GROUNDWATER TECHNOLOGY
A DIVISION OF OIL RECOVERY SYSTEMS, INC.

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SITE ASSESSMENT INVESTIGATION REPORT
3400 SAN PABLO AVENUE
OAKLAND, CALIFORNIA
August 18, 1986

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20-8126

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3400 SAN PABLO AVENUE
OAKLAND, CALIFORNIA

INTRODUCTION

This report presents the results of Groundwater Technology, Inc.'s Site Assessment Investigation conducted at the Thrifty Oil Gasoline Station located at 3400 San Pablo Avenue, Oakland, California. Groundwater Technology was retained by Arco Petroleum Product Company to conduct the assessment with the consent of the present property owner the Thrifty Oil Company. The investigation was to serve as a preliminary assessment of subsurface contamination resulting from inadvertant loss of gasoline type hydrocarbons from the underground tanks and product lines at the facility.

WORK SCOPE

The purpose of this investigation was to evaluate the actual and potential impacts of a gasoline spill at the study site. The scope of work included the following activities:

1. Research reported subsurface fuel leaks for the site.

2. Drilling, geologically logging, and soil sampling borings using a hollow stem auger.

3. Field analyses of soil samples for presence of volatile organic vapors using a photoionization detector (PID).

4. Construction of 2-inch diameter monitoring wells (where applicable).

5. Measurement of water levels and field description of water quality in all monitoring wells.

6. Laboratory analysis of select soil samples for total petroleum hydrocarbons.

7. Laboratory analysis of groundwater samples for total petroleum hydrocarbon.

8. Preparation of a Site Assessment Report.

SITE CONDITIONS

SITE SETTING

The study area is lcoated in Alameda County along the eastern edge of San Francisco Bay. The general topography slopes southwesterly at a 2 percent gradient from the site elevation at 30 feet above sea level.

The project site is a small self service gasoline station located approximately one mile east of San Francisco Bay near the junction of Interstate Highways 580 and 980. The station has a total of four underground fuel storage tanks and two pump islands which dispense regular, unleaded and premium leaded fuels. The area surrounding the station is comprised predominantly of commercial and light industrial businesses except for a small residential community to the east. A Shell Service Station which adjoins the northern property boundary is the nearest facility with underground fuel storage tanks. The location of the site relative to the general Oakland, California vicinity is shown on Figure 1, Site Location Map and the layout of the station is

shown on Figure 2, Site Plan.

AREA WATER SUPPLY

A survey of records for all of the water wells registered (permitted) with city, county and state agencies indicate a total of nine wells within a 1 mile radius of the project site. One well is reportedly pumped at a rate of between 1 to 250 gallons per minute (gpm) and the other eight wells are reported to not be currently pumping. No municipal pumping wells are located within this 1 mile radius. Municipal water supply for the city of Oakland is provided by East Bay Municipal Utilities District which obtains water from the Mokelumne River in the San Joaquin Valley.

HYDROGEOLOGY

The area of investigation lies within the Bay Plains ground water basin which consists of two main water bearing units. The primary unit is comprised of unconsolidated alluvial deposits of Late Quaternary age and a secondary, older semi-consolidated deposit of Tertiary - Quaternary age. Groundwater within these deposits is both confined and unconfined, with the majority of the aquifers being confined. Consolidated basement rock of Pre Quaternary age is considered non-water bearing due to poor water yield.

The study site is within the Berkeley alluvial plain sub area of the Bay Plains Groundwater Basin. The older deposits of the Berkeley alluvial plain contain confined aquifers but the groundwater hydrology is poorly understood. The water bearing unconsolidated deposits within this sub area are composed of coalescing alluvial plains to the East and marsh tideland deposits to the west.

