is the Certificate of Analysis for the following samples:

Client Work ID: GR7667, 350 Grand , Oakland
Date Received: 01/08/91
Number of Samples: 8
Sample Type: solid

TABLE OF CONTENTS FOR ANALYTICAL RESULTS

Reviewed and Approved:

Suzanne Veaudry
Project Manager

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-1-4.5
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-01
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/17/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	1.	None
BTEX		
Benzene	0.005	None
Toluene	0.005	0.005
Ethylbenzene	0.005	None
Xylenes (total)	0.005	None
High Boiling Hydrocarbons calculated as Diesel	1.	None

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-1-9.5
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-02
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/17/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	1.	None
BTEX		
Benzene	0.005	None
Toluene	0.005	None
Ethylbenzene	0.005	None
Xylenes (total)	0.005	None
High Boiling Hydrocarbons calculated as Diesel	1.	None

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-2-4.5
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-03
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/17/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	1.	None
BTEX		
Benzene	0.005	0.031
Toluene	0.005	0.006
Ethylbenzene	0.005	None
Xylenes (total)	0.005	0.007
High Boiling Hydrocarbons calculated as Diesel	1.	2.9 #

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

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-2-8.5
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-04
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/18/91

PARAMETER	DETECTION LIMIT	DETECTED	
Low Boiling Hydrocarbons calculated as Gasoline	100.	440.	
BTEX			
Benzene	1.	4.5	
Toluene	1.	1.6	
Ethylbenzene	1.	11.	
Xylenes (total)	1.	12.	
High Boiling Hydrocarbons calculated as Diesel	5.	360.	#

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

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-2-14.5
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-05
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/17/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	1.	None
BTEX		
Benzene	0.005	None
Toluene	0.005	None
Ethylbenzene	0.005	None
Xylenes (total)	0.005	None
High Boiling Hydrocarbons calculated as Diesel	1.	None

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-2-17.5
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-06
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/17/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	1.	None
BTEX		
Benzene	0.005	None
Toluene	0.005	None
Ethylbenzene	0.005	None
Xylenes (total)	0.005	None
High Boiling Hydrocarbons calculated as Diesel	1.	None

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-3-4.5
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-07
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/18/91

PARAMETER	DETECTION LIMIT	DETECTED	
Low Boiling Hydrocarbons calculated as Gasoline	8.	20.	
BTEX			
Benzene	0.08	0.33	
Toluene	0.08	0.17	
Ethylbenzene	0.08	0.50	
Xylenes (total)	0.08	2.0	
High Boiling Hydrocarbons calculated as Diesel	1.	23.	#

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

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

Work Order: T1-01-055

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-3-9.0
SAMPLE DATE: 01/07/91
LAB SAMPLE ID: T101055-08
SAMPLE MATRIX: solid
RECEIPT CONDITION: Cool

RESULTS in Milligrams per Kilogram:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020	01/10/91	01/17/91
Low Boiling Hydrocarbons	Mod.8015	01/10/91	01/17/91
High Boiling Hydrocarbons	Mod.8015	01/15/91	01/18/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	1.	None
BTEX		
Benzene	0.005	None
Toluene	0.005	None
Ethylbenzene	0.005	None
Xylenes (total)	0.005	None
High Boiling Hydrocarbons calculated as Diesel	1.	None

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 01/24/91
Client Work ID: GR7667, 350 Grand , Oakland

Work Order: T1-01-055

TEST CODE TPHN TEST NAME TPH High Boiling by 8015

The method of analysis for high boiling hydrocarbons s taken from the LUFT field manual. Samples are extracted with solvent and examined by gas chromatography using a flame ionization detector. Results in soils are corrected for moisture content and are reported on a dry soil basis unless otherwise noted.

TEST CODE TPHVB TEST NAME TPH Gas,BTEX by 8015/8020

The method of analysis for low boiling hydrocarbons is taken from EPA Methods modified 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 in series with a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline. Results in soils are corrected for moisture content and are reported on a dry soil basis unless otherwise noted.

APPENDIX D
GETTLER-RYAN INC. GROUND-WATER SAMPLING REPORT

gettler — ryan inc.

