Applied GeoSystems, Inc.
A RESNA Company

RESNA
Working To Restore Nature

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TRANSMITTAL

TO: MS. SUSAN HUGO
ALAMEDA COUNTY HEALTH CARE SERVICES
AGENCY-DEPT OF ENVIR. HEALTH
80 SWAN WAY, ROOM 200
OAKLAND, CALIFORNIA 94621

DATE: 10/21/91
PROJECT NUMBER: 60000.06
SUBJECT: ARCO STATION 771, 899 RINCON AVENUE, LIVERMORE, CALIFORNIA

FROM: JOEL COFFMAN
TITLE: PROJECT GOELOGIST

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REMARKS: THIS REPORT HAS BEEN FORWARDED TO YOU AT THE REQUEST OF MR. CHUCK CARMEL OF ARCO PRODUCTS COMPANY.

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SAN JOSE READER'S FILE

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October 17, 1991
60000.06

Mr. Chuck Carmel
ARCO Products Company
P.O. Box 5811
San Mateo, California 94402

Subject: Executive Summary of Additional Subsurface Investigation at ARCO Station 771, 899 Rincon Avenue, Livermore, California.

Mr. Carmel:

As requested by ARCO Products Company (ARCO), RESNA has performed an Additional Subsurface Investigation at the above referenced ARCO Service Station and prepared this report of the investigation, as specified in the Work Plan (RESNA, May 15, 1991) and Addendum One to Work Plan (RESNA, May 15, 1991). This report summarizes the information available to date regarding previous work performed at the site and includes the results of this subsurface investigation at the site. This phase of the investigation included drilling five soil borings (B-7 through B-11), collecting soil samples from the borings, constructing 4-inch diameter groundwater monitoring wells in four borings (MW-4 through MW-7 in borings B-7 through B-10, respectively), developing and sampling the monitoring wells, surveying wellhead elevations, submitting soil and water samples for laboratory analyses, and preparing this report. In addition RESNA's recommendations for future work at the subject site are included in this Executive Summary.

RESNA concludes the following, based on the results of this subsurface investigation:

- Gasoline hydrocarbons have impacted soil beneath the site. The majority of gasoline hydrocarbons at concentrations above 100 parts per million (ppm) in the soil at the site appear to be limited to the southwestern portion of the site at depths between 32 and 43 feet below the ground surface.

- The extent of gasoline hydrocarbons has not been delineated at the site with the exception of the northern portion of the property, where soils from borings B-6, B-9, and B-11 contained trace to nondetectable levels of total petroleum hydrocarbons as gasoline (TPHg) and benzene, toluene, ethylbenzene and total xylene (BTEX).

- Waste-oil related hydrocarbons do not appear to have impacted the soil beneath the former waste-oil tank, because nondetectable levels of total petroleum hydrocarbons as diesel (TPHd) and total oil and grease (TOG) were detected in the soil samples collected from soil boring B-11 located in the former waste-oil tank pit.

- Groundwater beneath the site has been impacted by gasoline hydrocarbons. Monitoring wells MW-1 and MW-2 contained floating product. The groundwater samples from monitoring wells MW-3 through MW-7 contained elevated concentrations of TPHg and BTEX. The State Maximum Contaminant Level (MCL) for benzene and total xylenes were exceeded in all wells, and for ethylbenzene in well MW-7. Toluene concentration exceeded the State Recommended Action Level (AL) in all wells. The extent of gasoline hydrocarbons in groundwater at the site has not been delineated.

RESNA recommends and proposes performing the following tasks for further delineation of soil and groundwater at the site:

(1) Submit an Addendum to Work Plan to Alameda County Health Care Services Agency (ACHCSA) describing proposed work for the subject site.

(2) Obtain offsite access and permit for monitoring well construction, and drill and obtain soil samples for laboratory analyses from three offsite soil borings, B-12 through B-14 as shown on Plate A, Proposed Borings/Monitoring Wells. Soil borings B-12 through B-14 are located to further delineate the lateral and vertical extent of gasoline hydrocarbons in the soil and groundwater in the vicinity of the site and to obtain data for confirmation of the gradient of the first water-bearing zone beneath the site. Drill these soil borings to the depth of at least 5 feet into a possible perching or confining layer beneath the first-encountered groundwater (total depths of approximately 45 feet).

(3) Install three offsite groundwater monitoring wells (MW-8 through MW-10) with 4-inch diameter well casing in soil borings B-12 through B-14. Install groundwater monitoring wells MW-8 through MW-10 in the first-encountered water-bearing zone to delineate the extent of gasoline hydrocarbons encountered in groundwater at the site, and to collect data for confirmation of the gradient of the first-encountered groundwater beneath the site.

(4) Submit selected soil samples from soil borings B-12 through B-14 to an ARCO contracted, State-certified laboratory for analyses of TPHg and BTEX by Environmental Protection Agency (EPA) Method 5030/8015/8020.

(5) Contract a licensed surveyor to survey wellhead elevations to a U.S. Coast and Geodetic Survey Datum, as appropriate.

(6) Develop monitoring wells MW-8 through MW-10. Measure depths-to-water, record visual evidence of free product in groundwater samples, and purge and obtain groundwater samples for laboratory analyses from the groundwater monitoring wells MW-1 through MW-10. Submit groundwater samples from the groundwater monitoring wells to an ARCO contracted, State-certified laboratory for analyses of TPHg and BTEX by EPA Method 5030/8015/8020.

(7) Perform a records research to identify potential secondary sources of hydrocarbons detected in soil and groundwater at the subject site.

(8) Perform a soil-vapor extraction test to collect data to evaluate the efficiency and practicality of vapor extraction as a soil remediation alternative, and to select the most appropriate off-gas treatment alternative if the operational data suggest that vapor extraction is recommended.

(9) Prepare a report including results of the assessment, our conclusions, and recommendations for future work at the subject site.

(10) RESNA also recommends continued quarterly groundwater monitoring of the groundwater monitoring wells to monitor fluctuations in groundwater elevations and hydrocarbon concentrations with time.

A Preliminary Time Schedule to perform the tasks 1 through 10, excluding quarterly monitoring, is included as Plate B to this executive summary. Field work performed will be according to the same Field Methods included in Appendix B of the attached report. RESNA will contact Underground Services Alert to identify public utility lines at the site at least 48 hours before we begin drilling. ARCO will have a representative onsite to confirm the location of underground utilities before drilling. RESNA will not be responsible for underground utilities not so located. Before drilling, the first 5 feet of the boring will be advanced with a hand auger. Cuttings generated during drilling will be placed on and covered with plastic. Water generated by purging of wells will be stored in liquid-waste drums approved for this use by the Department of Transportation. The soil cuttings and purge water will remain the responsibility of ARCO. RESNA can arrange to have the soil cuttings and purge water removed to an appropriate disposal facility with the authorization of ARCO and at additional cost.

Copies of the Additional Subsurface Investigation report should be forwarded to:

Ms. Susan Hugo
Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Mr. Tom Callaghan
California Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612

Mr. Randy Griffith
Livermore Fire Department
4550 East Avenue
Livermore, California 94550

If you should have any questions or comments about this report, please call us at (408) 264-7723.

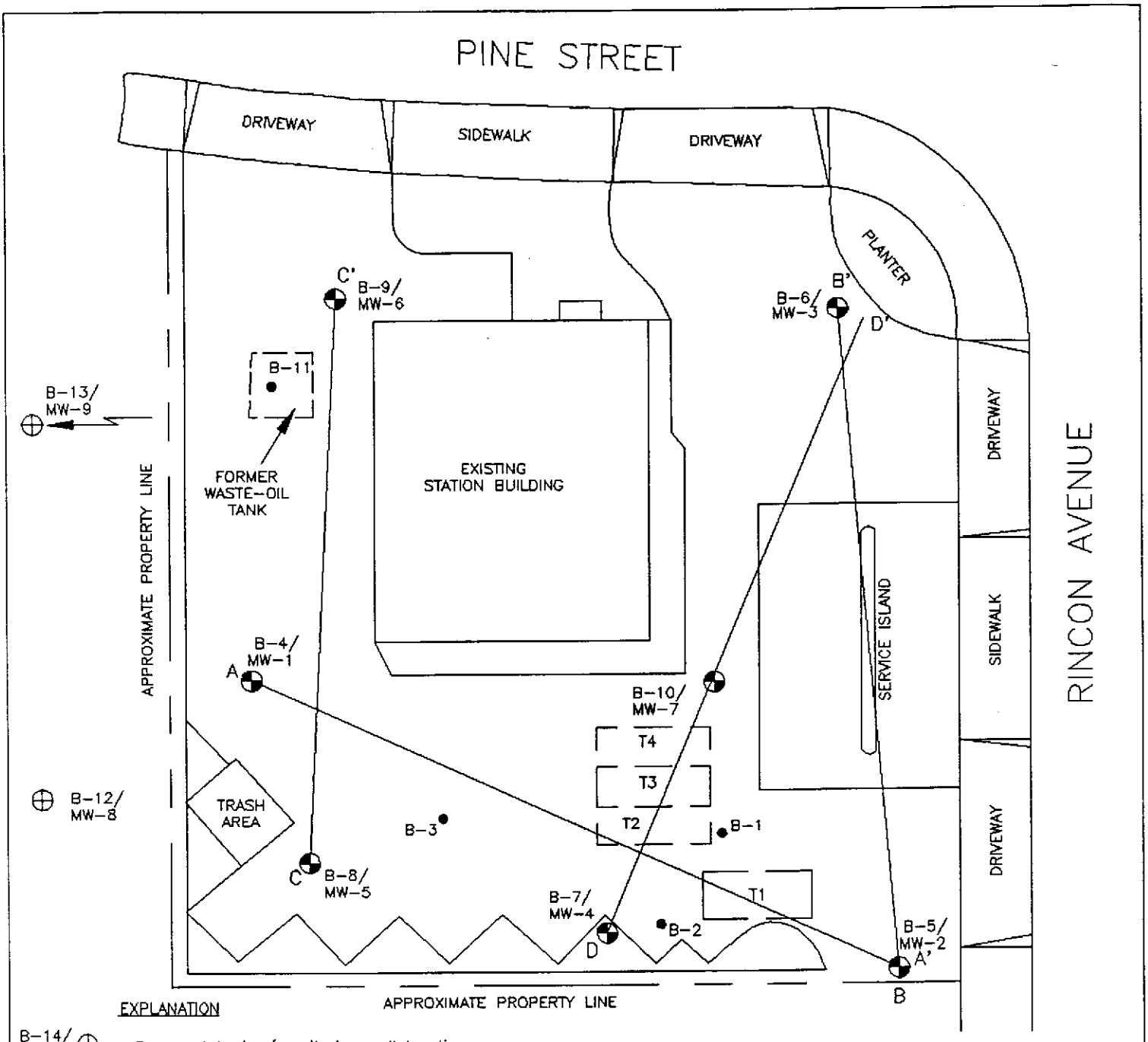
Sincerely,
RESNA

Joel Coffman
Project Geologist

Greg Barclay
Greg Barclay
General Manager

cc: H.C. Winsor, ARCO Products Company

Enclosure: Plate A, Generalized Site Plan with Proposed Soil Borings/Well Locations
Plate B, Preliminary Time Schedule
Report on Additional Subsurface Investigation



Source: Surveyed by John Koch, Licensed Land Surveyor.

RESNA	**PROPOSED BORING/ MONITORING WELL LOCATIONS ARCO Station 771 899 Rincon Avenue Livermore, California**	**PLATE A**
PROJECT 60000.06		

STEP 1:
Addendum Two to Work Plan

STEP 2 & 3:
Obtain permits, field work: drilling borings and install monitoring wells

STEP 4:
Laboratory analyses of soil samples

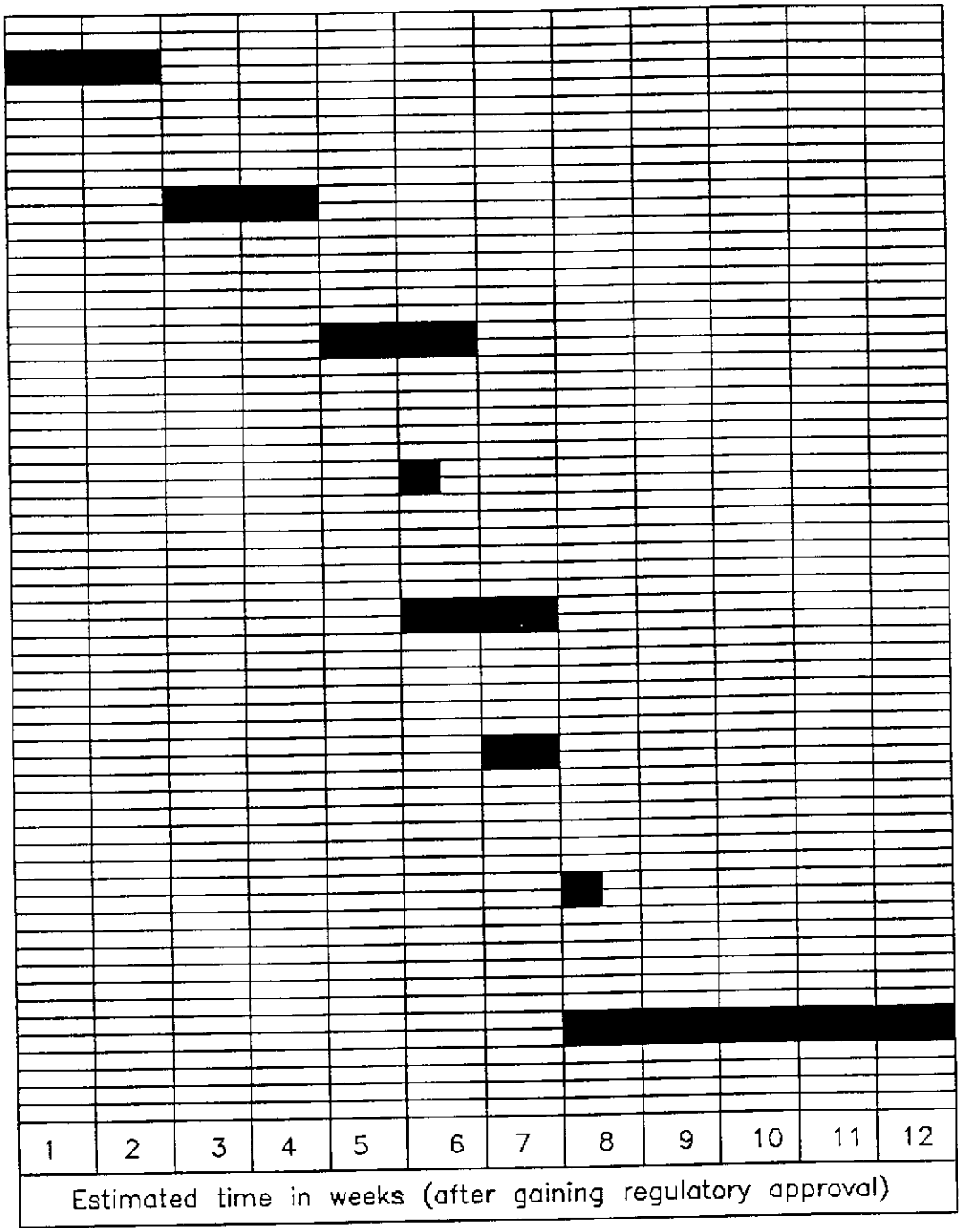
STEP 5:
Survey wellhead elevations

STEP 6:
Well development, monitoring, laboratory analyses of water samples

STEP 7:
Perform a records search

STEP 8:
Perform a soil-vapor extraction test

STEP 9:
Prepare Draft Report



RESNA

PROJECT 60000.06

PRELIMINARY TIME SCHEDULE
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
B

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REPORT
ADDITIONAL SUBSURFACE INVESTIGATION
at
ARCO Station 771
899 Rincon Avenue
Livermore, California

OCT
1991

60000.06

Prepared for
ARCO Products Company
P.O. Box 5811
San Mateo, California 94402
by
RESNA

Barbara Sieminski
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CIVIL
STATE OF CALIFORNIA

October 17, 1991

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(Continued)

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SITE DESCRIPTION AND BACKGROUND

General

ARCO Station 771 is located on the southwestern corner of the intersection of Rincon Avenue and Pine Street in Livermore, California, as shown on the Site Vicinity Map, Plate 1. The station is an operating gasoline station and mini-market which retails leaded, unleaded, and supreme unleaded gasoline. Residential homes are present to the north of the site and east of the site across Rincon Avenue. A shopping center is to the south and west of the site. The site is on a relatively flat lot at an elevation of approximately 450 feet above mean sea level.