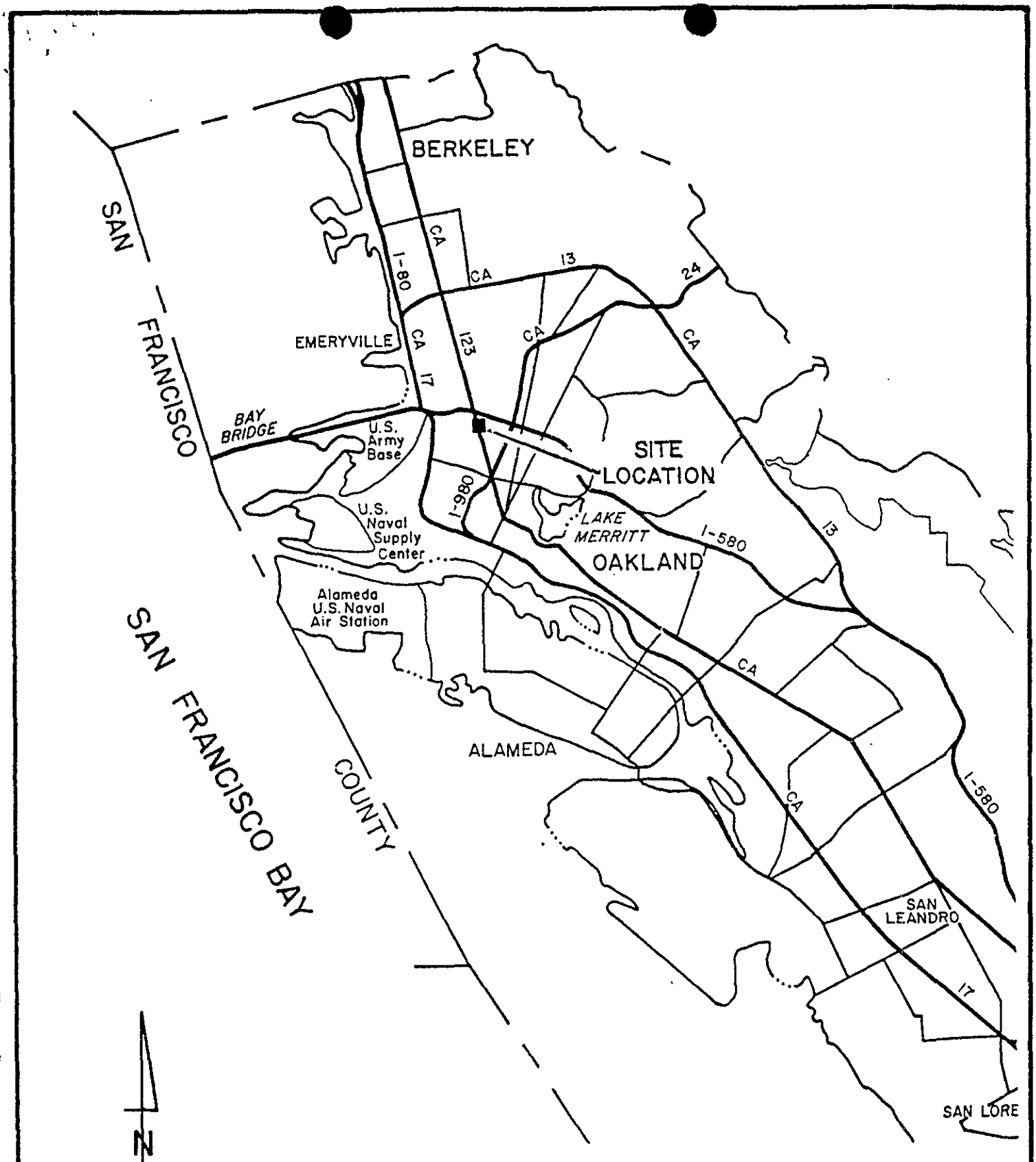


FIGURE 1

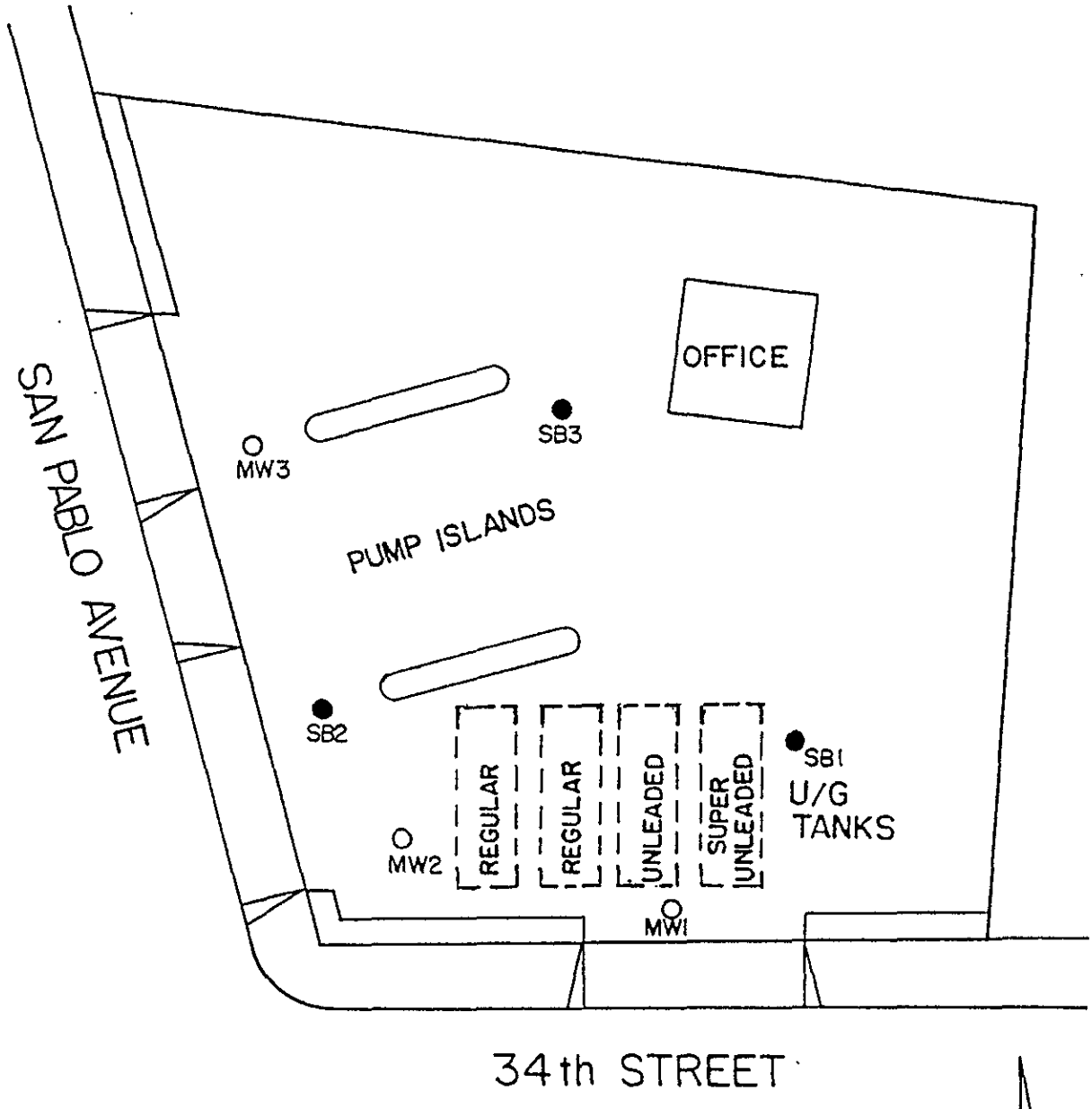
SITE LOCATION MAP

0 2

MILES

ARCO/SAN PABLO
OAKLAND, CALIFORNIA

GROUNDWATER TECHNOLOGY



EXPLANATION

O MWI-MONITORING WELL

● SBI-SOIL BORING

FIGURE 2

SITE PLAN

0 25

FEET

ARCO/SAN PABLO
OAKLAND, CALIFORNIA

GROUNDWATER TECHNOLOGY

These alluvial sediments consist of gravels, sands, silts and clays which increase in grain size and thickness eastward towards the head of the alluvial plain at the foot of the uplands. The sands and gravels were deposited by streams which braided over periods of thousands of years. The finer grained silt and clay material were deposited by flood stage overbank deposition and occasional inundation by the sea. Where these silts and clay are thick or widespread enough they form confining beds.

The marsh and tideland deposits are generally fine grained and consist mostly of marine organic silts and clays which are interfingered with the alluvial deposits over a broad belt. The Merrit sands which outcrop one mile south of the site are a main water bearing unit lcoated within these deposits. They consist of a well graded sand and form a unconfined aquifer.

Alluvial deposits, present at the study site, consisted predominantly unconsolidated stiff, sandy and silty clays to a depth of 25 feet. This clay has relatively low permeability, however, more pervious, water bearing alluvial may underlie this clay unit. Groundwater is present at a depth of approximately 8 feet below the ground surface and is assumed to flow westerly towards the San Francisco Bay. The nearest surface water body, Lake Merrit and the San Francisco Bay, are located at a distance of about 1 mile south and west of the station respectively.

INVESTIGATION PROCEDURES

Prior to on site investigative studies, research was conducted to provide background information on area hydrogeology, reported leaks, and permitting agency requirements. The hydrogeologic information has been discussed in the previous section. Communication with the California Regional Water Quality Control

Board, Alameda County Health Department and the City of Oakland Fire Prevention District indicated no reported fuel loss from this site. Permitting and installation of groundwater monitoring wells/soil borings was conducted in accordance with Alameda County Flood Control and Water Conservation District Zone 7 guidelines.