February 12, 1991

GROUNDWATER SAMPLING REPORT

Referenced Site: Shell Service Station
350 Grand Avenue/Perkins Street
Oakland, California

Sampling Date: January 23, 1991

This report presents the results of the quarterly groundwater sampling and analytical program conducted by Gettler-Ryan Inc. on January 23, 1991 at the referenced location. The site is occupied by an operating service station located on the northeast corner of Grand Avenue and Perkins Street. The service station has underground storage tanks containing leaded, unleaded, super unleaded gasoline and diesel products.

There are currently three groundwater monitoring wells on or near the site at the locations shown on the attached site map. Wells S-1 through S-3 were developed on January 15, 1991. 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 or deny the presence and thickness of separate phase product. Groundwater depths ranged from 9.73 to 14.67 feet below grade. Well S-3 contained insufficient water for sampling. Separate phase product was not observed in any monitoring wells.

The wells were then purged and sampled. The purge water was contained in drums for proper disposal. 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. Details of the final well purging results are presented on the attached Table of Monitoring Data. In cases where a well dewatered or less than four case volumes were purged, groundwater samples were obtained after the physical parameters had stabilized. Under such circumstances the sample may not represent actual formation water, due to low flow conditions.

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.

2150 west winton avenue • hayward, california 94545-1210 • (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 E630. 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

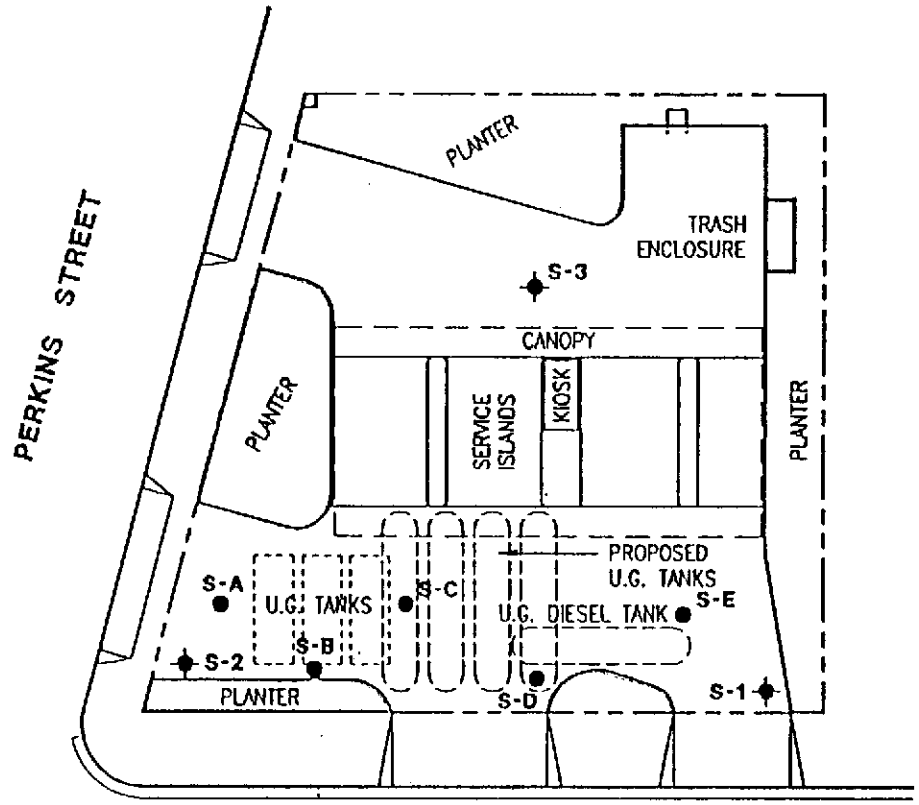
WELL I.D.	S-1	S-2	S-3
Casing Diameter (inches)	3	3	3
Total Well Depth (feet)	17.60	15.05	15.10
Depth to Water (feet)	9.73	10.55	14.67
Free Product (feet)	none	none	none
Reason Not Sampled	----	----	insufficient water
Calculated 4 Case Vol.(gal.)	11.9	6.8	----
Did Well Dewater?	no	yes	----
Volume Evacuated (gal.)	13.0	5.5	----
Purging Device	Bailer	Bailer	----
Sampling Device	Bailer	Bailer	----
Time	16:10	16:25	----
Temperature (F)*	66.5	67.3	----
pH*	7.36	7.18	----
Conductivity (umhos/cm)*	902	860	----

* Indicates Stabilized Value

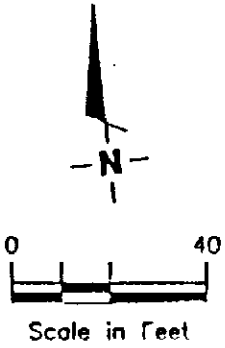
EXPLANATION

✦ Ground-water monitoring well

● Soil boring



Base Map: Shell Site Plan dated 12-21-89



GeoStrategies Inc.