It is RESNA's understanding, from information provided by ARCO, that one 10,000-gallon underground gasoline-storage tank (T1), one 6,000-gallon underground gasoline-storage tank (T2) and two 4,000-gallon underground gasoline-storage tanks (USTs) (T3 and T4) are present at the site. RESNA also understands that USTs T2, T3, and T4 were installed approximately 25 years ago and tank T1 approximately 15 years ago. The tanks are believed to have contained only gasoline. A 240-gallon waste-oil tank was removed from the site in 1987 (Brown and Caldwell, 1987). The location of these tanks and other site features are shown on the Generalized Site Plan, Plate 2.

Regional Hydrogeology

The site is in the north-central portion of the Livermore Valley, within the Coast Ranges Geomorphic Province of Northern California. The Livermore Valley is approximately 13 miles long oriented in an east-west direction, approximately 4 miles wide, and is surrounded by hills of the Diablo Range (California Department of Water Resources, 1974). The valley slopes gently toward the west. The principal streams in the area are the Arroyo Valley and Arroyo Mocho, which flow toward the western end of the valley. Arroyo Mocho is approximately 1/10 mile south-southwest of the site and Arroyo Valley is approximately 2-3/4 miles southwest of the site.

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REPORT
ADDITIONAL SUBSURFACE INVESTIGATION
at
ARCO Station 771
889 Rincon Avenue
Livermore, California
for
ARCO Products Company

INTRODUCTION

As requested by ARCO Products Company (ARCO), RESNA performed an additional subsurface investigation at ARCO Station 771, located at 889 Rincon Avenue in Livermore, California. This investigation was initiated in response to the results of previous investigations conducted at the site indicating the presence of gasoline hydrocarbons in soil and groundwater. The purpose of this investigation was to further evaluate the lateral and vertical extent of gasoline-hydrocarbon impacted soil and groundwater and to confirm the vertical extent of waste-oil hydrocarbons in the area of the former waste-oil tank.

The work performed for this investigation included drilling five soil borings (B-7 through B-11), collecting and describing soil samples from the borings, installing and developing four 4-inch diameter groundwater monitoring wells (MW-4 through MW-7) in borings B-7 through B-10, respectively. Subsequently, groundwater levels were measured, groundwater samples collected, selected soil and groundwater samples submitted for laboratory analysis, and wellhead elevations surveyed. This report presents the field procedures, results and conclusions of the above tasks. The work was performed as outlined in the RESNA/Applied GeoSystems (RESNA) Work Plan, (RESNA, May 15, 1991), and Addendum One to Work Plan (RESNA, May 15, 1991), which were approved by the Alameda County Health Care Services Agency (ACHCSA), and the Site Safety Plan (RESNA, June 1991).

The Livermore Valley groundwater basin is divided into sub-basins on the basis of fault traces or other hydrogeologic discontinuities (California Department of Water Resources, 1974). The groundwater system in Livermore Valley is a multi-layered system with an unconfined aquifer overlying a sequence of leaky or semiconfined aquifers. Groundwater in the basin flows downslope toward the east-west-trending axis of the valley and then flows generally to the west. Regional groundwater is inferred to flow to the west-northwest and is approximately 30 feet below the ground surface (Alameda County Flood Control, 1986).

PREVIOUS WORK

August and September 1987

In August 1987, a 240-gallon underground waste-oil storage tank was removed from the site by Crosby and Overton Environmental Management, Inc., of Oakland, California. The waste-oil tank pit was excavated to a depth of 10 feet and a soil sample (AL-1) was collected by Brown and Caldwell (B&C) of Sacramento, California, for laboratory analyses. Results of analyses indicated 378 parts per million (ppm) total petroleum fuel hydrocarbon levels. Volatile organic compounds (VOCs) and benzene, toluene, and total xylene isomers (BTX), and polychlorinated biphenols (PCBs) were not detected above laboratory reporting limits. One sample of the waste-oil sludge from the tank and two samples from the stockpiled soil were also collected and analyzed by B&C. In September 1987, B&C further excavated the waste-oil tank pit and collected a soil sample (AL-2) from a depth of 12 feet. Petroleum fuel hydrocarbons were not detected in the sample. In October 1987, soil containing waste-oil was transported to a Class I landfill in Casmalia, California (Brown and Caldwell, 1987). Table 1 summarizes the analytical results from August and September 1987.

February 1990

Applied GeoSystems (AGS) performed a limited environmental site assessment (AGS, June 1990) to evaluate the presence of gasoline hydrocarbons in the subsurface soil in the area adjacent to the four USTs prior to ARCO's planned tank replacement at the site. This work involved drilling and sampling three soil borings (B-1 through B-3), performing laboratory

analyses of 12 soil samples from the borings, and preparing a report. The locations of the borings are shown on Plate 2, Generalized Site Plan. Groundwater was first encountered at a depth of approximately 33 feet below the ground surface in boring B-1. Borings B-2 and B-3 were terminated before encountering groundwater. A "grab" water sample was collected from B-1. Results of laboratory analyses of soil samples indicated the highest concentration (190 ppm) of total petroleum hydrocarbons as gasoline (TPHg) in the soil sample collected from a depth of approximately 32 feet below ground surface in boring B-3. The results of laboratory analyses of soil samples are presented in Table 2, Cumulative Results of Laboratory Analyses of Soil Samples. An approximately 1/8-inch thick layer of floating product was noted on the surface of a groundwater "grab" sample obtained from boring B-1.

December 1990 through March 1991

In December 1990, RESNA performed an Supplemental Subsurface Investigation (RESNA, April 1991) to evaluate the vertical and lateral extent of gasoline hydrocarbons in soil and first groundwater in the area near the four onsite USTs. This investigation included drilling and sampling three soil borings (B-4 through B-6) and installing three 4-inch diameter groundwater monitoring wells (MW-1 through MW-3) in the borings, laboratory analyses of soil and groundwater samples, measuring depth-to-water (DTW) levels in the wells and performing a well search within a 1/2-mile radius of the site. Because ARCO scheduled the USTs for replacement in 1991, the locations of soil borings/monitoring wells were not drilled/installed immediately adjacent to the USTs since they would likely be damaged or destroyed during removal of the tanks. Locations of borings/monitoring wells are shown on Plate 2, Generalized Site Plan. A total of 37 soil samples were collected from the soil borings. The earth materials encountered during this investigation consisted primarily of clayey to sandy gravel interbedded with some gravelly and sandy clay. Groundwater was first encountered within sandy gravel in borings B-4 through B-6 between depths of approximately 36 to 38 feet below the ground surface. A stratum of at least 5 feet of moist sandy clay, which may be a perching or confining layer, was encountered at approximately 38 to 41 feet below the ground surface in borings B-4 through B-6. The highest concentrations of TPHg were found in boring B-4: 140 ppm at a depth of 36-1/2 feet and 3,800 ppm at 43 feet. Results of soil analyses are reported in Table 2.

The groundwater monitoring wells MW-1 through MW-3 were developed and sampled as part of the investigation. DTW measurements were taken and groundwater samples were collected and visually inspected for floating product on January 15, 1991 and February 27, 1991. Water level data are presented in Table 3, Cumulative Groundwater Monitoring Data. The groundwater gradient has been interpreted to be to the north-northeast. On January 15, 1991, initial water samples were collected from each well. MW-1 exhibited an obvious odor and a product sheen; approximately 0.16 feet of floating product was measured in well MW-2; and MW-3 showed no subjective evidence of hydrocarbon product. Water samples were not collected for laboratory analyses from wells MW-1 and MW-2 due to the presence of hydrocarbon product and sheen; however, well MW-3 was purged and sampled on January 15, 1990. Laboratory analyses of the groundwater collected from MW-3 indicated 230 parts per billion (ppb) TPHg. Analytical results of groundwater samples are presented in Table 4, Cumulative Results of Laboratory Analyses of Groundwater Samples. On February 27, 1991, no free product was observed in MW-1 or MW-3, but 0.02 feet of free product was present in MW-2.

FIELD WORK

Drilling

A permit for groundwater monitoring well construction was obtained from the Alameda County Flood Control and Water Conservation District, Zone 7 (ACFCWCD) prior to drilling. A copy of this permit is included in Appendix A. On June 28 through July 2, 1991, five soil borings (B-7 through B-11) were drilled and four groundwater monitoring wells MW-4 through MW-7 were constructed in borings B-7 through B-10, respectively. Boring B-11 was drilled through the former waste-oil tank pit. Drilling was conducted by RESNA/Exceltech of Fremont, California using a truck-mounted drilling rig. Borings B-7 through B-10 were drilled using 10-inch hollow stem augers while boring B-11 was drilled with 8-inch diameter hollow stem augers. Field work at the site was conducted in accordance with RESNA's field protocol and Site Safety Plan (RESNA, June 27, 1991). A description of the field methods and Site Safety Plan is included in Appendix B, Field Methods.

The rationale for the locations of the soil borings/monitoring wells was based on the following: hydrocarbon concentrations reported in soil samples collected during the previous investigation; the locations of the former waste-oil tank and underground tanks; the locations of existing utilities; and future work planned by ARCO. According to ARCO, the existing USTs are scheduled for replacement in late 1991 or early 1992. Soil boring/monitoring well locations were chosen such that they would not be damaged or destroyed during removal of the tanks.

Borings B-7 and B-10 were drilled south and north of the USTs and groundwater monitoring wells MW-4 and MW-7 were installed in these borings, respectively, to investigate the presence and extent of gasoline hydrocarbons in the soil and groundwater in the immediate vicinity of the tanks. To investigate the extent of gasoline hydrocarbons in the soil and groundwater in the western portion of the property and to confirm the groundwater gradient and flow direction of the first-encountered groundwater, borings B-8 and B-9 were drilled near the southwestern and northwestern corners of the site, and groundwater monitoring wells MW-5 and MW-9 were installed in the borings, respectively. Boring B-11 was drilled through the former waste-oil tank pit to evaluate the vertical extent of waste-oil hydrocarbons in the soil. The locations of the borings/monitoring wells are shown on Plate 2.

Soil Sampling and Description

Soil samples were described in accordance with the Unified Soil Classification System, Plate 3, and collected as indicated on the Logs of Borings B-7 through B-11, Plates 4 through 13. A total of fifty-four soil samples were collected for description and possible laboratory analyses at maximum intervals of 5 feet from the ground surface to the total depth of the borings. Soil samples were also collected continuously in borings B-7 through B-10 near first groundwater, at depths of approximately 29-1/2 to 35-1/2 feet in boring B-7 and 34 to 38-1/2 feet in borings B-8 through B-10. In addition, continuous soil samples were collected near the bottom of the borings from approximately 40 to the total depth of 46-1/2, 45-1/2, 47-1/2 and 44-1/2 feet in borings B-7 through B-10, respectively. Boring B-11 was terminated at 40 feet below ground surface. A summary of the sampling methods used for this investigation are presented in Appendix B.

The earth materials encountered during this investigation consisted primarily of clayey to sandy gravel interbedded with some sandy clay. Groundwater was first encountered within sandy gravel in borings B-7 through B-10 at a depths of approximately 35-1/2 to 37 feet below the ground surface. A stratum of at least 4-1/2 feet of damp to moist sandy clay, which may be a perching or confining layer, was encountered at approximately 40 to 42-1/2 feet below the ground surface in borings B-7 through B-10. Graphic interpretations of the soil stratigraphy encountered in the borings are shown on Geologic Cross Sections A-A', B-B', C-C', and D-D' (Plates 14 through 17). The locations of the geologic sections are shown on Plate 2.

A product odor was noted for the soil samples collected from boring B-7 at the depths between 17 to 35-1/2 feet; from boring B-8 at the depths of 35 and 41 feet; and from boring B-10 at the depths between 20 to 38 feet below ground surface. Field organic vapor (OVM) measurements of soil samples from borings B-7 through B-11 are shown on the boring logs in the column labeled PID (photoionization detector).

Soil cuttings generated from the borings were temporarily stockpiled onsite and covered with plastic sheeting pending proper disposal. On August 12, 1991, four soil samples were collected from the stockpiled drill cuttings, as requested by ARCO's contractor Dillard Trucking, Inc. of Byron, California, and submitted for composite laboratory analyses to Sequoia Analytical Laboratory or Redwood City, California (Hazardous Waste Testing Laboratory Certification 1210). The method used to obtain this sample is described in Appendix B.

Results of laboratory analyses of the composite soil sample collected from the stockpile indicated nondetectable concentrations of TPHg and BTEX. These results are shown in Table 2. The soil stockpile was disposed by ARCO's contractor, Dillard Trucking, Inc. of Byron, California, on August 22, 1991.

Monitoring Well Construction and Development

Four groundwater monitoring wells (MW-4 through MW-7) were constructed in borings B-7 through B-10, respectively. The wells were completed with four-inch-diameter schedule 40

polyvinyl chloride (PVC) casing and the screened interval consisted of 4-inch-diameter, 0.020 machine slotted PVC. The screened portion in these wells were set from 26 to 32-1/2 feet below the ground surface to 40 to 42-1/2 feet below ground surface.