One July 31, 1986, Groundwater Technology drilled a total of six borings at the project site. The borings were drilled adjacent to underground fuel storage tanks and product lines using a truck mounted 8 inch diameter hollow stem auger. Soil sampling conducted was at five foot intervals, and field analysis for volatile organic vapors using a photoionization detector, was conducted in accordance with Groundwater Technology's Standard Operating Procedures SOP 11, 14, 15 and 19 (See Appendix I). Because groundwater was encountered at a depth of less than 40 feet below grade, three of the borings were converted into groundwater monitoring wells. The location of the soil borings and monitoring wells is graphically depicted on the site plan (See Figure 2). The drilling logs contain information on the following parameters: description of soils encountered; location of soil sample points; field PID readings; and well construction specifications (See Appendix II).

Subsequent to installation, the monitoring wells were developed by bailing in order to remove silts and improve well performance. Groundwater monitoring to determine the presence of gasoline and the depth of the liquid interface was conducted in accordance with Groundwater Technology's Standard Operating Procedure SOP 8 (See Appendix I). Groundwater samples obtained for laboratory analyses were collected, preserved and transported under Chain of Custody as per guidelines outlined in Groundwater Technology's Standard Operating Procedures SOP 9, 10 and 11 (See Appendix I).

ANALYTICAL RESULTS

GROUNDWATER MONITORING

The three on-site monitoring wells were monitored on August 5, 11 and 18, 1986 (See Table 1). The monitoring determined that depth to water is less than 8 feet below the ground surface. Visual inspection of a bailer sample from each well indicated monitoring wells 1 and 2 have strong gas odor and a slight sheen of gasoline on the surface. Monitoring well 3 was clear and had no apparent odor.

GROUNDWATER SAMPLE ANALYSES

On August 5, 1986, water samples were collected from the three monitoring wells for analyses of dissolved gasoline type hydrocarbon concentrations. Analyses were performed by purge and trap gas chromatography with photoionization and flame ionization detection as per EPA Method 602. The laboratory test results and method detection limits for the analyses performed are presented in Appendix III.* The analyses indicate relatively high concentration of 85.3 and 93.7 parts per million (ppm) total dissolved hydrocarbons in monitoring wells 1 and 2 respectively. A significantly lower concentration of 2.1 ppm was detected in monitoring well 3.

SOIL SAMPLE ANALYSES

On July 31, 1986, soil samples collected during soil borings were field analyzed for volatile organic vapor concentrations. The field analyses were conducted using an HNU photoionization detector (PID) which has a detection limit of 1 ppm. The measured vapor concentration for each soil sample is plotted adjacent to the sample point on the drilling logs (See Appendix

II). Measured concentrations ranged from 0 to 55 ppm with the higher readings occuring in the soil interval between 0 and 10 feet.

Select soil samples were laboratory analyzed to determine total petroleum hydrocarbon concentrations. Analyses was performed by a Modified EPA Method 418.1 procedure which has a detection limit of 10 ppm. The laboratory test results for the samples analyzed are contained in Appendix IV. Concentrations above the detection limit were recording in samples from soil boring 2 (67 ppm at 9 - 9.5 ft.) and monitoring well 3 boring (22 ppm at 4 - 4.5 ft.). All other sample concentrations were below the method detection limit.

SUMMARY

Groundwater Technology was contacted to provide a site assessment investigation of subsurface contamination at the Thrifty Gasoline Service Station at 3400 San Pablo Avenue, Oakland, California. The investigation consisted of research, drilling of six soil borings, installation of three monitoring wells, soil sampling and analyses, and water sampling and analyses. The results of this investigation are summarized below.

- Subsurface soils at the site consist predominantly of stiff, silty and sandy clays.
- Groundwater is approximately 8 feet below the ground surface and exists under water table conditions.
- No measurable, free floating gasoline product was observed on the water table through the August 18, 1986 monitoring.

- Gasoline odors were noted by field inspection and field PID analyses of soil samples.
  - Field inspection of samples indicated slight to moderate gasoline odor to a depth of 10 feet below grade.
  - The highest field PID readings were in sample obtained between 4 and 10 feet below grade.
- Adsorbed petroleum hydrocarbons exist in the soils.
  - Soil Boring 1 had 67 ppm (mg/kg) total petroleum hydrocarbons at 9 - 9.5 feet.
  - Monitoring well 3 boring had 22 ppm (mg/kg) total petroleum hydrocarbons at 4 - 4.5 feet.
- Dissolved gasoline hydrocarbons exist in the groundwater.
  - Well 1 had 85.3 ppm total dissolved hydrocarbons.
  - Well 2 had 93.7 total dissolved hydrocarbons.
  - Well 3 had 2.1 ppm total dissolved hydrocarbons.

CLOSURE

Groundwater Technology would like to thank ARCO Petroleum Products for the opportunity to conduct this site assessment investigation. Should you have any questions or comments regarding this report, please feel free to contact us.

TABLE 1

GROUNDWATER MONITORING DATA
3400 SAN PABLO AVENUE
OAKLAND, CALIFORNIA

Date	Well #	Depth to Water (ft.)	Depth to Water (ft.)	Product Thickness (ft.)	Comments
08/05/86	1	6.54	-	-	Moderate Gas Odor, Clear
	2	6.19	-	-	Strong Gas Odor, Gas Sheen
	3	6.23	-	-	No Odor, Clear
08/11/86	1	6.72	-	-	Strong Gas Odor, Gas Sheen
	2	6.42	-	-	Strong Gas Odor, Gas Sheen
	3	7.57	-	-	No Odor, Clear
08/19/86	1	6.85	-	-	Strong Gas Odor, Gas Sheen
	2	6.48	-	-	Strong Gas Odor, Gas Sheen
	3	7.40	-	-	Slight Gas Odor, Sheen

APPENDIX I

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING GROUNDWATER MONITORING
SOP 8

Groundwater monitoring of wells at the site shall be conducted using an ORS Interface Probe and Surface Sampler. The Interface Probe is a hand held, battery operated device for measuring depth to petroleum product and depth to water as measured from an established datum (i.e., top of the well casing which has been surveyed). Product thickness is then calculated by subtracting the depth to product from the depth to water. In addition, water elevations are adjusted for the presence of fuel with the following calculation:

(Product Thickness)(.8)+(Water Elevation)
= Corrected Water Elevation

Note: The factor of 0.8 accounts for the density difference between water and petroleum hydrocarbons.

The Interface Probe consists of a dual sensing probe utilizing an optical liquid sensor and electrical conductivity to distingish between water and petroleum products. A coated steel measuring tape transmits the sensor's signals to the reel assembly, where an audible alarm sounds a continuous tone when the sensor is immersed in petroleum product and an oscillating tone when immersed in water. The Interface Probe is accurate to 1/16-inch.