SITE PLAN
Shell Service Station
350 Grand Avenue
Oakland, California

PLATE 2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
766701-1		3/91	

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

RECEIVED

FEB 08 1991

GETTLER-RYAN INC.
GENERAL CONTRACTORS

CERTIFICATE OF ANALYSIS

Shell Oil Company
Gettler-Ryan
2150 West Winton
Hayward, CA 94545
Tom Paulson

Date: 02/07/91

Work Order: T1-01-233

P.O. Number: MOH 880-021 Vendor #I0002402

This is the Certificate of Analysis for the following samples:

Client Work ID: GR3667, 350 Grand Ave,Oakland
Date Received: 01/24/91
Number of Samples: 3
Sample Type: aqueous

TABLE OF CONTENTS FOR ANALYTICAL RESULTS

Reviewed and Approved:

Suzanne Veaudry
Project Manager

Company: Shell Oil Company
Date: 02/07/91
Client Work ID: GR3667, 350 Grand Ave,Oakland

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order: T1-01-233

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-1
SAMPLE DATE: 01/23/91
LAB SAMPLE ID: T101233-01
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2

RESULTS in Milligrams per Liter:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020		02/01/91
Low Boiling Hydrocarbons	Mod.8015		02/01/91
High Boiling Hydrocarbons	Mod.8015	02/06/91	02/06/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	0.05	None
BTEX		
Benzene	0.0005	None
Toluene	0.0005	None
Ethylbenzene	0.0005	None
Xylenes (total)	0.0005	None
High Boiling Hydrocarbons calculated as Diesel	0.05	None

Company: Shell Oil Company
Date: 02/07/91
Client Work ID: GR3667, 350 Grand Ave,Oakland

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order: T1-01-233

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: S-2
SAMPLE DATE: 01/23/91
LAB SAMPLE ID: T101233-02
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2

RESULTS in Milligrams per Liter:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020		02/04/91
Low Boiling Hydrocarbons	Mod.8015		02/04/91
High Boiling Hydrocarbons	Mod.8015	02/06/91	02/06/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	0.5	2.5
BTEX		
Benzene	0.005	0.55
Toluene	0.005	0.015
Ethylbenzene	0.005	0.033
Xylenes (total)	0.005	0.042
High Boiling Hydrocarbons calculated as Diesel	0.05	1.2 #

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

Company: Shell Oil Company
Date: 02/07/91
Client Work ID: GR3667, 350 Grand Ave,Oakland

IT ANALYTICAL SERVICES
SAN JOSE, CA

Work Order: T1-01-233

TEST NAME: Petroleum Hydrocarbons

SAMPLE ID: Trip Blank
SAMPLE DATE: not spec
LAB SAMPLE ID: T101233-03
SAMPLE MATRIX: aqueous
RECEIPT CONDITION: Cool pH < 2

RESULTS in Milligrams per Liter:

	METHOD	EXTRACTION DATE	ANALYSIS DATE
BTEX	8020		01/31/91
Low Boiling Hydrocarbons	Mod.8015		01/31/91

PARAMETER	DETECTION LIMIT	DETECTED
Low Boiling Hydrocarbons calculated as Gasoline	0.05	None
BTEX		
Benzene	0.0005	None
Toluene	0.0005	None
Ethylbenzene	0.0005	None
Xylenes (total)	0.0005	None

IT ANALYTICAL SERVICES
SAN JOSE, CA

Company: Shell Oil Company
Date: 02/07/91
Client Work ID: GR3667, 350 Grand Ave,Oakland

Work Order: T1-01-233

TEST CODE TPHN TEST NAME TPH High Boiling by 8015

The method of analysis for high boiling hydrocarbons s taken from the LUFT field manual. Samples are extracted with solvent and examined by gas chromatography using a flame ionization detector. Results in soils are corrected for moisture content and are reported on a dry soil basis unless otherwise noted.