The wells were developed on July 15, 1991 to remove fine-grained sediments and to allow better communication between the water-bearing zone and the groundwater monitoring well. Development was performed using a combination of surge block and bailing techniques. Details regarding well construction and development are described in Appendix B.

Groundwater Level Measurements and Sampling

On July 25, and August 13, 1991, DTW were measured in the existing wells (MW-1 through MW-3) and in the new wells MW-1 through MW-7, and groundwater samples were collected and visually inspected for floating product.

Initial water samples collected from wells MW-3 and MW-7 on July 25, 1991 showed no subjective evidence of hydrocarbon product. Monitoring wells MW-4 through MW-6 exhibited a slight hydrocarbon odor. Water samples collected from wells MW-1 and MW-2 exhibited an obvious odor and approximately 0.1 and 0.49 feet of floating product was measured in each well, respectively. During the August monitoring event, groundwater monitoring wells MW-4 and MW-7 exhibited an hydrocarbon odor, and monitoring wells MW-1, MW-2, and MW-5 contained 0.17, 0.52 and 0.03 feet of floating product, respectively. Subjective analyses results of groundwater samples are included in Table 3, Cumulative Groundwater Monitoring Data. Appendix B contains a description of subjective analyses procedures.

Groundwater monitoring wells MW-3 through MW-7 were then purged and water samples were collected for laboratory analyses on July 25, 1991. Water samples were not collected for laboratory analyses from wells MW-1 and MW-2 due to the presence of hydrocarbon product and sheen in these wells. Groundwater samples were transported under Chain-of-Custody to Sequoia Analytical Laboratory in Redwood City, California. Appendix B contains a description of groundwater sampling procedures and well purge data sheets.

EVALUATION OF GROUNDWATER GRADIENT

On July 29, 1991 the wellheads for the groundwater monitoring wells MW-1 through MW-7 were surveyed to a local National Geodetic Vertical Datum benchmark by John E. Koch Licensed Land Surveyor of Oakland, California. The results of this wellhead survey are included in Appendix C, Wellhead Survey. Groundwater elevations for each well were calculated by subtracting the measured DTW from the elevation of the wellhead. The wellhead elevations, DTW measurements and groundwater elevations are presented in Table 3, Cumulative Groundwater Monitoring Data.

The groundwater gradient was evaluated from DTW measurements collected from wells MW-1 through MW-7 on July 25, and August 13, 1991. The interpreted groundwater gradient for July 25, and August 13, 1991 is approximately 0.020 to the northwest. The interpreted groundwater gradients for July 25, and August 13, 1991 are shown on Plates 18 and 19, Groundwater Gradient Maps. These data are also reported in the draft Third Quarter 1991 Quarterly Monitoring Report (RESNA, October 1991).

LABORATORY METHODS

Soil Samples

Soil samples collected from borings B-7 through B-11 were analyzed for TPHg and the purgeable gasoline constituents benzene, toluene, ethylbenzene, and total xylenes (BTEX) using Environmental Protection Agency (EPA) methods 5030/8010/8020. In addition, soil samples collected from boring B-11 were also analyzed for total petroleum hydrocarbons as diesel (TPHd) using EPA method 5030/8015 and total oil and grease (TOG) using Standard Method 5520 E&F (Gravimetric). All soil samples analyses were performed by Sequoia Analytical of Redwood City, California (Hazardous Waste Testing Laboratory Certification 1210).

Thirty-three soil samples from the borings were selected for laboratory analyses based on:

- Location above first-encountered groundwater;

- Location in a potential confining or perching layer below first-encountered groundwater;
- Areas where the presence of gasoline or waste-oil hydrocarbons was suspected; and
- At 5-foot intervals and/or change in stratigraphic units, as recommended by State Department of Health Services (DHS) guidelines.

Chain of Custody forms and laboratory analytical reports for soil samples are included in Appendix E of this report.

Nine soil samples from different stratigraphic units from borings B-7 through B-11 were sent to Johnson Filtration System Inc. (Johnson) of St. Paul, Minnesota for gradation analyses. Johnson reported the samples to be silt to fine gravel. Sieve analyses report is included in Appendix D of this report.

Groundwater Samples

Groundwater samples obtained from monitoring wells MW-3 through MW-7 were analyzed for BTEX and TPHg by modified EPA Methods 5030/8015/8020. All groundwater and soil samples were analyzed by Sequoia Analytical of Redwood City, California (Hazardous Waste Testing Laboratory Certification No. 1210). Chain of Custody records and laboratory analyses reports are included in Appendix E.

LABORATORY RESULTS

Soil Samples

Results of laboratory analyses of soil samples are summarized in Table 2, Cumulative Results of Laboratory Analysis of Soil Samples, under the section labeled June and July 1991. Chain of Custody forms and laboratory analysis reports for soil samples are included in Appendix E of this report.

Laboratory results of soil samples collected from boring B-7, southwest of the USTs indicated nondetectable (less than 1.0 ppm) to less than 50 ppm TPHg to 44 feet. BTEX ranged from nondetectable (less than 0.0050 ppm) to 1.9 ppm xylenes.

Laboratory results of soil samples collected from boring B-8, located in the southwestern corner of the site, indicated nondetectable to 3.5 ppm TPHg from a depth of 10-1/2 to a depth of 25-1/2 feet, and 210 ppm at a depth of 34-1/2 feet (just above first-encountered groundwater); and 3,200 ppm and 4.9 ppm at depths of 41 and 43 feet, respectively, within the sandy clay below first groundwater. Concentrations of BTEX for soil samples collected from B-8 ranged from nondetectable to 170 ppm of total xylenes.

Laboratory results of soil samples collected from boring B-9, located in the northwestern corner of the site, indicated nondetectable concentrations of TPHg and BTEX in all the samples analyzed with the exception of the sample collected at the depth of 42 feet below ground surface, where TPHg was detected at 1.8 ppm and BTEX ranged from 0.006 ppm of toluene to 0.049 ppm of benzene.

Laboratory results of soil samples collected from boring B-10, north of the USTs indicated nondetectable concentrations of TPHg from 10-1/2 to 20-1/2 feet below grade; 27 to 110 ppm TPHg at a depth of 25-1/2 to 36 feet and nondetectable at 42 feet, within the possible perching or confining layer. BTEX ranged from nondetectable to 2.7 ppm xylenes.

Laboratory results of soil samples collected from boring B-11, in the backfilled former waste-oil tank excavation, indicated nondetectable concentrations of TPHg, TPHd, BTEX, and TOG in all the samples analyzed to a depth of 40 feet.

Plate 20 summarizes the TPHg concentration contours for soil at the subject site at a depth of 30 to 43 feet. From Plate 20 it can be seen that the area of greatest TPHg concentrations is due west of tanks T2, T3, and T4. The greatest TPHg soil concentrations are present just below first encountered groundwater at a depth of about 40 to 43 feet.

Groundwater Samples

Results of laboratory analyses of groundwater samples are presented in Table 4, Results of Laboratory Analyses of Groundwater Samples. Chain-of-custody records and laboratory analyses reports for groundwater samples are included in Appendix D.

Laboratory results of the water sample collected from well MW-3, north-northeast of the USTs and dispenser island, indicated 110 parts per billion (ppb) TPHg, 0.32 ppb benzene, 0.75 ppb toluene, 2.2 ppb ethylbenzene, and 2.1 ppb total xylenes. Laboratory analyses of water samples collected from wells MW-4 through MW-7 indicated 10,000 to 57,000 ppb TPHg; and BTEX from 77 ppb ethylbenzene to 14,000 ppb total xylenes. Benzene and total xylene concentrations exceeded the State Maximum Contaminant Level (MCL) (which is 1 ppb for benzene and 1,750 ppb for total xylene isomers) in all sampled wells. The Ethylbenzene concentration exceeded the MCL (which is 680 ppb) in well MW-7. Toluene concentrations exceeded the State Recommended Action Level (AL) (100 ppb) in all wells.

DISCUSSION AND CONCLUSIONS

RESNA concludes the following based on the results of this investigation:

- Gasoline hydrocarbons have impacted soil beneath the site. The majority of gasoline hydrocarbons at concentrations above 100 parts per million (ppm) in the soil at the site appear to be limited to the southwestern portion of the site at depths between 32 and 43 feet below the ground surface.

- The extent of gasoline hydrocarbons has not been delineated at the site with the exception of the northern portion of the property, where soils from borings B-6, B-9, and B-11 contained trace to nondetectable levels of total petroleum hydrocarbons as gasoline (TPHg) and benzene, toluene, ethylbenzene and total xylene (BTEX).

- Waste-oil related hydrocarbons do not appear to have impacted the soil beneath the former waste-oil tank, because nondetectable levels of total petroleum hydrocarbons as diesel (TPHd) and total oil and grease (TOG) were detected in the soil samples collected from soil boring B-11 located in the former waste-oil tank pit.

- Groundwater beneath the site has been impacted by gasoline hydrocarbons. Monitoring wells MW-1 and MW-2 contained floating product. The groundwater samples from monitoring wells MW-3 through MW-7 contained elevated concentrations of TPHg and BTEX. The State Maximum Contaminant Levels (MCL) for benzene and total xylenes were exceeded in all wells, and for ethylbenzene in well MW-7. Toluene concentration exceeded the State Recommended Action Level (AL) in all wells. The extent of gasoline hydrocarbons in groundwater at the site has not been delineated.

LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental geological practice in California at the time this investigation was performed. This investigation was conducted solely for the purpose of evaluating environmental conditions of the soil and first groundwater with respect to gasoline hydrocarbon contamination at the subject site in the immediate area of and related to the USTs. No soil engineering or geotechnical implications are stated or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this investigation is made from a limited number of observation points. Subsurface conditions may vary away from the data points available. Additional work, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of investigation.

REFERENCES

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California Department of Water Resources. 1974. Evaluation of Ground-Water Resources Engineering Livermore and Sunol Valleys: Bulletin No. 118-2, Appendix A.

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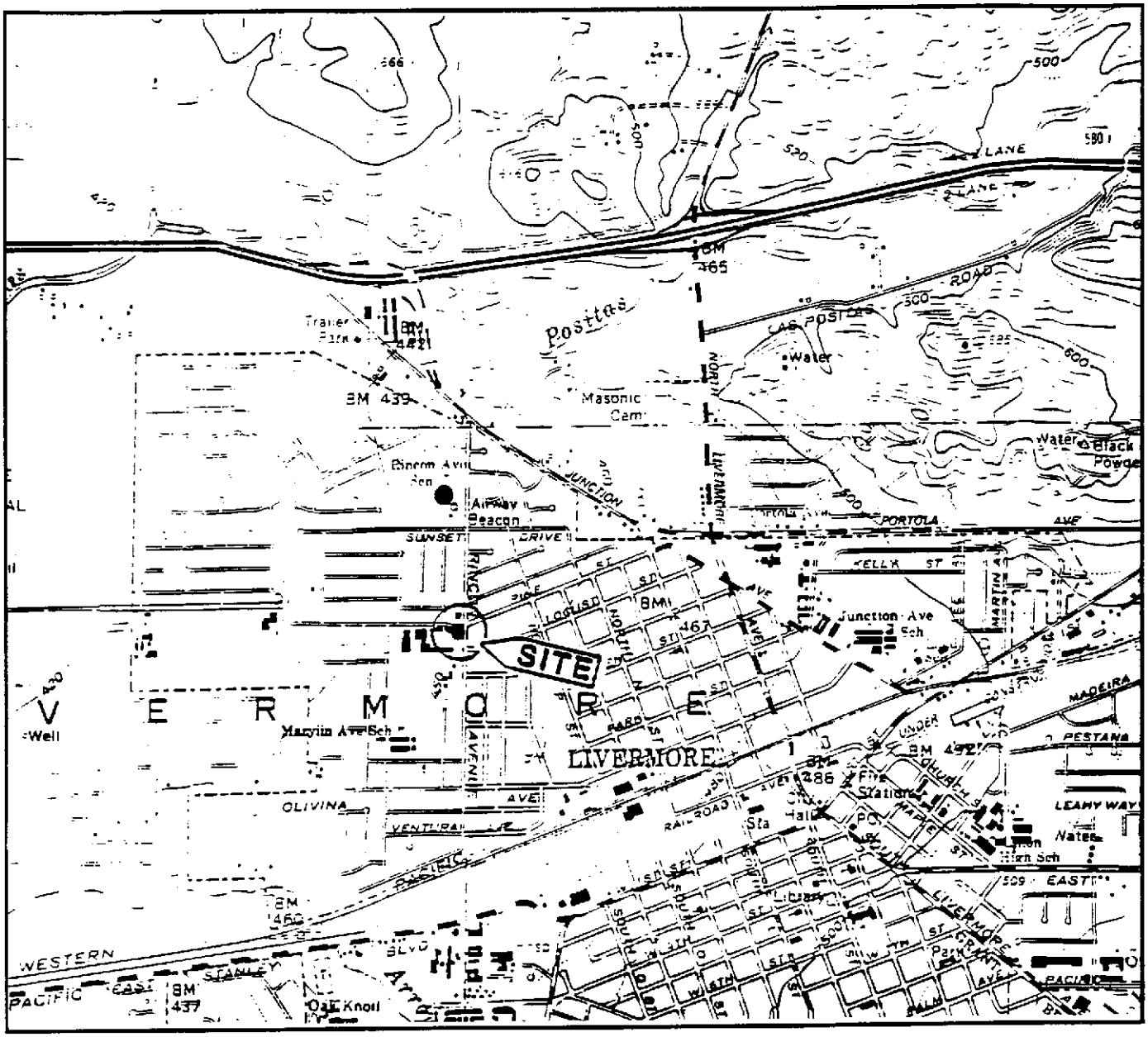
RESNA/Applied GeoSystems. July 11, 1991. Letter Report Quarterly Ground-Water Monitoring, Second Quarter 1991, at the ARCO Service Station No. 771, 899 Rincon Avenue, Livermore, California: RESNA 60000.05.