A Surface Sampler shall be used for visual inspection of the groundwater to note sheens (difficult to detect with the Interface Probe), odors, microbial action, etc.

The Surface Sampler used consists of a 12-inch long cast acrylic tube with a Delrin ball which closes onto a conical surface creating a seal as the sampler is pulled up. The sampler is calibrated in inches and centimeters for visual inspection of product thickness.

To reduce the potential for cross contamination between wells the monitorings shall take place in order from the least to most contaminated wells. Wells containing free product should be monitored last. Between each monitoring the equipment shall be washed with laboratory grade detergent and double rinsed with distilled water.

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING WATER SAMPLING METHODOLOGY
SOP 9

Prior to water sampling, each well shall be purged by pumping a minimum of four well volumes or until the discharge water indicates stabilization of temperature, conductivity,and pH. If the well is evacuated before four well volumes are removed or stabilization is achieved, the sample should be taken when the water level in the well recovers to 80% of its initial level.

Retrieval of the water sample, sample handling and sample preservation shall be conducted in accordance with Groundwater Technology Laboratory Standard Operating Procedure (GTL SOP 10) concerning Sampling For Volatiles in Water". The sampling equipment used shall consist of a teflon and/or stainless steel samplers, which meets EPA regulations. Glass vials with teflon lids should be used to store the collected samples.

To insure sample integrity, each vial shall be filled with the sampled water such that the water stands above the lip of the vial. The cap should then be quickly placed on the vial and tightened securely. The vial should then be checked to ensure that air bubbles are not present prior to labeling of the sample. Label information should include a sample identification number, job identification, date, time, type of analysis requested and the sampler's name. Chain-of-Custody forms shall be completed as per Groundwater Technology Laboratory Standard Operating Procedure (SOP 11) concerning Chain of Custody.

The vials should be immediately placed in high quality coolers for shipment to the laboratory. The coolers should be packed with sufficient ice or freezer packs to ensure that the samples are kept below 4C. Samples which are received at the Groundwater Technology Laboratory above 10 C. will be considered substandard. To minimize sample degradation the prescribed analysis shall take place within seven days of sample collection unless specially prepared acidified vials are used.

To minimize the potential for cross contamination between wells, all the well development and water sampling equipment which contacts the groundwater shall be cleaned between each well sampling. As a second precautionary measure, the wells shall be sampled in order of increasing contaminant concentrations as established by previous analysis.

GROUNDWATER TECHNOLOGY LABORATORY (GTL)
STANDARD OPERATING PROCEDURE
CONCERNING SAMPLING FOR VOLATILES IN WATER (DISSOLVED GASOLINE, SOLVENTS, ETC.).
SOP 10

1. Use only vials properly washed and baked, available from GTL or Pierce Chemical.

2. Use clean sampling equipment. Scrub with Alconox or equivalent laboratory detergent and water followed by a thorough water rinse. Complete with a distilled water rinse.

   Sampling equipment which has come into contact with liquid hydrocarbons (free product) should be regarded with suspicion. Such equipment should have tubing and cables replaced and all resilient parts washed with laboratory detergent solution, as above. Visible deposits may have to be removed with hexane, breath methanol fumes. Solvent washing should be followed be detergent washing as above.

   This procedure is valid for volatile organics analysis only. For extractable organics (for example, pesticides, or base neutrals for EPA method 625) a final rinse with pesticide grade isopropyl alcohol, followed by overnight or oven drying, will be necessary.

3. Take duplicate samples for GTL. Mark on forms as a single sample with two containers to avoid duplication of analysis.

4. Take a site blank using distilled water or known uncontaminated source. This sample will be run at the discretion of the project manager.

5. Fill out labels and forms as much as possible ahead of time. Use an indelible laundry marker or a Space pen.

6. Preservatives are required for some types of samples. Use specially prepared vials from GTL, marked as indicated below, or use the appropriate field procedure (SOP 12 for acidification). Make note on forms that samples were preserved. Always have extra vials in case of problems. For samples from dissolved gasoline sites or other samples shoudl be acidified below pH 2 with sulfuric acid. Use vials with care and keep them upright. Eye protection, foot protection, and disposable vinyl golves are required for handling. Samples designated for expedited service and analyzed within seven (7) days of sampling will be acceptable without preservation.

   Acid causes burns. Glasses or goggles (not contacts) are necessary for protection of the eyes. Wash eyes with fresh water for 15 minutes if contact occurs and seek medical attention. Rinse off hands frequently with water during handling.

   For sampling chlorinated drinking water supplies for chlorinated volatiles, samples shall be preserved with sodium thiosulfate. Use vials labeled "CONTAINS THIOSULFATE". No particular cautions are necessary.

7. Fill vial to overflowing with water, avoiding turbulence and bubbling as much as possible. Water should stand above lip of vial.

8. Carefully but quickly slip cap onto vial. Avoid dropping the teflon disc from cap by not inverting cap until in contact with vial. Disc should have teflon face toward the water. Also avoid touching white teflon face with dirty fingers.

9. Tighten cap securely, invert vial and tap against hand to see that there are no bubbles inside.

10. Label vial using indelible ink as follows:

    a) Sample I.D. No. (and "Groundwater Technology" if not on preprinted label).
    b) Job I.D. No.
    c) Date and Time.
    d) Type of analysis requested.
    e) Your name.

11. Unless the fabric type label is used, place scotch tape over the label to preserve its integrity.

12. For Chain of Custody reasons, sample vial should be wrapped end-for-end with scotch tape or evidence tape and signed with indelible ink where the end of the tape seals on itself. The septum needs to be covered.

13. Chill samples immediately. Samples to be stored should be kept at 4°C (39°F). Samples received at the laboratory above 10°C (as measured at glass surface by a thermocouple probe), after overnight shipping will be considered substandard, so use a high quality cooler with sufficient ice or freezer packs. (Coolers are available from GTL).

14. Fill out Chain of Custody and Analysis Request form. (See Chain of Custody Procedures SOP11).

GROUNDWATER TECHNOLOGY LABORATORY (GTL)
STANDARD OPERATING PROCEDURE
CONCERNING CHAIN OF CUSTODY
SOP 11

1. Samples must be maintained under custody until shipped or delivered to the laboratory. The laboratory will then maintain custody. A sample is under custody if:

    a) It is in your possession
    b) It is in your view after being in your possession
    c) You locked it up after being in your possession
    d) It is in a designated secure area

2. Custody of samples may be transferred from one person to the next. Each transferee and recipient must date, sign and note the time on the chain of custody form.