TEST CODE TPHVB TEST NAME TPH Gas,BTEX by 8015/8020

The method of analysis for low boiling hydrocarbons is taken from EPA Methods modified 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 in series with a photoionization detector. The result for total low boiling hydrocarbons is calculated as gasoline. Results in soils are corrected for moisture content and are reported on a dry soil basis unless otherwise noted.

Gettler - Ryan Inc. — ENVIRONMENTAL DIVISION — 1T1-01-233 — Chain of Custody

COMPANY Shell Oil Company JOB NO.

JOB LOCATION 1350 Grand Avenue / Perkins

CITY Oakland CA PHONE NO.

AUTHORIZED ~~Tom~~ Tom Paulson DATE 1-23-91 P.O. NO. 3667.C2

SAMPLE ID	NO. OF CONTAINERS	SAMPLE MATRIX	DATE/TIME SAMPLED	ANALYSIS REQUIRED	SAMPLE CONDITION LAB ID
S-1	5	Liquid	1-23-91/16:10	A,B,C (Gas) BTXE TPH (Diesel) DE	OK (Ice)
S-2	5	↓	↓ 16:25	↓	↓
Trip	2	↓	—	↓	↓

A= Gas, BTEX
B= TPH (Diesel)

WIC 204-5510-0204
EXP 5440
ENG Jack Brasund

RELINQUISHED BY: 1-24-91 07:00
RECEIVED BY: Refrig #1 1-23-91

RELINQUISHED BY: Refrig #1 1-24-91
RECEIVED BY: Guadalupe Sanchez 1-24-91

RELINQUISHED BY: Guadalupe Sanchez 1-24-91 1015
RECEIVED BY LAB: Jason J. Koehn 1/24/91 1015

DESIGNATED LABORATORY: ~~ZT~~/SCY DHS #: EG30

REMARKS: Normal TAT

DATE COMPLETED 1-23-91 FOREMAN

ORIGINAL

APPENDIX E
FALLING-HEAD PERMEABILITY
AND
GRADATION TEST RESULTS

1365 VANDER WAY SAN JOSE, CALIFORNIA 95112 (408) 297-6969 FAX (408) 297-7716

February 14, 1991
Project 4710

Geostrategies, Inc.
2140 W. Winton Avenue
Hayward, Ca. 94545

Subject: Sieve/Hydrometer Analyses and Permeability Tests

Geostrategies Project: 7667

Dear Mr. Walker:

Two soil samples, collected by your staff, were delivered to our laboratory on January 21, 1991 for permeability tests and grain size analyses. Sieve/Hydrometer results are attached.

Permeability results are summarized below.

Permeability Test Results

Sample No.	Depth (ft.)	K (cm/s)	Before Test Dry Density (pcf)	Before Test Water Content (%)	After Test Dry Density (pcf)	After Test Water Content (%)
S1	9.5	1.1×10^{-7}	107.9	19.0	110.3	19.3
S1	14.5	4.1×10^{-8}	95.2	27.6	94.2	29.7

If you have any questions, please feel free to call.

Sincerely,

TERRATECH, INC.