RESNA/Applied GeoSystems. October 16, 1991. Draft-Third Quarter 1991 Groundwater Monitoring Report. 60000.05



Base: U.S. Geological Survey
7.5–Minute Quadrangle
Livermore, California
Photorevised 1980

N

LEGEND

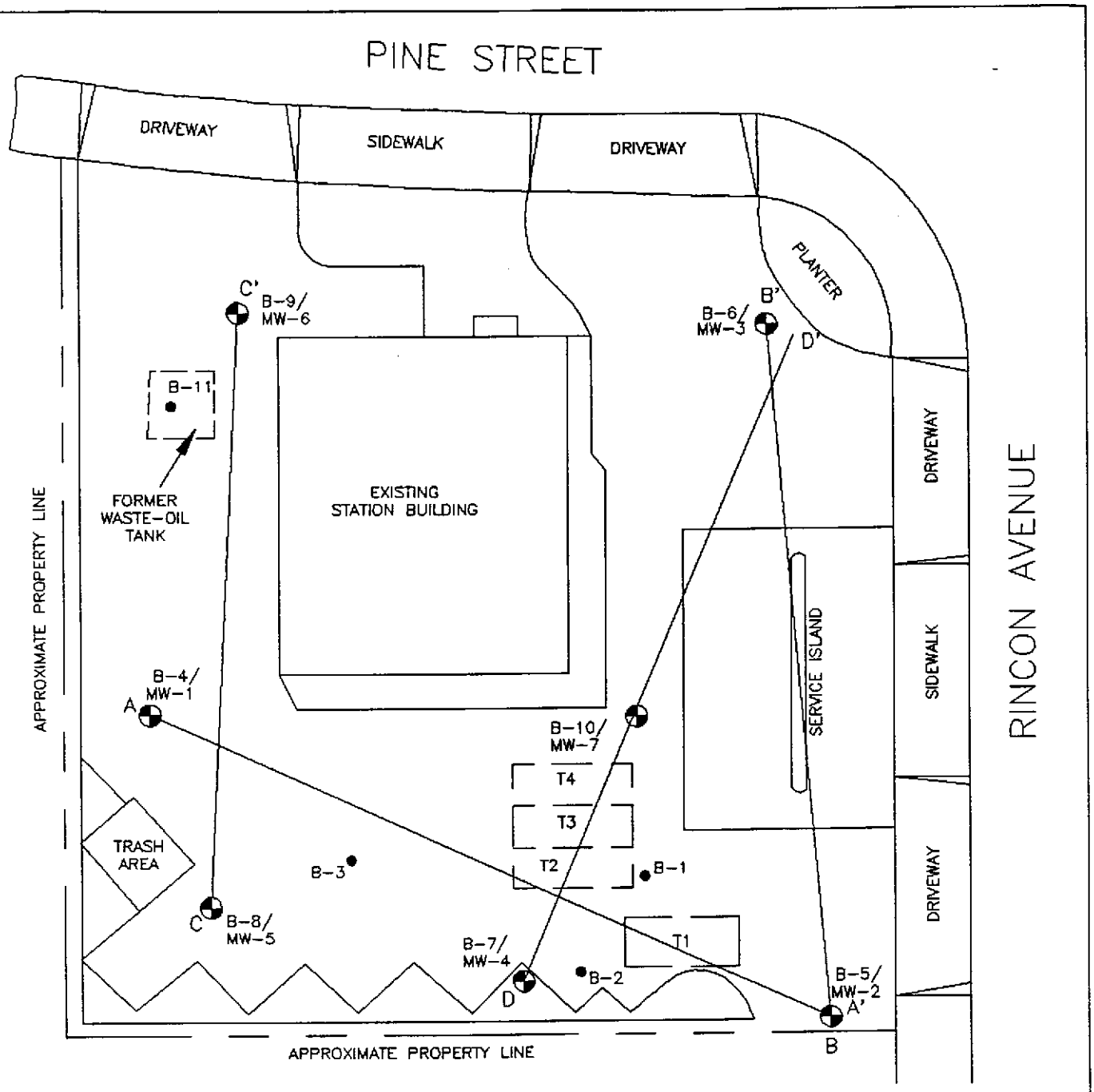
◉ = Site Location

Approximate Scale

2000 1000 0 2000 4000

feet

RESNA	**SITE VICINITY MAP** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **1**
PROJECT 60000.06		



EXPLANATION

B-10/ MW-7 = Monitoring well (Applied GeoSystems, December 1990, June, and July 1991)

B-11 = Soil boring (Applied GeoSystems, February 1990, July 1991)

D – D' = Geologic cross sections

T4 = Underground gasoline-storage tank

N

Approximate Scale

20 10 0 20 40

feet

Source: Surveyed by John Koch, Licenced Land Surveyor.

RESNA	**GENERALIZED SITE PLAN** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **2**
PROJECT 60000.06		

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION		LTR	DESCRIPTION	MAJOR DIVISION		LTR	DESCRIPTION
COARSE-GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded Gravels or Gravel-Sand mixtures, little or no fines.	FINE-GRAINED SOILS	SILTS AND CLAYS LL<50	ML	Inorganic Silts and very fine sands, rock flour, Silty or Clayey fine Sands, or Clayey Silts with slight plasticity.
		GP	Poorly-graded Gravels or Gravel-Sand mixtures, little or no fines.			CL	Inorganic Clays of low to medium plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays.
		GM	Silty Gravels, Gravel-Sand-Silt mixtures.			OL	Organic Silts and Organic Silt-Clays of low plasticity.
		GC	Clayey Gravel, Gravel-Sand-Clay mixtures.		SILTS AND CLAYS LL>50	MH	Inorganic Silts, micaceous or diatomaceous fine Sandy or Silty Soils, Elastic Silts.
	SAND AND SANDY SOILS	SW	Well-graded Sand or Gravelly Sands, little or no fines.			CH	Inorganic Clays of high plasticity, fat Clays.
		SP	Poorly-graded Sands or Gravelly Sands, little or no fines.			OH	Organic Clays of medium to high plasticity, organic Silts.
		SM	Silty Sands, Sand-Silt mixtures.				
		SC	Clayey Sands, Sand-Clay mixtures.	HIGHLY ORGANIC SOILS		PT	Peat and other highly Organic Soils.

Depth through which sampler is driven

Relatively undisturbed sample

No sample recovered

Static water level observed in well/boring

Initial water level observed in boring

S-10 Sample number

Sand pack

Bentonite

Neat cement

Caved native soil

Blank PVC

Machine-slotted PVC

P.I.D. Photoionization detector

BLOWS REPRESENT THE NUMBER OF BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES TO DRIVE THE SAMPLER THROUGH EACH 6 INCHES OF AN 18-INCH PENETRATION.

DASHED LINES SEPARATING UNITS ON THE LOG REPRESENT APPROXIMATE BOUNDARIES ONLY. ACTUAL BOUNDARIES MAY BE GRADUAL LOGS REPRESENT SUBSURFACE CONDITIONS AT THE BORING LOCATION AT THE TIME OF DRILLING ONLY.

RESNA	**UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY ARCO Station 771 899 Rincon Avenue Livermore, California**	**PLATE 3**
PROJECT 60000.06		

Depth of boring: 46-1/2 feet Diameter of boring: 10 inches Date drilled: 6-28-91

Well depth: 42 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 26 to 42 feet Slot size: 0.020-inch

Drilling Company: Exceltech Driller: Don & Kenny

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional:

Registration No.: CE044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
				SW	Sand, with small gravel, yellow, damp, loose: fill.	
2				GW	Sandy gravel with cobbles, brown, damp, medium dense: fill.	
				GW	Sandy gravel with clay, brown, damp, medium dense.	
4						
	S-5.5	3 4 10	0			
6						
8						
10	S-10	18 16 21	0		Moist, dense.	
12						
14						
	S-15	18 21 28	0		Gray, very moist.	
16					Noticeable product odor.	
18						
20	S-20	18 26 35	82		Very dense.	
					(Section continues downward)	

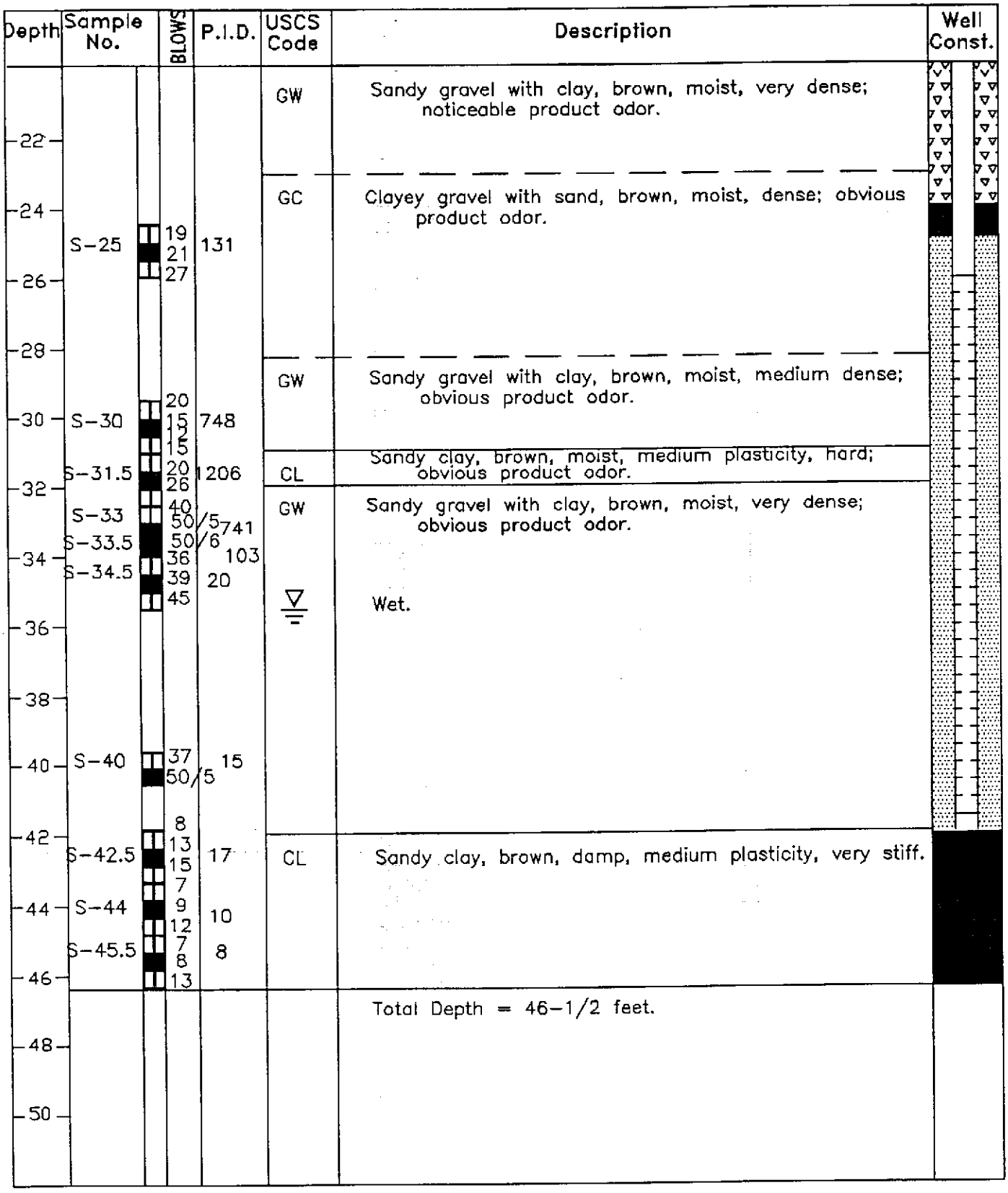
RESNA

PROJECT: 60000.06

LOG OF BORING B-7/MW-4

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 4



RESNA

PROJECT 60000.06

LOG OF BORING B-7/MW-4

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 5

Depth of boring: 45-1/2 feet Diameter of boring: 10 inches Date drilled: 7-2-91

Well depth: 41 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 31-1/2 to 41 feet Slot size: 0.020-inch

Drilling Company: Exceltech Driller: Dan, Kenny, and Adam

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional:

Registration No.: CE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
2				GW	Sandy gravel, dark brown, damp, medium dense: fill.	
4				GW	Sandy gravel with clay, brown, damp, medium dense; gravel up to 3-inches diameter.	
6	S-5.5	7 8 13	3.4			
8						
10	S-10.5	12 30 37	9.6		More sand, moist, very dense.	
12						
14	S-15.5	12 13 20	0		Dense.	
16						
18						
20	S-20.5	18 19 22	34		More clay.	
					(Section continues downward)	

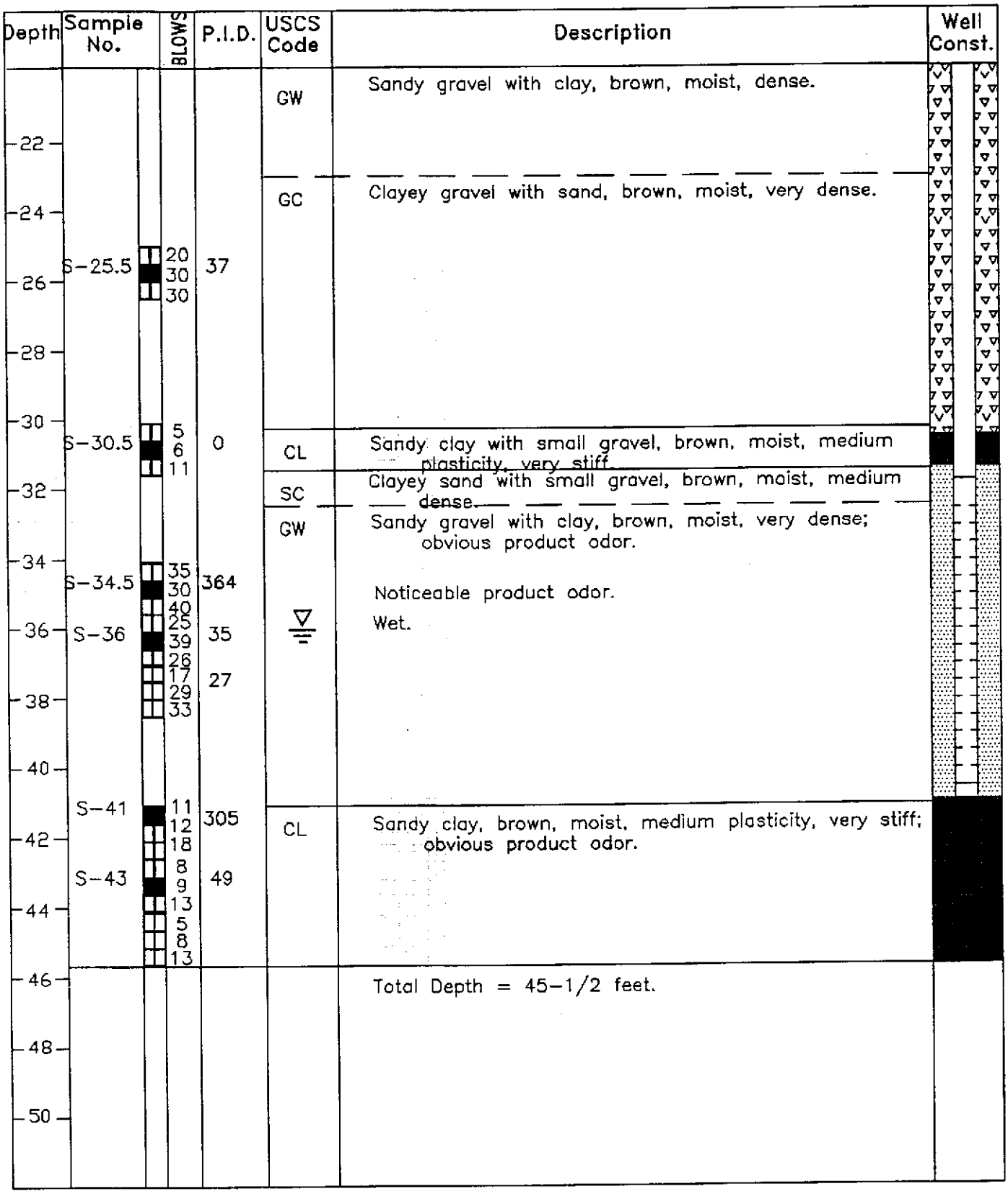
RESNA

PROJECT: 60000.06

LOG OF BORING B-8/MW-5

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 6



RESNA

PROJECT 60000.06

LOG OF BORING B-8/MW-5

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 7

Depth of boring: 47-1/2 feet Diameter of boring: 10 inches Date drilled: 7-1-91

Well depth: 42-1/2 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 32-1/2 to 42-1/2 feet Slot size: 0.020-inch