3. In shipping, the container must be sealed with tape, bearing the sender's signature across the area of bonding at the ends of the tape in order to prevent undetected tampering. Each sampling jar should be taped and signed as well. Scotch tape works well.

4. Write "sealed by" and sign in the Remarks box at the bottom of the form before sealing up the box. Place form in a plastic bag and seal inside the box.

5. The "REMARKS" section in the upper right part of the form is for documenting details such as:

    a) correlation of sample numbers if samples are split between labs.
    b) QC numbers when lab is logging in the samples.
    c) sample temperature and condition when received by lab.
    d) Preservation notation.
    e) pH of samples when opened for analysis (if acidified).

6. The chain of custody form should be included inside the shipping container. A copy should be sent to the project coordinator.

7. When the samples are received by the lab, the chain of custody form will be dated, signed, and a note of the time made by a laboratory representative. The form along with shipping bills and receipts will be retained in the laboratory files.

8. At the time of receipt of samples by the laboratory, the shipping container will be inspected and the sealing signature will be checked, the samples will be inspected for condition and bubbles and the temperature of a representative sample container will be measured externally by a thermocouple probe (held tightly between two samples) and recorded. The laboratory QC numbers will be placed on the labels, in the accession log, and on the chain of custody form. If samples are acidified their pH will be measured by narrow range pH papre at the time of opening fir analysis. All comments concerning procedures requiring handling of the samples will be dated and initialed on the form by the laboratory person performing the procedure. A copy of the completed chain of custody form with the comments on sample integrity will be returned to the sampler.

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING SOIL SAMPLING METHODOLOGY
SOP 14

Soil samples should be collected and preserved in accordance with Groundwater Technology Laboratory's Standard Operating Procedure (GTL SOP 15) concerning Soil Sample Collection and Handling when Sampling for Volatile Organics. A hollow stem soil auger should be used to drill to the desired sampling depth. A standard 2 inch diameter split spoon sampler 18 inches in length shall be used to collect the samples. The samples are contained in 2 inch diameter by 6 inch long thin walled brass tube liners fitted into the split spoon sampler (three per sampler).

The split spoon sampler should be driven the full depth of the spoon into the soil using a 140 pound hammer. The spoon shall then be extracted from the borehole and the brass tube liners containing the soil sample removed from the sampler. The ends of the liner tubes should be immediately covered with aluminum foil, sealed with a teflon or plastic cap, and then taped with duct tape. After being properly identified with sample data entered on a standard chain of custody form the samples shall be placed on dry ice (maintained below 4°C) and transported to the laboratory within 24 hours.

One of the three soil samples retreived at each sample depth shall be analyzed in the field using a photoionization detector and/or explosimeter. The purpose of the field analysis is to provide a means to choose samples to be laboratory analyzed for hydrocarbon concentrations and to enable comparisions between the field and laboratory analyses. The soil sample shall be sealed in a plastic bag and placed in the sun to accelerate the vaporization of volatile hydrocarbons from the soil. One of the two field vapor instruments shall be used to quantify the amount of hydrocarbon released to the air from the soils. The data shall be recorded on the drill logs at the depth corresponding to the sample point.

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING SOIL SAMPLE COLLECTION AND
HANDLING WHEN SAMPLING FOR VOLATILE ORGANICS
SOP 15

1. Use a sampling means which maintains the physical integrity of the samples. The project sampling protocol will designate a preferred sampling tool. A split spoon sampler with liners or similar tube sampler which can be sealed is best.

2. At the discretion of the project manager, the samples should be either.

   A. sealed in liner with teflon plugs (The "California Sampler") or

   B. field prepped for sample analysis.

   Projects using method (A) will incur a separate sample preparation charge of $ 10.00 per sample in the laboratory. For method (B), prepared and pre-weighed vials, and sample coring syringes must be ordered at least 2 weeks ahead of time from the laboratory before sampling. (Vials are free if samples will be sent to Groundwater Technology Laboratory).

3. For sending whole-core samples (2A above):

   A. Seal ends of liner with teflon plugs leaving no free air space inside.

   B. Tape with duct tape.

   C. Cover with a non-contaminating sealant (paraffin).

   D. Place in plastic bag labeled with indelible marker. Use Well #, depth, date, and job #.

   E. Place inside a second bag and place a labelling tag inside outer bag.

   F. Enclose samples in a cooler with sufficient ice or dry ice to maintain samples at 4 degrees during shipment.

   G. Seal cooler with a lock or tape with samplers signature so tampering can be detected.

H. Package cooler in a box with insulating material. Chain of custody forms can be placed in a plastic bag in this outer box.

I. If dry ice is used, a maximum of 5 pounds is allowed by Federal Express without special documents (documents are easy to obtain but just not necessary for under 5 pounds). Simply write "ORM-A dry ice," "_____ pounds, for research" on outside packaging and on regular airbill under classification. UPS does not accept dry ice.

J. Make yourself a supplies list necessary before going into the field.

K. Soil cores kept a 4 degrees C are only viable for up to 7 days when aromatic hydrocarbons are involved. The lab will prepare them in methanol as above once in the lab, but we will need a call ahead of time to schedule personnel.

4. For field-prepping (Step 2B above):

A. Obtain prepared sample containers from the laboratory. Order for # of samples intended and add 50%. This should be sufficient for QA requirements (below), breakage, and additional samples taken by discretion of sampler.

B. Organize containers consecutively - they are all numbered and pre-weighed. Make a necessary supplies list before going into the field.

C. For a 6" liner section retrieved from the spoon sampler, spread a 12" square piece of broiler (heavy) aluminum foil and slice it lengthwise with a clean stainless steel spatula.

D. Immediately sample with a coring syringe with plunger removed. Poke tube into mid-section of core (into undisturbed soil) to capture a 1/2 to 1 inch plug.

E. Immediately transfer to the sample vial with methanol by using plunger. Clean around lip of vial to remove soil with clean laboratory paper towelling

CAUTION: WORK ONLY IN WELL VENTILATED AREA. DO NOT BREATH METHANOL VAPOR. IT IS TOXIC. SEE MSDS ATTACHED.

and seal septum onto the vial with lid, teflon side (shiny) toward the sample. shake sample enough to break it up so that whole sample is immersed in methanol. The rapid progression of steps indicated here is necessary to prevent loss of volatiles from the soil. Do not leave vials unopened for any extended period - the methanol evaporates quickly. Grit left on threads of vial can cause vial to break.

F. * If required (see 5 below). Take a duplicate sample from the other half directly across from the first sample, or where ever undisturbed, yet representative soil occurs.