Frank R. Rancadore

Frank R. Rancadore
Laboratory Director

Attachments

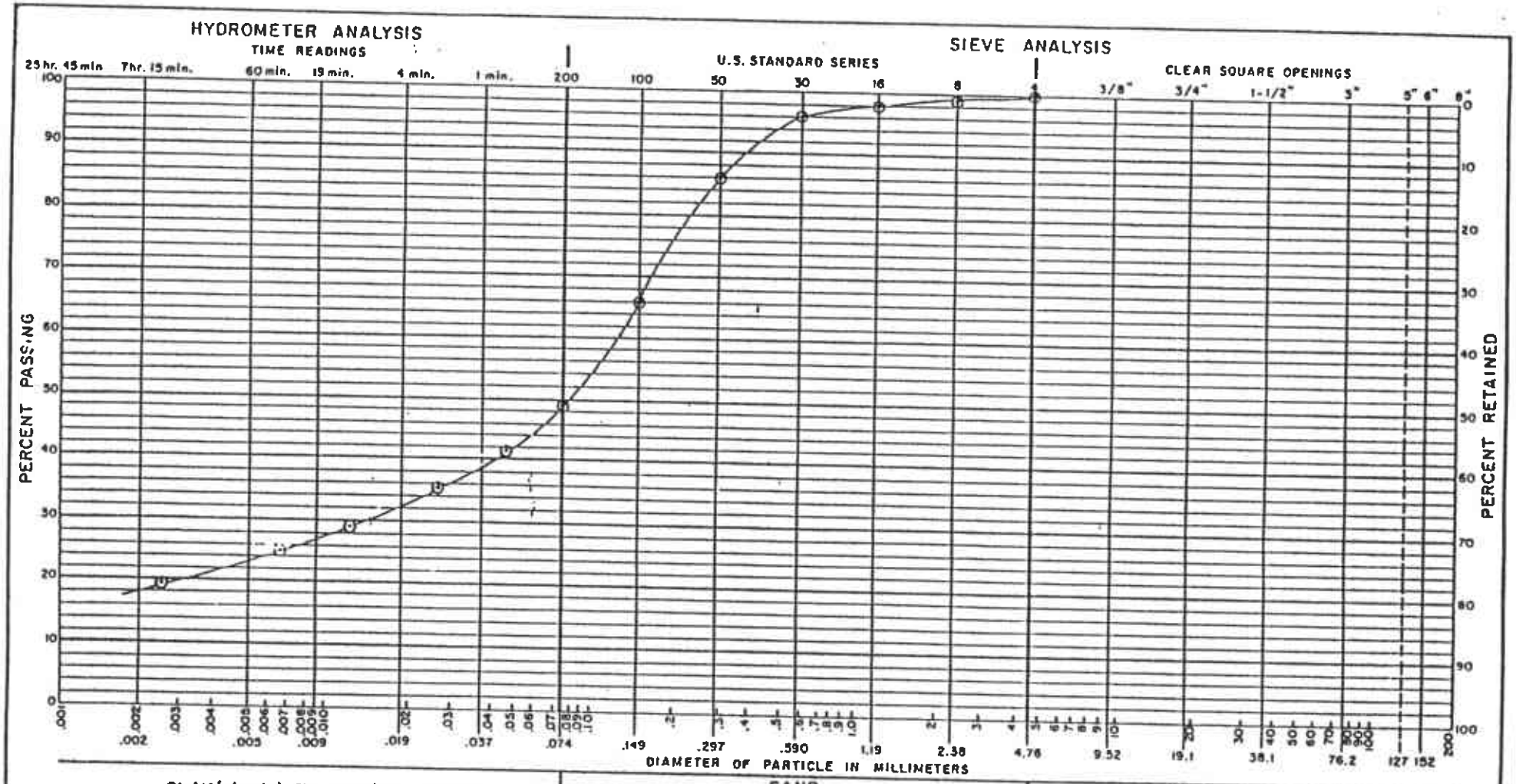
225-K CANNERY ROW
7891 WESTWOOD DR., SUITE 101
141 SUBURBAN RD., SUITE C2
MONTEREY, CA 93940
GILROY, CA 95020
SAN LUIS OBISPO, CA 93401
(408) 372-8716
(408) 842-0236
(805) 543-5493
FAX (408) 372-7481
FAX (408) 842-7314
FAX (805) 543-2748