Drilling Company: Exceltech Driller: Dan & Kenny

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional: [signature]

Registration No.: CE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
2				GW	Sandy gravel, brown, dry, loose: fill.	
4				GC	Clayey gravel with sand, dark brown, damp, dense.	
6	S-5.5	10 17 15	0	GW	Sandy gravel with clay, brown, damp, dense; gravel up to 2-inches diameter.	
8						
10	S-10.5	20 36 45	0		Very dense.	
12						
14						
16	S-15.5	15 16 16	0		Moist, dense.	
18						
20	S-20	17 50/1	0		Gravel up to 3-inches diameter.	
					(Section continues downward)	

RESNA

PROJECT: 60000.06

LOG OF BORING B-9/MW-6

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 8

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				GW	Sandy gravel with clay, brown, dense; gravel up to 3-inches diameter.	
24					More clay.	
26	S-25.5	18 27 50/1	0			
28				GC	Clayey gravel with sand, brown, moist, dense.	
30	S-30.5	15 34 28	0	GW	Sandy gravel with clay, brown, moist, very dense.	
32						
34	S-34.5	32 44 50	0			
36	S-36	36 49 40	0			
38		19 18 30	0	▽	Wet.	
40	S-40.5	30 33 28	0			
42	S-42	10 16 8	19			
44	S-43.5	4 6 9	0	CL	Sandy clay, brown, moist, medium plasticity, stiff.	
	S-45	6 11 14	0			
46		6 11 13	0			
48					Total Depth = 47-1/2 feet.	
50						

RESNA

PROJECT 60000.06

LOG OF BORING B-9/MW-6

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 9

Depth of boring: 44-1/2 feet Diameter of boring: 10 inches Date drilled: 7-2-91

Well depth: 40 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 30 to 40 feet Slot size: 0.020-inch

Drilling Company: Exceltech Driller: Don, Kenny, and Adam

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional: [signature]

Registration No.: CE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
2				GW	Sandy gravel, dark brown, damp, medium dense: fill.	
4				GW	Sandy gravel with clay, brown, damp, medium dense; gravel up to 3-inches diameter.	
6	S-5.5	6 7 8	0			
8						
10	S-10.5	19 20 29	0		Moist, dense.	
12						
14						
16		35 50/1				
18						
20	S-20.5	17 35 43	152		Very dense; obvious product odor.	

(Section continues downward)

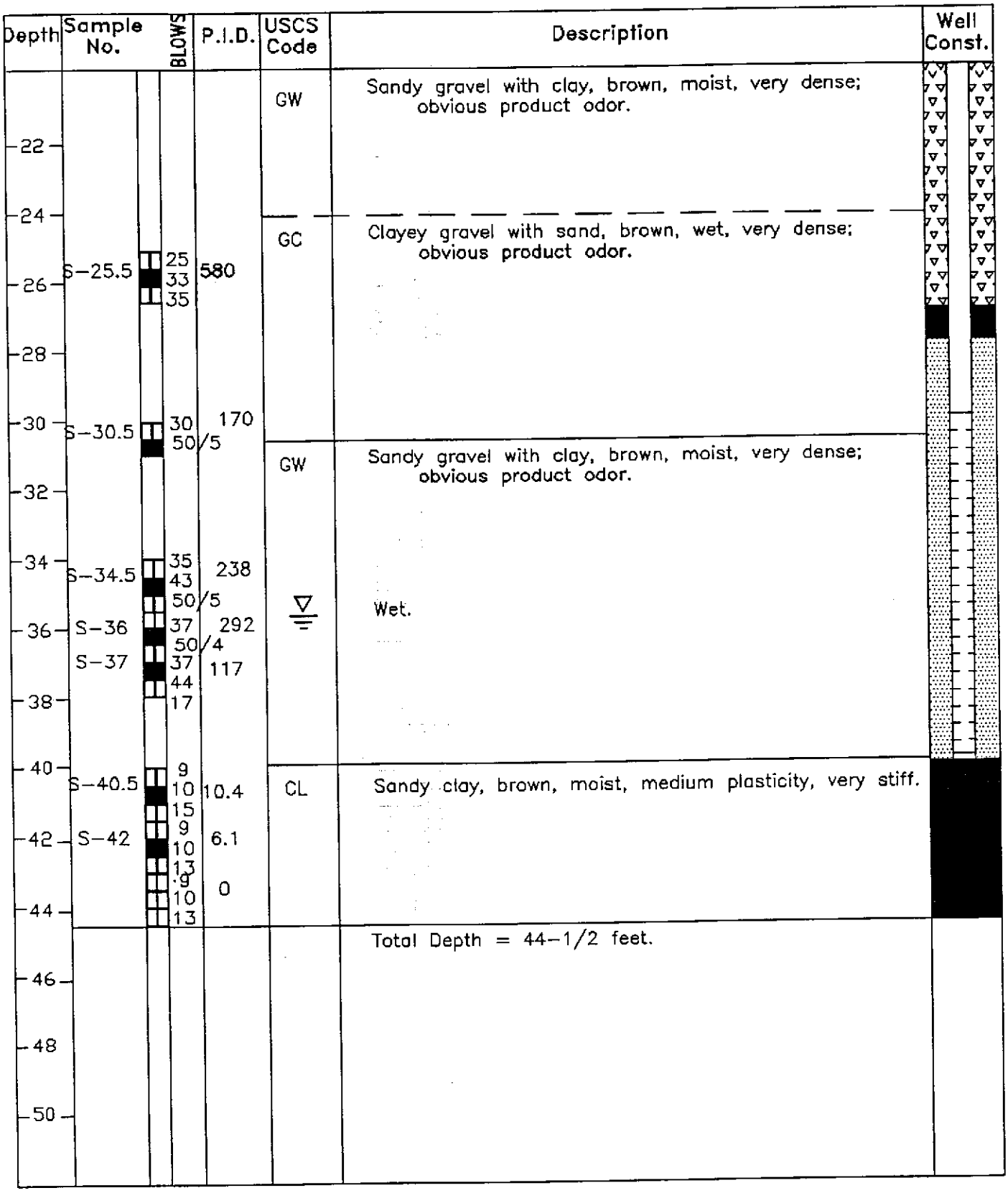
RESNA

PROJECT: 60000.06

LOG OF BORING B-10/MW-7

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 10



RESNA

PROJECT 60000.06

LOG OF BORING B-10/MW-7

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 11

Depth of boring: 40-1/2 feet Diameter of boring: 8 inches Date drilled: 7-1-91

Well depth: NA Material type: NA Casing diameter: NA

Screen interval: NA Slot size: NA

Drilling Company: Exceltech Driller: Don, Kenny

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional:

Registration No.: State:

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
				GW	Sandy gravel, dark brown, damp, medium dense: fill.	
2						
4						
6	S-7	12 17 17	0		With clay, brown, dense.	
8	S-8.5	16 12 26	0			
10		15 26 50	0		Very dense.	
12		50/3				
				GW	Sandy gravel with clay, brown, damp, dense.	
14						
	S-15.5	32 36 36	0		Moist.	
16						
18						
20	S-20.5	23 30 33	0		(Section continues downward)	

RESNA

PROJECT: 60000.06

LOG OF BORING B-11

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 12

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				GW	Sandy gravel with clay, brown, moist, very dense.	
24						
26	S-25	25 50/5	3.4		More clay.	
28				GC	Clayey gravel with sand, brown, moist, dense.	
30	S-30.5	14 10 10	0	GW	Sandy gravel with clay, brown, moist, medium dense.	
32						
34						
36	S-35.5	40 50/5	0		Very dense.	
38				▽	Wet.	
40	S-40	50/5	0			
42					Total Depth = 40-1/2 feet.	
44						
46						
48						
50						

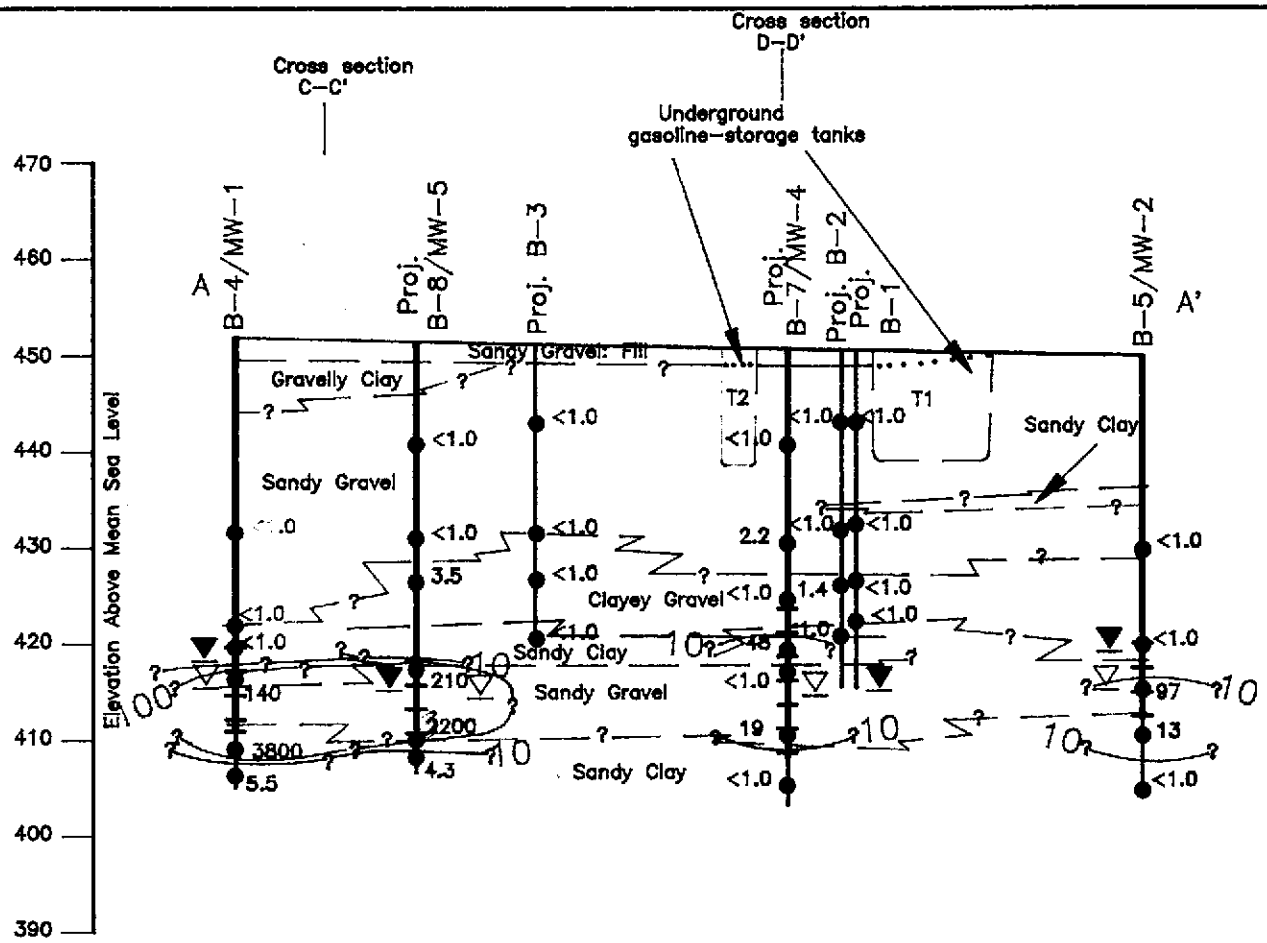
RESNA

PROJECT 60000.06

LOG OF BORING B-11

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 13



EXPLANATION

10 = Line of equal concentration of TPHg in soil

3800 = Laboratory analyzed soil sample showing concentration of TPHg in parts per million

= Well casing

= Well screen

= Boring

= Initial water level in boring

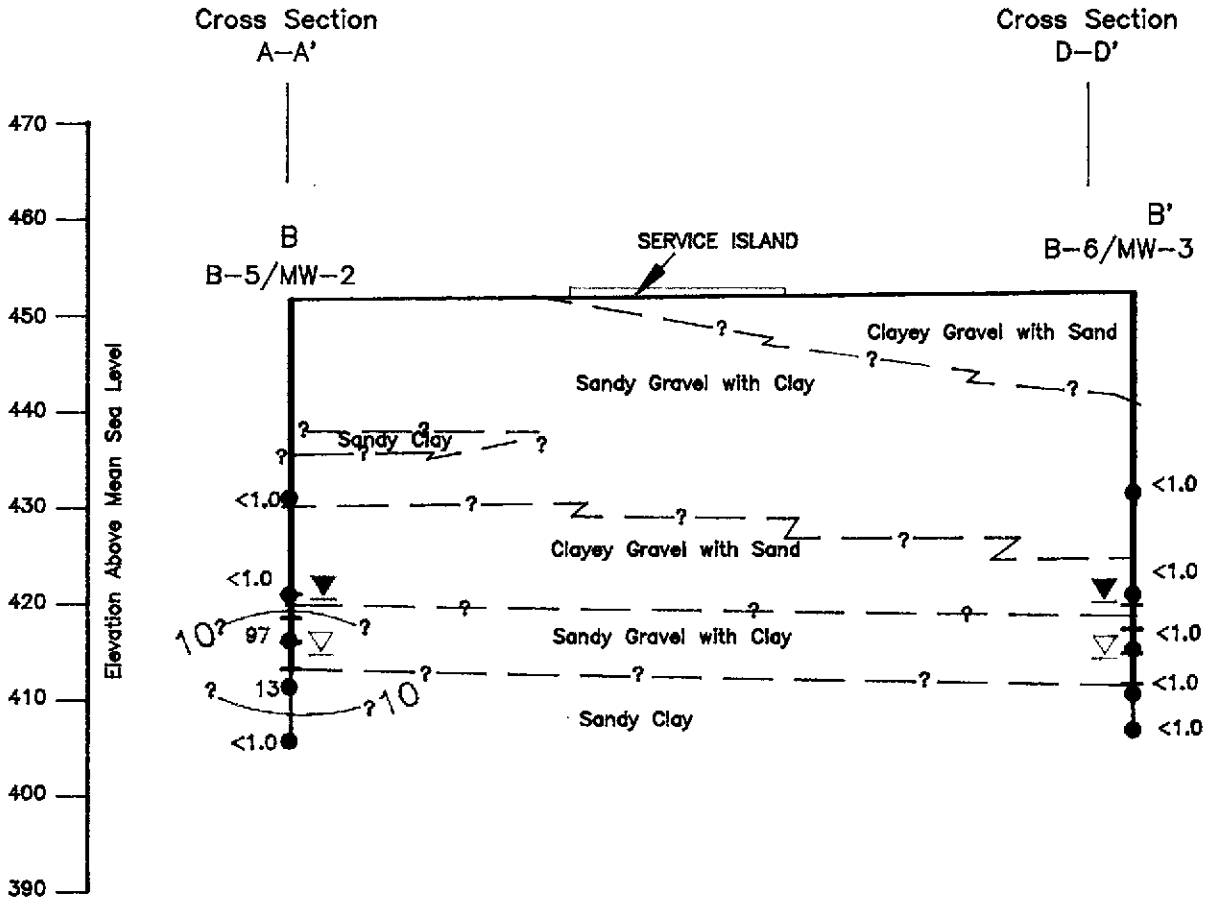
= Static water level in well

Approximate Horizontal and Vertical Scale

20 10 0 20 40

feet

RESNA	**GEOLOGIC CROSS SECTION A - A'** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **14**
PROJECT 60000.06		