G. Label vial with legible information as follows:

1. Job name or number.

2. Date.

3. Time.

4. Depth and well number.

5. Samplers initials.

H. Tape vial across septum with scotch tape and around cap and sign on the tape with indelible ink to prevent tampering.

I. Wrap up a representative section of the core equivalent in volume to cube 3 cm on a side in the aluminum foil square, discarding the rest appropriately. Seal in saran wrap. This section is for dry weight determination. Close it in plastic bag with a tag or write on the bag with an indelible marker. These samples go into a separate cooler or box and not with the vials. The cooler for dry weight samples need not be iced, but overnight delivery is requested.

J. Discard plastic coring syringe, clean the spatula, and get clean equipment ready for next sample.

K. Ice the sample vials immediately and keep them iced through shipment.

L. Fill out chain of custody form. SOP 11 gives major details. Make sure sample requests is for proper analysis type.

M. Shipping of hazardous materials (methanol) requires special documents from Federal Express and UPS. Have this all arranged ahead of time (once set up with documents, the actual process will be little different than normal). Briefly you will need to add following to outside of package and on documents:

1. Flammable liquid label (some will come from lab with the vials).

2. "UN1230 methyl alcohol".

3. For UPS, a "Hazardous Material" label.

N. Ship overnight delivery to the lab. If dry ice is available, up to 5 pounds per package can be sent via Federal Express by simply writing "ORM-A dry ice", "_____ pounds, for research" on outside of package and on shipping document. UPS does not accept dry ice shipments.

5. Good sampling practice would include preparing 1 out of 5 samples to be prepared in duplicates for analysis. These 4 out of 20 samples will be for the following purposes.

A. One in every 20 samples should be analyzed as a field replicate to evaluate the precision of the sampling technique. A minimum of 1 sample per data set is suggested.

B. An additional 1 in 20 samples should be selected by sampler to be prepared in duplicate as alternative to Step (A). Choose a different soil type if available.

C. The lab does spiking with reference materials for internal QC so additionally a minimum of 2 in 20 samples need to be prepared in duplicate.

6. Other QC procedures can be specified at the project manager's discretion. See Table 3-2 (reference 2) attached.

7. Decontamination of equipment in the field requires a detergent wash, a water rinse, and spectrographic quality acetone rinse followed by distilled water.

REFERENCES

1. Soil Sampling Quality Assurance Users Guide, U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, NV, EPA 600/4-84-043, May 1984.

2. Preparation of Soil Sampling Protocol. Techniques and Strategies, U.S. EPA, Environmental Monitoring Systems Laboratory, Las Vegas, NV, EPA 600/4-83-020, August 1983 (PB83-206979).

3. Test Methods for Evaluating Solid Waste, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., SW 846, July 1982.

APPENDIX II

GROUNDWATER TECHNOLOGY
Division of Oil Recovery Systems, Inc.

Drilling Log

Well Number MW 1

Project Arco/San Pablo Owner Arco Petroleum

Location 3400 San Pablo Ave. Project Number 20-8126

Date Drilled 7/31/86 Total Depth of Hole 25 ft Diameter 8 in.

Surface Elevation ____ Water Level, Initial ____ 24-hrs. ____

Screen: Dia. 2 in. Length 20 ft. Slot Size .020

Casing: Dia. 2 in. Length 5 ft. Type PVC

Drilling Company Sierra Pacific Drilling Method H. S. Auger

Driller L. Pera Log by B. Channell

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		PID			Concrete
1				CL	Black clay, stiff, damp, no odor
2					
3				CL	Green gray clay, stiff, damp, moderate odor
4					
5				CL	Brown silty clay, stiff, damp, moderate odor
6					
7				CL	Brown sandy clay; soft, wet, pebbles, moderate odor
8		3 ppm	A 12		
9			16		Grey gravel and brown clay, dry, crumbly, moderate
10			27		▼ 7/31/86 odor
11					
12				CC	
13		0 ppm	B		Gray gravel in brown clay, soft, wet, no odor
14			9		
15			8		
16			7		
17					
18					
19					
20				CL	Brown silty clay, stiff, dry, no odor
21					
22					
23					
24					
25					

02100144

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Drilling Log

Well Number MW 2

Project Arco/San Pablo — Owner Arco Petroleum

Location 3400 San Pablo Ave. — Project Number 20-8126

Date Drilled 7/31/86 — Total Depth of Hole 25 ft. — Diameter 8 in.

Surface Elevation ____ — Water Level, Initial ____ : ____ — 24-hrs. ____

Screen: Dia. 2 in. — Length 20 ft. — Slot Size .020

Casing: Dia. 2 in. — Length 5 ft. — Type PVC

Drilling Company Sierra Pacific — Drilling Method H. S. Auger

Driller L. Pera — Log by B. Channell

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		PID			Concrete
1					Black clay, stiff, dry, no odor
2					
3					Green gray clay, stiff, camp, moderate odor
4				CL	
5					
6					Brown clay, soft, moist, pebbles, moderate odor
7					
8					
9		12 ppm	A 5 6 7		Brown silty clay, stiff, pockets of water, minor pebbles, no odor
10					▼ 7/31/86
11					
12					
13		7 ppm	B		
14			3 4 6		
15					
16				CL	Brown silty clay, very stiff, damp, no odor
17					
18					
19					
20					
21					
22					
23					
24					
25					

02100144

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Drilling Log

Well Number MW 3

Project Arco/San Pablo Owner Arco Petroleum

Location 3400 San Pablo Ave. Project Number 20-8126

Date Drilled 7/31/86 Total Depth of Hole 25 ft. Diameter 8 in.

Surface Elevation ____ Water Level, Initial ____ 24-hrs. ____

Screen: Dia. 2 in. Length 20 ft Slot Size .020 in.

Casing: Dia. 2 in. Length 5 ft. Type PVC

Drilling Company Sierra Pacific Drilling Method H. S. Auger

Driller L. Pera Log by B. Channell

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		PID			Concrete
1					Black clay, stiff, damp, slight odor
2				CL	
3		15 ppm	A		
4			4 4 4		Gray silty clay, soft, damp, minor gravel, moderate odor
5				CL	
6					
7					
8		15 ppm	B		Brown silty clay, stiff, damp, pebbles, slight odor
9			4 4 6		
10					▼ 7/31/86
11					
12					
13		0 ppm	C		
14			4 5 7		
15				CL	Brown silty clay, stiff, dry, no odor
16					
17					
18					
19		0 ppm	D		
20			5 7 13		
21					
22					
23					
24					
25					

GROUNDWATER TECHNOLOGY
Division of Oil Recovery Systems, Inc.

SOIL BORING SB 1

Drilling Log

Project Arco/San Pablo Owner Arco Petroleum

Location 3400 San Pablo Ave. Project Number 20-8126

Date Drilled 7/31/86 Total Depth of Hole 20ft Diameter 8 in.