GRADATION TEST RESULTS

PROJECT Geostrategies PROJECT NO. 4710

SAMPLE NO. S1 DEPTH 9.5

SAMPLE DESCRIPTION Clayey SAND; gray



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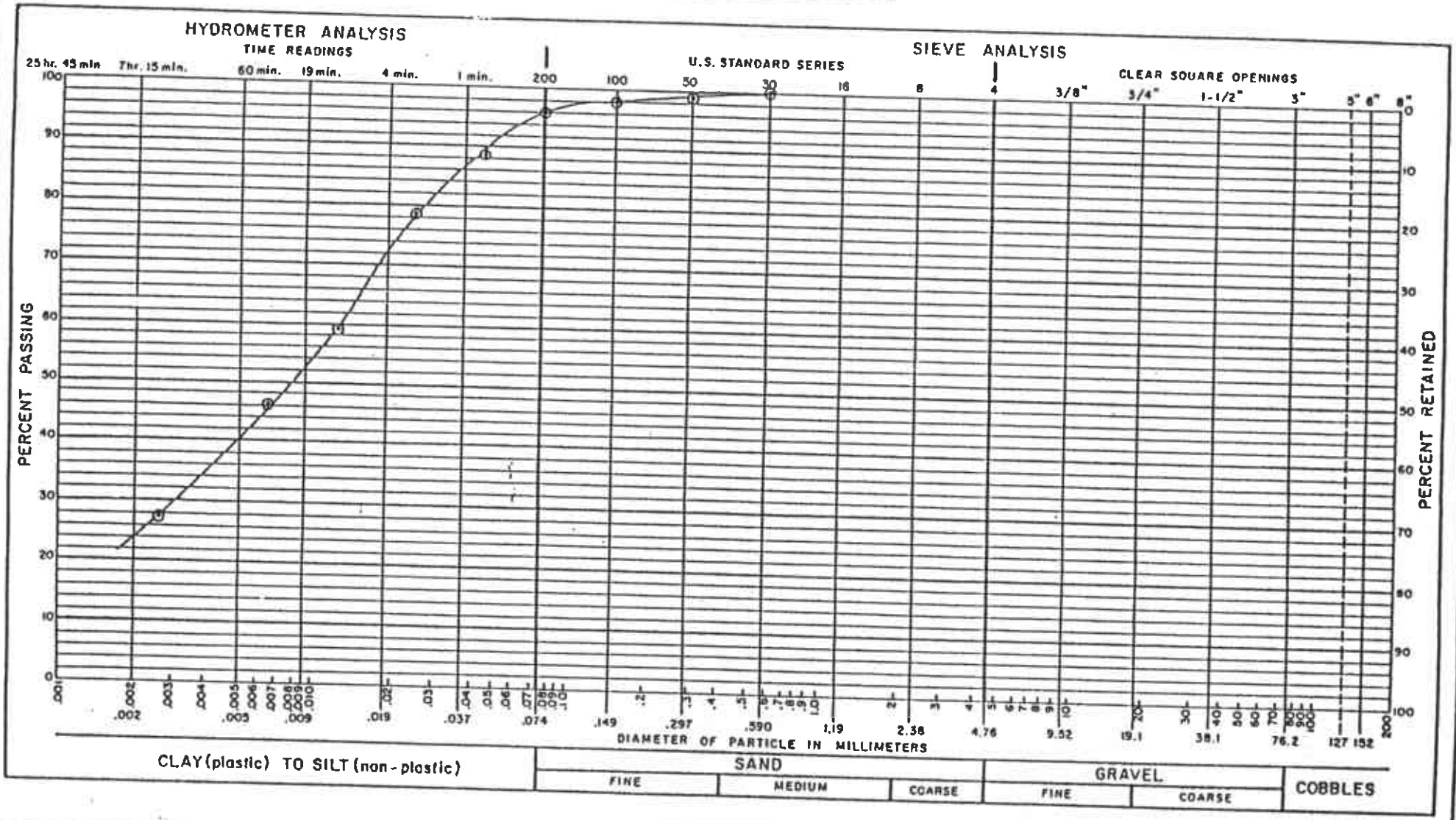
GRADATION TEST RESULTS

PROJECT Geostrategies PROJECT NO. 4710

SAMPLE NO. S1 DEPTH 14.0

SAMPLE DESCRIPTION FAT CLAY; green-gray



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L-0098

GeoStrategies Inc.
Environmental Consulting,
Engineering and Geologic Services

Letter of Transmittal **Date:**

From: Robert Lauritzen **Project No:** 7667

To: Jennifer Eberle
Alameda County Department
of Environmental Health
50 Iwan Way, Rm 200
Oakland, CA 94621

Subject: Monitor Well Installation
Report

The following items are: (X) **Enclosed** ( ) **Sent Separately via** _____

Date	Description	No. of Copies
8/16/92	Monitor Well Installation Report	1

These are transmitted:

- (X) At you request
- ( ) For your action
- ( ) For your approval
- ( ) For your files
- ( ) For your review
- ( ) For your information
- ( ) Preliminary
- ( ) _____

Comments: Report for Background info on site

[X] 2140 W. Winton Avenue, Hayward, CA 94545
(510) 352-4800 - Fax (510) 783-1089

[ ] 601 University Avenue, Sacramento, CA 95825
(916) 568-7500 - Fax (916) 568-7504

Robert A. Lauritzen
(Signed)