EXPLANATION

10 = Line of equal concentration of TPHg in soil

97 = Laboratory analyzed soil sample showing concentration of TPHg in parts per million

= Well casing

= Well screen

= Boring

= Initial water level in boring

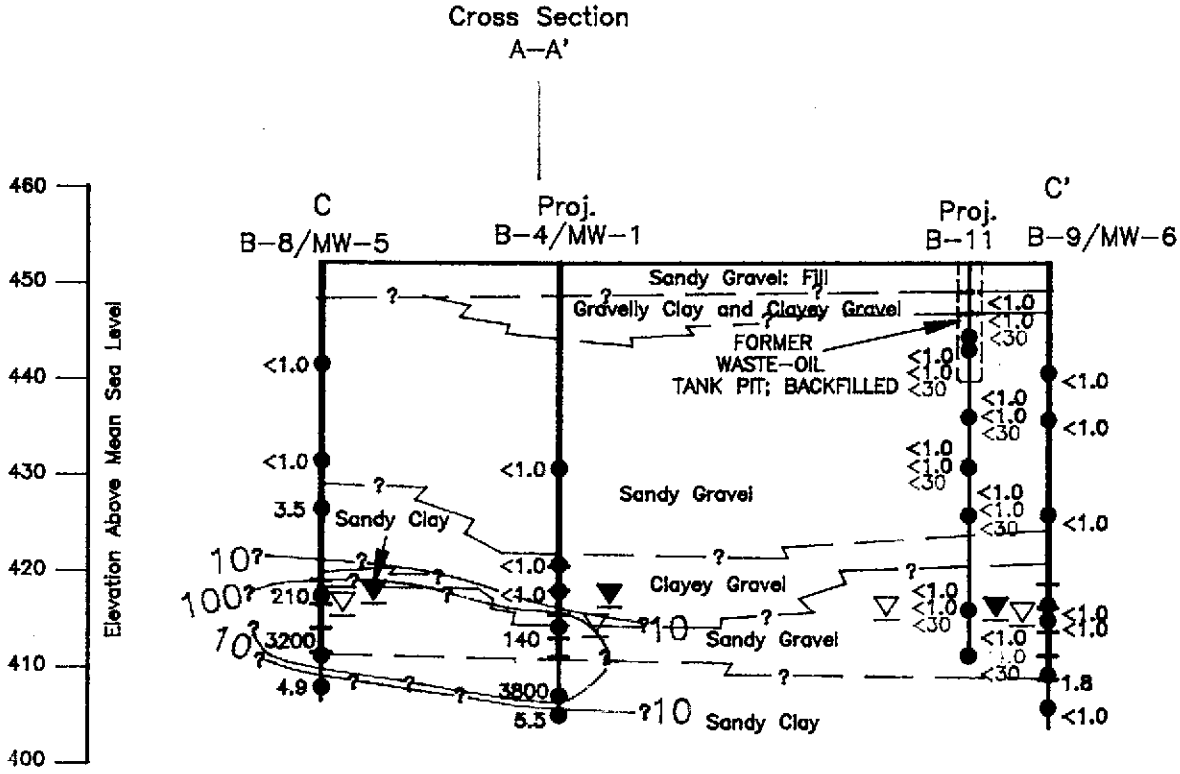
= Static water level in well

Approximate Horizontal and Vertical Scale

20 10 0 20 40

feet

RESNA	**GEOLOGIC CROSS SECTION B - B'** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **15**
PROJECT 60000.06		



EXPLANATION

10 = Line of equal concentration of TPHg in soil

3800 / <1.0 / <30 = Laboratory analyzed soil sample showing concentration of TPHg (red), TPHd (green), and TOG (blue) in parts per million (ppm).

= Well casing

= Well screen

= Boring

= Initial water level in boring

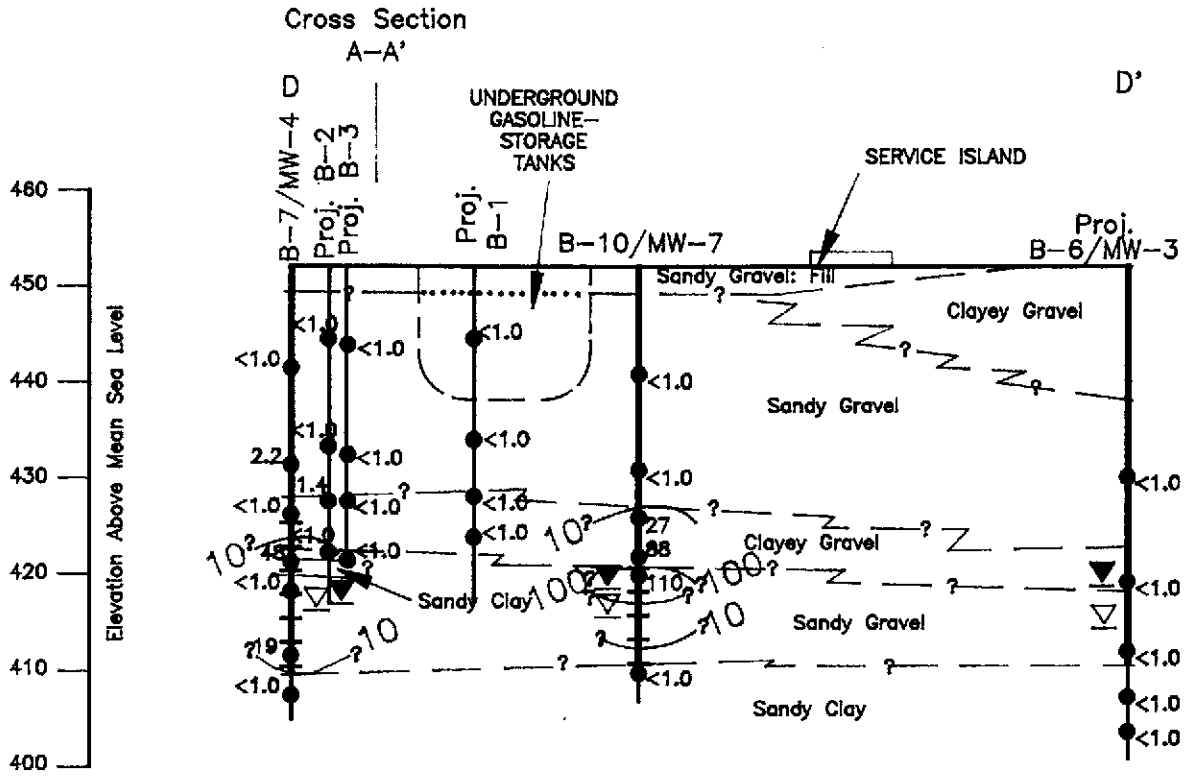
= Static water level in well

Approximate Horizontal and Vertical Scale

20 10 0 20 40

feet

RESNA	GEOLOGIC CROSS SECTION C - C' ARCO Station 771 899 Rincon Avenue Livermore, California	PLATE 16
PROJECT 60000.06		



EXPLANATION

10 — = Line of equal concentration of TPHg in soil

48 = Laboratory analyzed soil sample showing concentration of TPHg in parts per million

= Well casing

= Well screen

= Boring

= Initial water level in boring

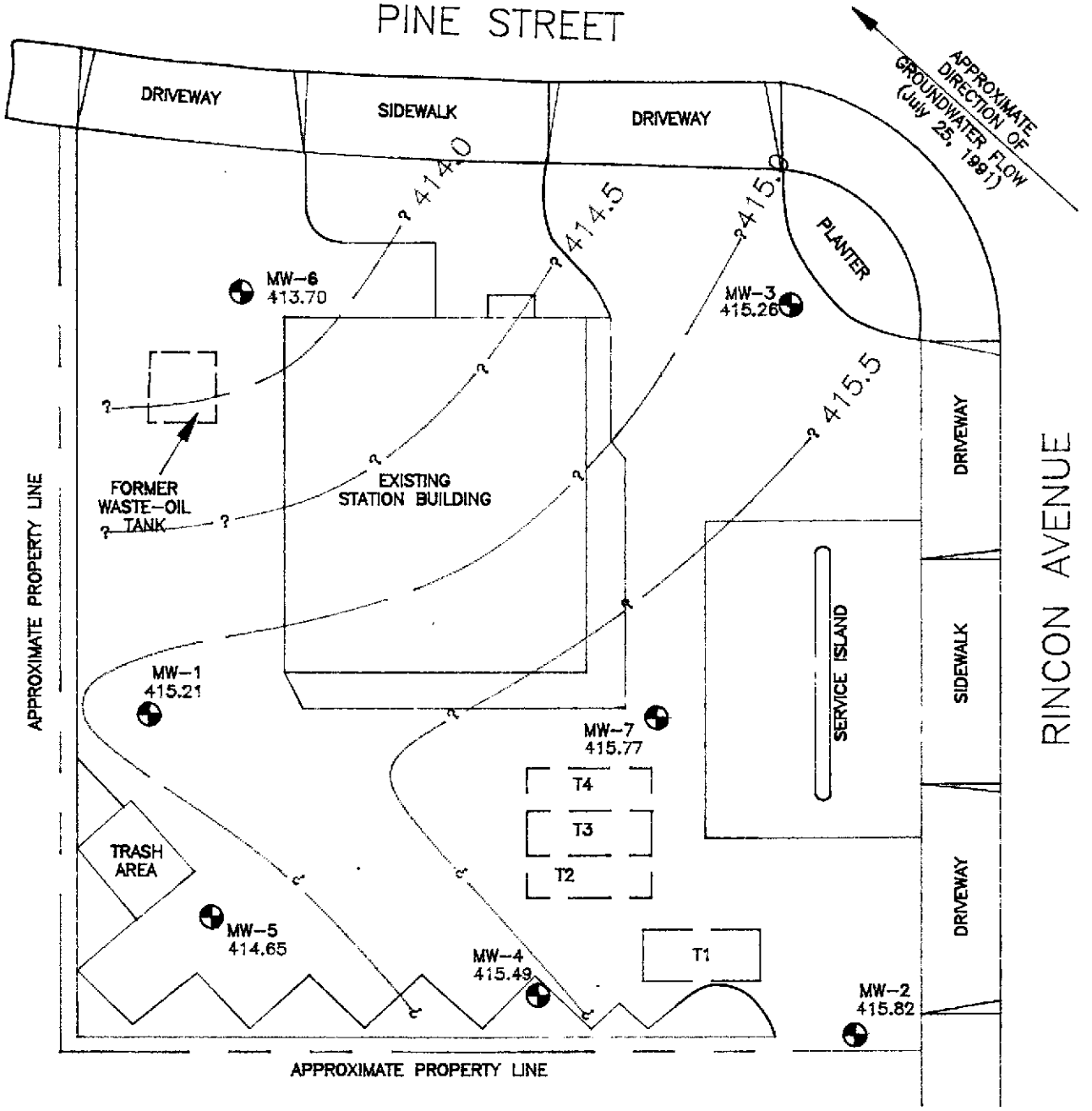
= Static water level in well

Approximate Horizontal and Vertical Scale

20 10 0 20 40

feet

RESNA	**GEOLOGIC CROSS SECTION D - D'** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **17**
PROJECT 60000.06		



EXPLANATION

415.5 = Line of equal elevation of groundwater in feet mean sea level (MSL)

415.82 = Elevation of groundwater in feet (MSL), July 25, 1991

MW-7 = Monitoring well (Applied GeoSystems, December 1990, June, and July 1991)

T4 = Underground gasoline-storage tank

N

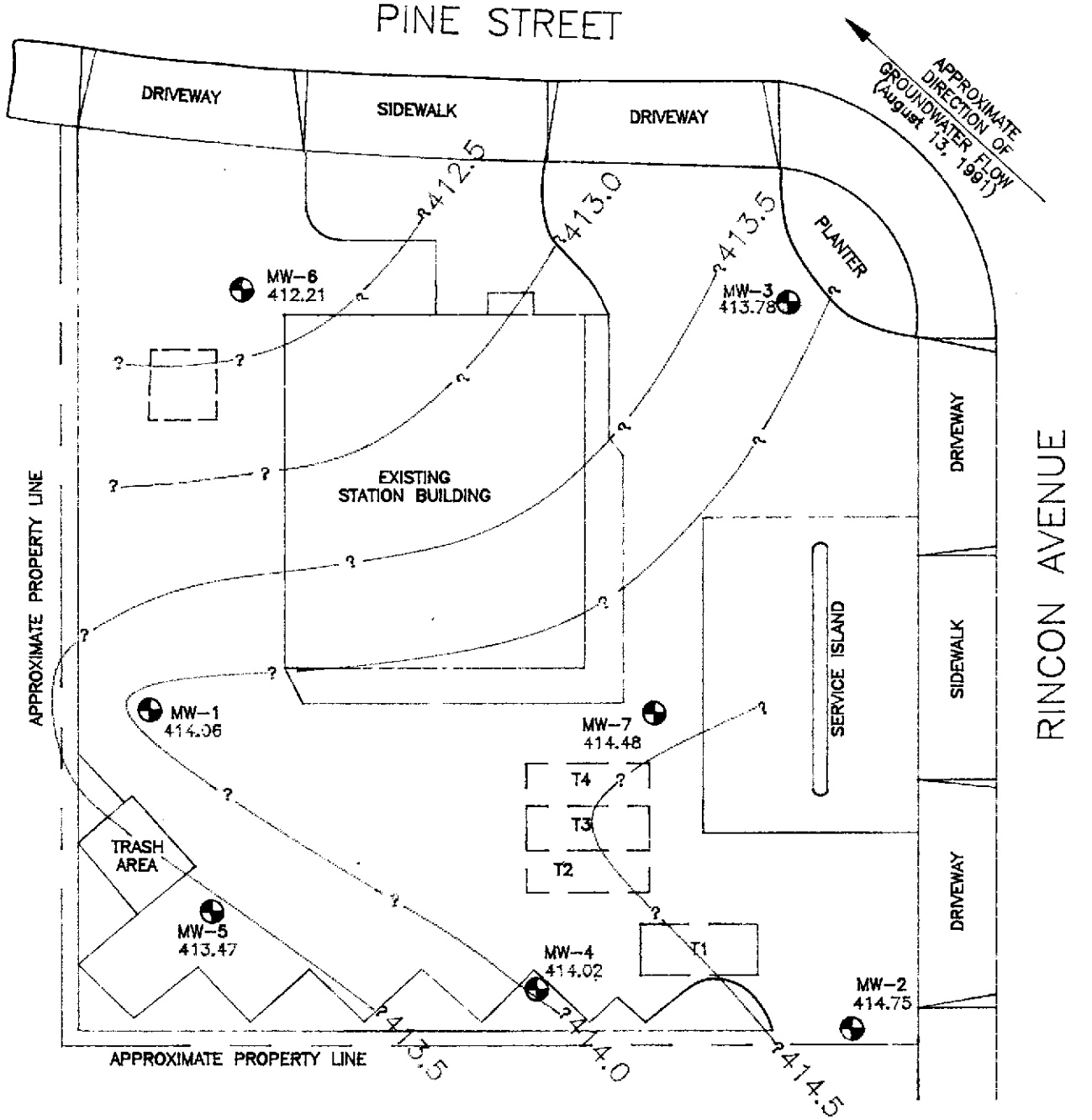
Approximate Scale

20 10 0 20 40

feet

Source: Surveyed by John Koch, Licenced Land Surveyor.