Surface Elevation _____ Water Level, Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company Sierra Pacific Drilling Method H. S. Auger

Driller L. Pera Log by B. Channell

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		PID			Asphalt
1				CL	Black clay, damp, semi-stiff, no odor
2					
3					
4				CL	Green gray clay, stiff, damp, no odor
5					
6					
7					
8		55 ppm	A 6		Green gray sandy clay, moderately stiff, wet in
9			7	CL	▼7/31/86 places, moderate odor
10			21		
11					Brown silty clay, stiff, dry, no odor
12					
13		0 ppm	B 3		
14			5		
15			6	CL	
16					
17					Brown silty clay, very stiff, damp, minor pebbles,
18					no odor
19		0 ppm	5 C 12		
20			14		
21					
22					
23					
24					
25					

02100144

GROUNDWATER TECHNOLOGY
Division of Oil Recovery Systems, Inc.

SOIL BORING SB 2

Drilling Log

Project Arco/San Pablo Owner Arco Petroleum
Location 3400 San Pablo Ave. Project Number 20-8126
Date Drilled 7/31/86 Total Depth of Hole 20 ft Diameter 8 in.
Surface Elevation ____ Water Level, Initial ____ 24-hrs. ____
Screen: Dia. ____ Length ____ Slot Size ____
Casing: Dia. ____ Length ____ Type ____
Drilling Company Sierra Pacific Drilling Method H. S. Auger
Driller L. Pera Log by B. Channell

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		PID			Concrete
1				CL	Black clay, stiff, damp, no odor
2					
3		11 ppm	A		Gray gravel and brown clay, damp, moderate odor
4			5	GC	
5			7 12		
6					
7					
8		7 ppm	B		Brown silty clay, stiff, damp, minor pebbles, slight odor
9			4 5 6		
10					
11				▼7/31/86	
12					
13		0 ppm	C	CL	
14			4 5		
15			5		Brown silty clay, very stiff, dry, no odor
16					
17					
18		0 ppm	D		
19			5 10		
20			12		
21					
22					
23					
24					
25					

02100144

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc

SOIL BORING SB 3 — Drilling Log

Project Arco/San Pablo — Owner Arco Petroleum

Location 3400 San Pablo Ave. — Project Number 20-8126

Date Drilled 7/31/86 — Total Depth of Hole 20 ft — Diameter 8 in.

Surface Elevation ____ — Water Level, Initial ____ — 24-hrs. ____

Screen: Dia. ____ — Length ____ — Slot Size ____

Casing: Dia. ____ — Length ____ — Type ____

Drilling Company Sierra Pacific — Drilling Method H. S. Auger

Driller L. Pera — Log by Lynn Pera

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0					Concrete
1					Black silty clay, stiff, damp, slight hydrocarbon odor
2					
3					Greenish gray fine sandy clay with gravel, stiff,
4		28 ppm	A 5 7 11		moist, slight odor
5					
6					Greenish brown fine sandy clay, medium stiff, moist,
7					
8					Brown sandy clay with gravel, stiff, moist
9		12 ppm	B 5 7 7	CL	
10					
11					
12					
13					Grayish brown sandy clay, stiff, moist
14		0ppm	C 3 6 8		
15					
16					▼ 7/31/86
17					
18					(grades orange-brown)
19		0ppm	D 5 7 10		
20					
21					
22					
23					
24					
25					

02100144

APPENDIX III

GT ENVIRONMENTAL LABORATORY

ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
P. O. Box 541, Greenville, NH 03048
Tel: (603) 878-2500

8/12/86
Report No. 20-8126-1
Submitted to: Robert Juncal
Groundwater Technology
4080 Pike Lane
Concord, CA. 94520

Sample Identification:
The attached report covers water samples #29039-29041 taken by S. Thompson using 40mL septum-capped glass vials at site #20-8126, Oakland, California.

Method:
Analysis was performed for purgeable aromatic priority pollutants and xylenes by purge and trap gas chromatography with photoionization and flame ionization detection as per EPA Method 602. Quantification was performed on a very polar column which fractionates aliphatics (up to C12) away from volatile aromatics. Chromatographic conditions are referenced in GTL Method Code 110. Hexane is used as a calibration standard for the aliphatic hydrocarbons and miscellaneous aromatics, if reported.

Minimum Detection Limit (MDL) at 5 times background is 0.5 ppb for all parameters. The level for reliable quantitation for the summed groups such as aliphatics is 20 ppb. Samples diluted in order to maintain the calibrated range are so indicated by a footnote giving the factor by which the HDL is raised.

Sampling and sample handling and preservation are specified by this laboratory to be as per EPA Method 602. Any irregularities are referenced in the attached quality assurance report.

Results:
Results are reported in ppb (ug/l)

Prepared by:
Bob Edwards
GC Manager Bob Edwards

C.P.
Analyst

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING OPERATION/CALIBRATION OF
PHOTOIONIZATION ANALYZER
SOP 19

The HNU Model 101 Photoionization Analyzer shall be used to measure the concentration of trace gases over a range of less than 1 ppm to 2,000 ppm by employing the principle of photoionization for detection. The specific instrument used for investigations related to hydrocarbon contamination should be calibrated for direct readings in parts per million (ppm) volume/volume of benzene. This portable field analyzer consists of two components (1) probe which contains a fan for moving air into the sensor, an ultraviolet light (provides ionization energy), an ionization chamber and signal amplifer (2) readout assembly which contains a battery, ion chamber bias, meter readout and control panel. Specifics of the detection principle/theory and functions of various components can be found in the manufactures instruction manual (HNU Systems, Inc.).

To assure optimum performance, the photoionization analyzer should be calibrated with a standard gas mixture of known concentration from a pressurized container. A daily procedure for calibration involves bringing the probe and readout in close proximity to the calibration gas, cracking the valve on the tank and checking the instrument reading. This provides a useful spot check for the instrument.

A procedure conducted weekly for more accurate calibration of the instrument from a pressurized container is to connect one side of a "T" to the pressurized container of calibration gas, another side of the "T" to a rotameter and the third side of the "T" directly to the 8" extension to the photoionization probe (see Figure 2). Crack the valve of the pressurized container until a slight flow is indicated on the rotameter. The instrument draws in the volume of sample required for detection, and the flow in the rotameter indicates an excess of sample. Now adjust the span pot so that the instrument is reading the exact value of the calibration gas. (If the instrument span setting is changed, the instrument should be turned back to the standby position and the electronic zero should be readjusted, if necessary).

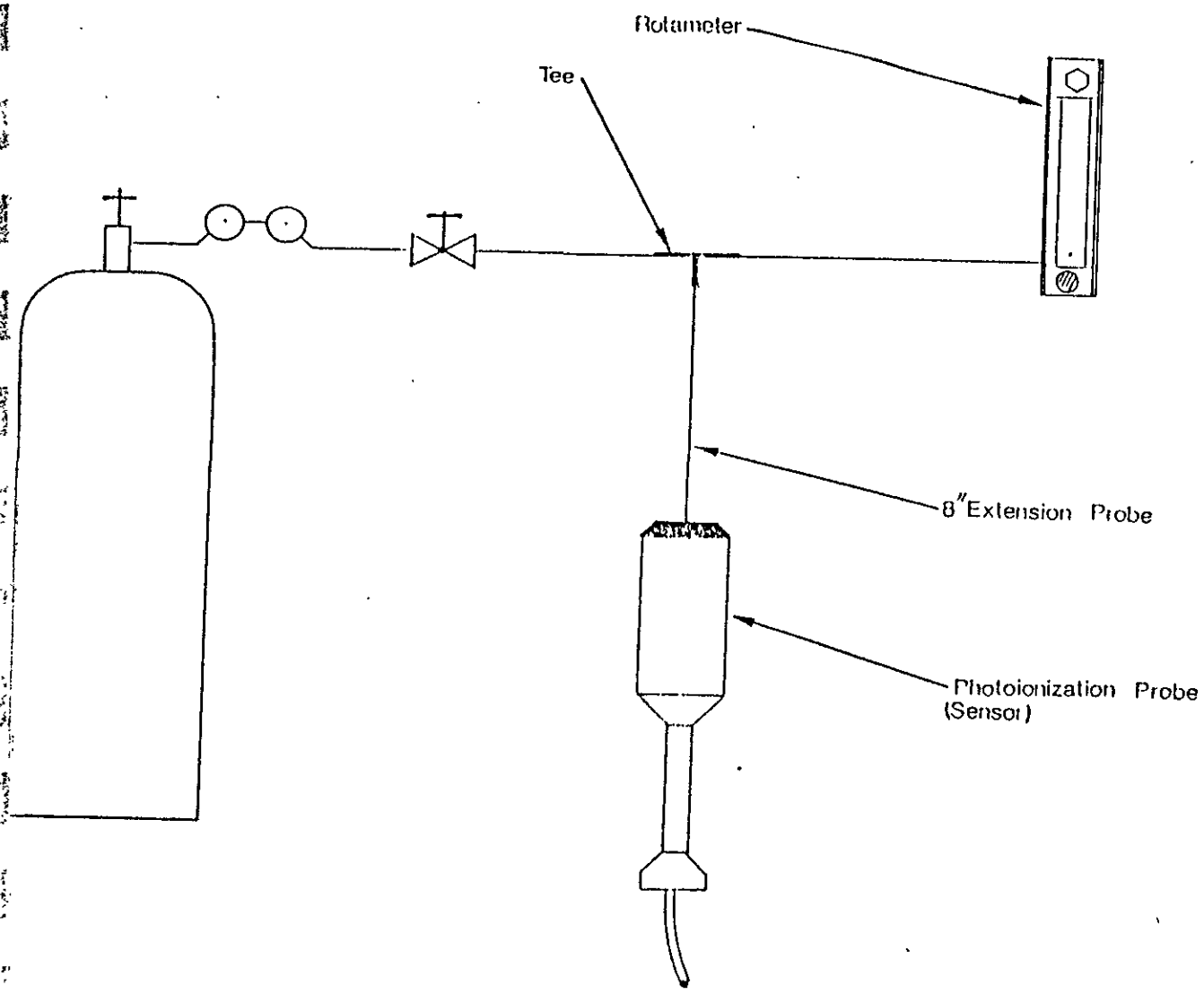


Figure 2

GROUNDWATER
TECHNOLOGY
Consulting Groundwater Geologists

GT ENVIRONMENTAL LABORATORY

ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
P. O. Box 541, Greenville, NH 03048
Tel: (603) 878-2500

HYDROCARBONS IN WATER ug/L (ppb)
REPORT NO. 20-8126-1

Sample I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	TOTAL BTEX
29039 MW-1	8/5/86	8/08/86	14000	21900	2730	15700	54100
29040 MW-2	8/5/86	8/11/86	11000	21900	2500	17000	52400
29041 MW-3	8/5/86	8/11/86	358	11.2	ND	380	750

*NOTES:

ND = BELOW DETECTION LIMIT

TOTAL BTEX = THE SUM OF BENZENE, TOLUENE, ETHYL BENZENE, AND XYLENES, ROUNDED TO THREE SIGNIFICANT FIGURES.

GT ENVIRONMENTAL LABORATORY
ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
P. O. Box 541, Greenville, NH 03048
Tel: (603) 878-2500

HYDROCARBONS IN WATER ug/l
REPORT NO. 20-8126-1

SAMPLE NO.	I.D.	C4-C12 ALIPHATIC HYDROCARBONS	MISC AROMATICS C8-C12	TOTAL
29039	MW-1	16900	14300	85300
29040	MW-2	30000	11300	93700
29041	MW-3	760	610	2100

*NOTES:

TOTAL = THE SUM OF THE TOTAL BTEX AND THE ABOVE PARAMETERS.

ND = BELOW DETECTION LIMIT
MW = MONITORING WELL

GT ENVIRONMENTAL LABORATORY
ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
P. O. Box 541, Greenville, NH 03048
Tel: (603) 878-2500

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including, daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report have been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director

APPENDIX IV

BROWN AND CALDWELL
ANALYTICAL LABORATORIES

LOG NO: E86-08-093

Received: 06 AUG 86
Reported: 15 AUG 86

Mr. Robert Juncal
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Project: 20-8126

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , SOIL SAMPLES	DATE SAMPLED
08-093-1	1A, 9.0-9.5' (SB 1)	31 JUL 86
08-093-2	2A, 9.0-9.5' (MW 1)	31 JUL 86
08-093-3	3A, 9.0-9.5' (MW 2)	31 JUL 86
08-093-4	4A, 4.0-4.5' (SB 2)	31 JUL 86
08-093-5	5A, 4.0-4.5' (MW 3)	31 JUL 86

PARAMETER	08-093-1	08-093-2	08-093-3	08-093-4	08-093-5
Hydrocarbons by IR, mg/kg	67	<10	<10	<10	22

BROWN AND CALDWELL
ANALYTICAL LABORATORIES

LOG NO: E86-08-093

Received: 06 AUG 86
Reported: 15 AUG 86

Mr. Robert Juncal
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Project: 20-8126

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , SOIL SAMPLES	DATE SAMPLED
08-093-6	6A, 4.0-4.5' (SB 3)	31 JUL 86

PARAMETER	08-093-6
Hydrocarbons by IR, mg/kg	<10

James Hatfield, Laboratory Director