RESNA	**GROUNDWATER GRADIENT MAP** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **18**
PROJECT 60000.06		



EXPLANATION

414.5 = Line of equal elevation of groundwater in feet mean sea level (MSL)

414.73 = Elevation of groundwater in feet (MSL), August 13, 1991

MW-7 = Monitoring well (Applied GeoSystems, December 1990, June, and July 1991)

T4 = Underground gasoline-storage tank

N

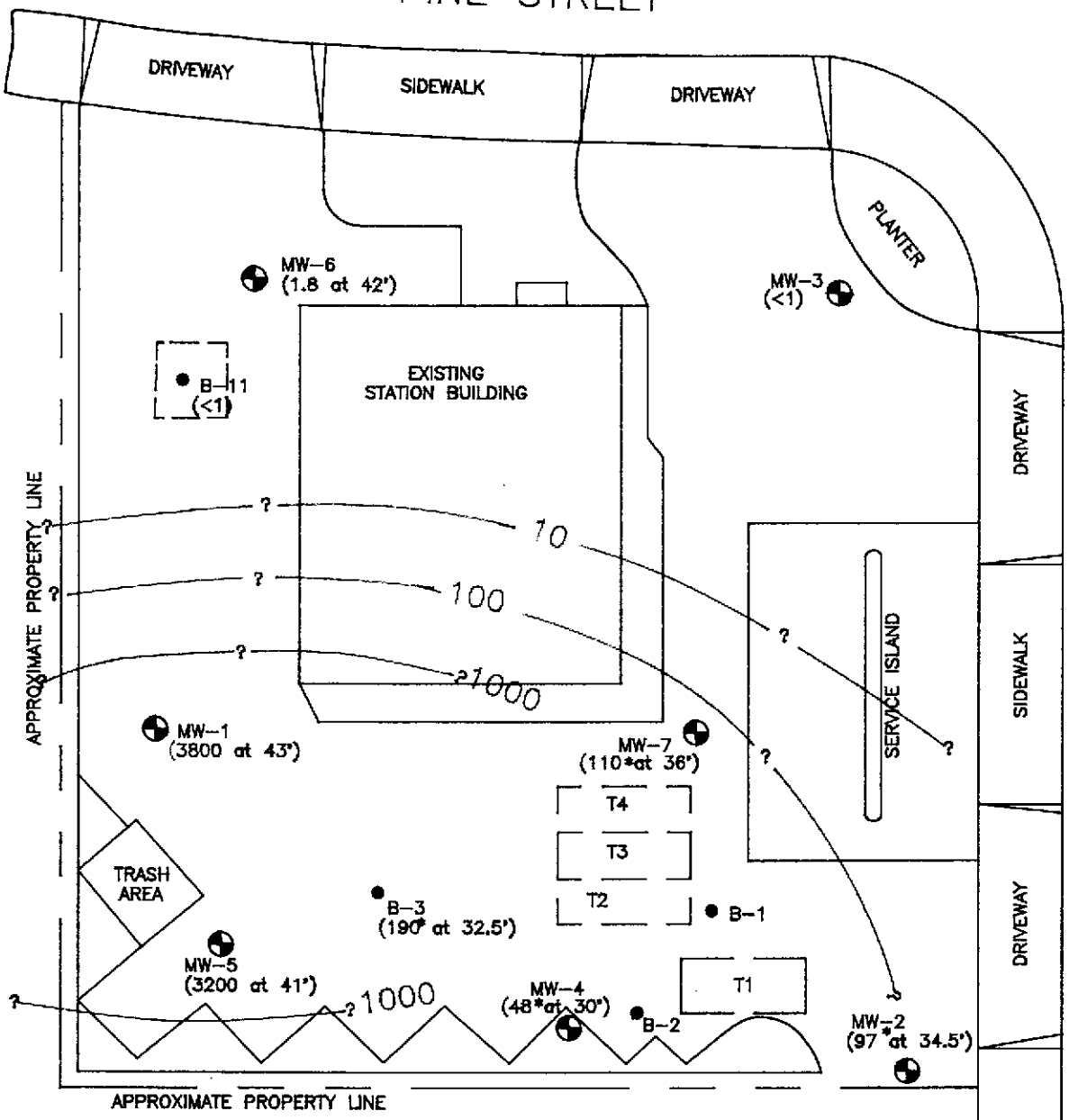
Approximate Scale

20 10 0 20 40

feet

Source: Surveyed by John Koch, Licensed Land Surveyor.

RESNA	**GROUNDWATER GRADIENT MAP** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **19**
PROJECT 60000.06		



EXPLANATION

1000 = Line of equal concentration of TPHg in soil, in ppm

3800 = Concentration of TPHg in soil in ppm, at stated depth, 1990, 1991

B-11 = Soil boring (Applied GeoSystems, February 1990, July 1991)

MW-7 = Monitoring well (Applied GeoSystems, December 1990, June, and July 1991)

T4 = Underground gasoline-storage tank

* = Concentration may be greater at 42 feet, but boring drilled to shallower depth

N

Approximate Scale

20 10 0 20 40

feet

Source: Surveyed by John Koch, Licensed Land Surveyor.

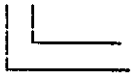
RESNA	**TPHg CONCENTRATIONS IN SOIL At 30 to 43 feet Depth ARCO Station 771 899 Rincon Avenue Livermore, California**	**PLATE 20**
PROJECT 60000.06		

TABLE 1
ANALYTICAL RESULTS OF SOIL AND SLUDGE SAMPLES
BY BROWN AND CALDWELL
ARCO Station 771
Livermore, California
August and September, 1987

Sample Identification	HVC	TPFH	B	T	X	PCBs
AL-1	ND	378	ND	ND	ND	ND
AL-2	ND	ND	ND	ND	ND	ND
LS-1	ND	3,779	ND	0.009	0.05	ND
LS-2	ND	808	ND	0.011	0.06	ND
WO-1	ND	256,508	ND	2.920	0.128	ND

Results measured in part per million (ppm).
HVC: Halogenated volatile compounds by EPA Method 8010.
TPFH: Total petroleum fuel hydrocarbons by modified EPA Method 8015.
B: Benzene by EPA Method 8020.
T: Toluene by EPA Method 8020.
X: Total xylenes isomers by EPA Method 8020.
PCBs: Polychlorinated biphenyls by EPA Method 8080.
ND: Below laboratory reported detection concentration.

Sample Identification: LS-2



Sample number
AL = Soil sample
LS = Stockpile sample
WO = Waste-oil sample

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 771
Livermore, California
(page 1 of 3)

Sample Identification	TPHg	TPHd	B	T	E	X	TOG
February 1990							
S-10-B1	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-19.5-B1	<1.0	NA	0.022	0.024	<0.005	0.022	NA
S-24.5-B1	<1.0	NA	0.022	0.015	0.010	0.048	NA
S-29.5-B1	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-10-B2	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-20-B2	<1.0	NA	0.016	0.020	<0.005	0.025	NA
S-25-B2	1.4	NA	<0.01	<0.01	<0.01	0.018	NA
S-31-B2	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-10-B3	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-19.5-B3	<1.0	NA	0.028	<0.005	<0.005	0.017	NA
S-25-B3	4.5	NA	0.047	<0.01	0.011	0.038	NA
S-32.5-B3	190	NA	<1.0	<1.0	<1.0	1.7	NA
December 1990							
S-20-B4	<1.0	NA	0.006	<0.005	<0.005	<0.005	NA
S-30-B4	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-32-1/2-B4	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-36-1/2-B4	140	NA	<0.15	0.80	1.7	4.2	NA
S-43-B4	3,800	NA	<1.5	130	50	280	NA
S-45-1/2-B4	5.5	NA	0.16	0.51	0.11	0.82	NA
S-20-B5	<1.0	NA	0.068	0.013	0.009	0.026	NA
S-30-B5	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-34-1/2-B5	97	NA	<0.005	0.13	0.087	0.22	NA
S-39-1/2-B5	13	NA	0.15	0.66	0.16	1.5	NA
S-45-B5	<1.0	NA	<0.005	0.006	<0.005	0.009	NA
S-20-B6	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-30-B6	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-36-1/2-B6	<1.0	NA	<0.005	<0.005	<0.005	0.006	NA
S-41-B6	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-44-1/2-B6	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-011591-1ABCD*	31	NA	0.25	0.67	0.34	2.8	NA
June, July 1991							
S-10-B7	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-20-B7	2.2	NA	0.074	0.12	0.061	0.43	NA
S-25-B7	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-30-B7	48	NA	0.064	0.15	0.41	1.9	NA

See notes on page 3 of 3.

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 771
Livermore, California
(page 2 of 3)

Sample Identification	TPHg	TPHd	B	T	E	X	TOG
June, July 1991 cont.							
S-33-B7	<1.0	NA	<0.005	0.006	<0.005	0.010	NA
S-40-B7	19	NA	0.019	0.059	0.14	0.74	NA
S-44-B7	<1.0	NA	0.049	0.020	0.021	0.024	NA
S-10.5-B8	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-20.5-B8	<1.0	NA	0.013	<0.005	<0.005	<0.005	NA
S-25.5-B8	3.5	NA	<0.005	0.007	0.015	0.028	NA
S-34.5-B8	210	NA	0.27	1.0	2.0	12	NA
S-41-B8	3,200	NA	10	70	37	170	NA
S-43-B8	4.9	NA	0.26	1.2	0.13	0.67	NA
S-10.5-B9	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-15.5-B9	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-25.5-B9	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-34.5-B9	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-36-B9	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-42-B9	1.8	NA	0.049	0.006	0.020	0.030	NA
S-45-B9	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-10.5-B10	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-20.5-B10	<1.0	NA	0.042	<0.005	0.007	<0.005	NA
S-25.5-B10	27	NA	0.44	0.74	0.36	2.0	NA
S-34.5-10	88	NA	0.20	0.50	0.84	0.96	NA
S-36-B10	110	NA	0.28	0.51	0.86	2.7	NA
S-42-B10	<1.0	NA	0.008	<0.005	<0.005	0.021	NA
S-7-B11	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	<30
S-8.5-B11	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	<30
S-15.5-B11	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	<30
S-20.5-B11	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	<30
S-25.5-B11	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	<30
S-35.5-B11	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	<30
S-40-B11	<1.0	<1.0	<0.005	<0.005	<0.005	<0.005	<30
August 12, 1991							
SP1-ABCD*	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA

See notes on page 3 of 3.

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 771
Livermore, California
(page 3 of 3)

Results measured in part per million (ppm).

TPHg:	Total petroleum hydrocarbons as gasoline (analyzed by EPA Method 5030/8015/8020).
TPHd:	Total petroleum hydrocarbons as diesel (analyzed by EPA Method 5030/8015).
B: benzene; T: toluene; E: ethylbenzene; X: xylenes.	
BTEX:	Analyzed by EPA Method 5030/8015/8020.
TOG:	Total oil and grease (analyzed by Standard Method 5520 E&F (Gravimetric).
*:	Composite sample of four soil samples obtained from stockpiled soil.
<:	Less than the laboratory detection limit.
NA:	Sample not analyzed.

Sample Identification: S-44-1/2-B6

- S = Soil sample
- 44 = Depth of boring in feet
- 1/2 = Boring number
- B6 = Boring number

TABLE 3
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California

Date Well Measured	Well Elevation	Depth to Water	Water Elevation	Floating Product	Adjusted Water Elevation
MW-1					
1-15-91	451.80	32.77	419.03	None	—
2-27-91		32.23	419.57	None	—
7-25-91	451.80*	36.67**	415.13**	0.1	415.21
8-13-91		37.88**	413.92**	0.17	414.06
MW-2					
1-15-91	449.52	30.89**	418.63**	0.16	418.76
2-27-91		29.11**	420.41**	0.02	420.43
7-25-91	449.51*	34.08**	415.43**	0.49	415.82
8-13-91		35.18**	414.33**	0.52	414.75
MW-3					
1-15-91	450.29	32.34	417.95	None	—
2-27-91		31.78	418.51	None	—
7-25-91	450.28*	35.02	415.26	None	—
8-13-91		36.50	413.78	None	—
MW-4					
7-25-91	451.56*	36.07	415.49	Odor	—
8-13-91		37.54	414.02	Odor	—
MW-5					
7-25-91	451.41*	36.76	414.65	Odor	—
8-13-91		37.96**	413.45**	0.03	413.47
MW-6					
7-25-91	451.38*	37.68	413.70	Odor	—
8-13-91		39.17	412.21	None	—
MW-7					
7-25-91	450.65*	34.88	415.77	None	—
8-13-91		36.17	414.48	Odor	—

Measurements in feet.
* = Surveyed July 29, 1991.
** = Floating product present in well. Adjusted water elevation calculated as:
Adjusted water elevation = well elevation - (depth to water - [product thickness x 0.8])

TABLE 4
CUMULATIVE RESULTS OF LABORATORY ANALYSIS OF GROUNDWATER SAMPLES
ARCO Station 771
Livermore, California

Sample ID	TPHg	Benzene	Toluene	Ethyl-benzene	Total xylenes
MW-1					
1-15-91	N/S	N/S	N/S	N/S	N/S
7-25-91	N/S	N/S	N/S	N/S	N/S
MW-2					
1-15-91	N/S	N/S	N/S	N/S	N/S
7-25-91	N/S	N/S	N/S	N/S	N/S
MW-3					
1-15-91	230	<0.5	<0.5	2.2	2.1
7-25-91	110	0.32	0.75	1.2	1.0
MW-4					
7-25-91	23,000	590	730	360	3,500
MW-5					
7-25-91	57,000	2,300	4,200	77	14,000
MW-6					
7-25-91	[illegible]	3,000	200	340	1,000
MW-7					
7-25-91	45,000	1,500	2,700	1,200	9,200
MCL	—	1	—	680	1,750
AL	—	—	100	—	—

Results in parts per billion (ppb)

<:	Less than the laboratory detection limit.
N/S:	Not Sampled due to presence of floating product.
BTEX:	Measured by EPA Method 5030/8015/8020.
TPHg:	Total petroleum hydrocarbons as gasoline (measured by EPA Method 5030/8015/8020).
MCL:	Maximum contaminant level.
AL:	Action level.

Sample Identification: MW-3
└— Monitoring well number

APPENDIX B

FIELD PROTOCOL
WELL PURGE DATA SHEETS

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE ♦ PLEASANTON, CALIFORNIA 94588 ♦ (415) 484-2600

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT ARCO Station #771
399 Rincon Ave.
Livermore, California

CLIENT
Name ARCO Products Company
Address P.O. Box 5811 Phone (415) 571-2434
City San Mateo Zip CA 94402

APPLICANT
Name RESNA / Applied GeoSystems
Address 3315 Almaden Expwy. #34 Phone (408) 264-7723
City San Jose Zip CA 95118

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection	___	General	___
Water Supply	___	Contamination	___
Monitoring	✓	Well Destruction	___

PROPOSED WATER SUPPLY WELL USE
Domestic ___ Industrial ___ Other ___
Municipal ___ Irrigation ___

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger ✓ Hollow Stem
Cable ___ Other ___

DRILLER'S LICENSE NO. C57 596545

WELL PROJECTS
Drill Hole Diameter 10 In. Maximum
Casing Diameter 4 In. Depth 50 ft.
Surface Seal Depth 20 ft. Number 4 monitoring wells and 1 soil boring

GEOTECHNICAL PROJECTS
Number of Borings ___ Maximum
Hole Diameter ___ In. Depth ___ ft.

ESTIMATED STARTING DATE 6/20/91
ESTIMATED COMPLETION DATE 6/25/91

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE Barbara Sieminski Date 6/4/91

FOR OFFICE USE

PERMIT NUMBER 91322
LOCATION NUMBER

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A.) GENERAL
1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
3. Permit is void if project not begun within 90 days of approval date.

(B.) WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

D. CATHODIC. Fill hole above anode zone with concrete placed by tremie.

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 11 Jun 91
Wyman Hong

5199

APPENDIX A
WELL PERMIT

FIELD PROTOCOL

The following presents RESNA's protocol for a typical site investigation involving gasoline hydrocarbon-impacted soil and/or groundwater.

Site Safety Plan

The Site Safety Plan describes the safety requirements for the evaluation of gasoline hydrocarbons in soil, groundwater, and the vadose-zone at the site. The Site Safety Plan is applicable to personnel of RESNA and its subcontractors. RESNA personnel and subcontractors of RESNA scheduled to perform the work at the site are be briefed on the contents of the Site Safety Plan before work begins. A copy of the Site Safety Plan is available for reference by appropriate parties during the work. A site Safety Officer is assigned to the project.

Sampling of Stockpiled Soil

One composite soil sample is collected for each 50 cubic yards of stockpiled soil, and for each individual stockpile composed of less than 50 cubic yards. Composite soil samples are obtained by first evaluating relatively high, average, and low areas of hydrocarbon concentration by digging approximately one to two feet into the stockpile and placing the intake probe of a field calibrated OVM against the surface of the soil; and then collecting one sample from the "high" reading area, and three samples from the "average" areas. Samples are collected by removing the top one to two feet of soil, then driving laboratory-cleaned brass sleeves into the soil. The samples are sealed in the sleeves using aluminum foil, plastic caps, and aluminized duct tape; labeled; and promptly placed in iced storage for transport to the laboratory, where compositing will be performed.

Soil Borings

Prior to the drilling of borings and construction of monitoring wells, permits are acquired from the appropriate regulatory agency. In addition to the above-mentioned permits, encroachment permits from the City or State are acquired if drilling of borings offsite in the City or State streets is necessary. Copies of the permits are included in the appendix of the project report. Prior to drilling, Underground Services Alert is notified of our intent to drill, and known underground utility lines and structures are approximately marked.

The borings are drilled by a truck-mounted drill rig equipped with 8- or 10-inch-diameter, hollow-stem augers. The augers are steam-cleaned prior to drilling each boring to minimize

the possibility of cross-contamination. After drilling the borings, monitoring wells are constructed in the borings, or neat-cement grout with bentonite is used to backfill the borings to the ground surface.

Borings for groundwater monitoring wells are drilled to a depth of no more than 20 feet below the depth at which a saturated zone is first encountered, or a short distance into a stratum beneath the saturated zone which is of sufficient moisture and consistency to be judged as a perching layer by the field geologist, whichever is shallower. Drilling into a deeper aquifer below the shallowest aquifer can begin only after a conductor casing is properly installed and allowed to set, to seal the shallow aquifer.

Drill Cuttings

Drill cuttings subjectively evaluated as having hydrocarbon contamination at levels greater than 100 parts per million (ppm) are separated from those subjectively evaluated as having hydrocarbon contamination levels less than 100 ppm. Evaluation is based either on subjective evidence of soil discoloration, or on measurements made using a field calibrated OVM. Readings are taken by placing a soil sample into a ziplock type plastic bag and allowing volatilization to occur. The intake probe of the OVM is then inserted into the headspace created in the plastic bag immediately after opening it. The drill cuttings from the borings are placed in labeled 55-gallon drums approved by the Department of Transportation; or on plastic at the site, and covered with plastic. The cuttings remain the responsibility of the client.

Soil Sampling in Borings

Soil samples are collected at no greater than 5-foot intervals from the ground surface to the total depth of the borings. The soil samples are collected by advancing the boring to a point immediately above the sampling depth, and then driving a California-modified, split-spoon sampler containing brass sleeves through the hollow center of the auger into the soil. The sampler and brass sleeves are laboratory-cleaned, steam-cleaned, or washed thoroughly with Alconox® and water, prior to each use. The sampler is driven with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive six inches are counted and recorded to evaluate the relative consistency of the soil.

The samples selected for laboratory analysis are removed from the sampler and quickly sealed in their brass sleeves with aluminum soil, plastic caps, and aluminized duct tape. The samples are then be labeled, promptly placed in iced storage, and delivered to a laboratory certified by the State of California to perform the analyses requested.

One of the samples in brass sleeves not selected for laboratory analysis at each sampling interval is tested in the field using an OVM that is field calibrated at the beginning of each day it is used. This testing is performed by inserting the intake probe of the OVM into the headspace created in the plastic bag containing the soil sample as described in the Drill Cuttings section above. The OVM readings are presented in Logs of Borings included in the project report.

Logging of Borings

A geologist is present to log the soil cuttings and samples using the Unified Soil Classification System. Samples not selected for chemical analysis, and the soil in the sampler shoe, are extruded in the field for inspection. Logs include texture, color, moisture, plasticity, consistency, blow counts, and any other characteristics noted. Logs also include subjective evidence for the presence of hydrocarbons, such as soil staining, noticeable or obvious product odor, and OVM readings.

Monitoring Well Construction

Monitoring wells are constructed in selected borings using clean 2- or 4-inch-diameter, thread-jointed, Schedule 40 polyvinyl chloride (PVC) casing. No chemical cements, glues, or solvents are used in well construction. Each casing bottom is sealed with a threaded end-plug, and each casing top with a locking plug. The screened portions of the wells are constructed of machine-slotted PVC casing with 0.020-inch-wide (typical) slots for initial site wells. Slot size for subsequent wells may be based on sieve analysis and/or well development data. The screened sections in groundwater monitoring wells are placed to allow monitoring during seasonal fluctuations of groundwater levels.

The annular space of each well is backfilled with No. 2 by 12 sand, or similar sorted sand, to approximately two feet above the top of the screened casing for initial site wells. The sand pack grain size for subsequent wells may be based on sieve analysis and/or well development data. A 1- to 2-foot-thick bentonite plug is placed above the sand as a seal against cement entering the filter pack. The remaining annulus is then backfilled with a slurry of water, neat cement, and bentonite to approximately one foot below the ground surface.

An aluminum utility box with a PVC apron is placed over each wellhead and set in concrete placed flush with the surrounding ground surface. Each wellhead cover has a seal to protect the monitoring well against surface-water infiltration and requires a special wrench to open. The design discourages vandalism and reduces the possibility of accidental disturbance of the well.

Groundwater Monitoring Well Development

The monitoring wells are developed by bailing or over-pumping and surge-block techniques. The wells are either bailed or pumped, allowed to recharge, and bailed or pumped again until the water removed from the wells is determined to be clear. Turbidity measurements (in NTUs) are recorded during well development and are used in evaluating well development. The development method used, initial turbidity measurement, volume of water removed, final turbidity measurement, and other pertinent field data and observations are included in reports. The wells are allowed to equilibrate for at least 48 hours after development prior to sampling. Water generated by well development will be stored in 17E Department of Transportation (DOT) 55-gallon drums on site and will remain the responsibility of the client.

Groundwater Sampling

The static water level in each well is measured to the nearest 0.01-foot using a Solinst® electric water-level sounder or oil/water interface probe (if the wells contain floating product) cleaned with Alconox® and water before use in each well. The liquid in the onsite wells is examined for visual evidence of hydrocarbons by gently lowering approximately half the length of a Teflon® bailer (cleaned with Alconox® and water) past the air/water interface. The sample is then retrieved and inspected for floating product, sheen, emulsion, color, and clarity. The thickness of floating product detected is recorded to the nearest 1/8-inch.

Wells which do not contain floating product are purged using a submersible pump. The pump, cables, and hoses are cleaned with Alconox® and water prior to use in each well. The wells are purged until withdrawal is of sufficient duration to result in stabilized pH, temperature, and electrical conductivity of the water, as measured using portable meters calibrated to a standard buffer and conductivity standard. If the well becomes dewatered, the water level is allowed to recover to at least 80 percent of the initial water level. Prior to the collection of each groundwater sample, the Teflon® bailer is cleaned with Alconox® and rinsed with tap water and deionized water, and the latex gloves worn by the sampler changed. Hydrochloric acid is added to the sample vials as a preservative (when applicable). A sample method blank is collected by pouring distilled water into the bailer and then into sample vials. A sample of the formation water is then collected from the surface of the water in each of the wells using the Teflon® bailer. The water samples are then gently poured into laboratory-cleaned, 40-milliliter (ml) glass vials, 500 ml plastic bottles or 1-liter glass bottles (as required for specific laboratory analysis) and sealed with Teflon®-lined caps, and inspected for air bubbles to check for headspace, which would allow volatilization to occur. The samples are then labeled and promptly placed in iced storage. A field log of

well evacuation procedures and parameter monitoring is maintained. Water generated by the purging of wells is stored in 17E DOT 55-gallon drums onsite and remains the responsibility of the client.

Sample Labeling and Handling

Sample containers are labeled in the field with the job number, sample location and depth, and date, and promptly placed in iced storage for transport to the laboratory. A Chain of Custody Record is initiated by the field geologist and updated throughout handling of the samples, and accompanies the samples to a laboratory certified by the State of California for the analyses requested. Samples are transported to the laboratory promptly to help ensure that recommended sample holding times are not exceeded. Samples are properly disposed of after their useful life has expired.

WELL PURGE DATA SHEET

Project Name: ARCO 771 Job No. 60000.06

Date: 7/25/91 Page 1 of 1

Well No. MW-3 Time Started 13:33

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)	Turbidity (NTU)
13:33	Begin purging well MW-3				
13:34	0.5	74.8	7.23	7.16	49.2
13:43	3	72.1	7.25	6.87	11.4
13:50	6	71.5	7.12	7.22	6.7
13:57	9	72.2	7.19	7.36	64.4
13:57	9	Well dewatered, stop purging MW-3			

Notes:

Well diameter (inches)	4
Depth to Bottom (feet)	39.35
Depth to Water - initial (feet)	35.02
Depth to Water - final (feet)	36.46
% recovery	67
Time Sampled	17:10
Gallons per Well Casing Volume	2.6
Gallons Purged	9
Well Casing Volumes Purged	3.5
Approximate Pumping Rate (gpm)	0.4

RESNA

WELL PURGE DATA SHEET

Project Name: ARCO 771 Job No. 60000.06

Date: 7/25/91 Page 1 of 1

Well No. MW-4 Time Started 14:18

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)	Turbidity (NTU)
14:18	Begin purging well MW-4				
14:19	0.5	74.5	7.39	13.76	>200
14:22	5	72.7	7.42	11.45	>200
14:26	10	70.3	7.40	16.00	>200
14:31	12	70.0	7.43	13.60	>200
14:31	12	Well dewatered, stop purging MW-3			

Notes:

Well diameter (inches)	4
Depth to Bottom (feet)	42
Depth to Water - initial (feet)	36.07
Depth to Water - final (feet)	39.94
% recovery	35
Time Sampled	17:20
Gallons per Well Casing Volume	3.6
Gallons Purged	12
Well Casing Volumes Purged	3.3
Approximate Pumping Rate (gpm)	0.9

RESNA

WELL PURGE DATA SHEET

Project Name: ARCO 771 Job No. 60000.06

Date: 7/25/91 Page 1 of 1

Well No. MW-5 Time Started 15:00

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)	Turbidity (NTU)
15:00	Begin purging well MW-5				
15:01	0.5	77.3	7.78	13.56	>200
15:05	5	76.10	7.67	13.72	>200
15:10	7	75.2	7.65	12.59	>200
15:10	Well dewatered				
15:27	9	76.2	7.60	12.60	>200
15:27	Well dewatered, stop purging MW-5				

Notes:

Well diameter (inches)	4
Depth to Bottom (feet)	41
Depth to Water - initial (feet)	36.76
Depth to Water - final (feet)	39.60
% recovery	33
Time Sampled	17:30
Gallons per Well Casing Volume	2.5
Gallons Purged	9
Well Casing Volumes Purged	3.6
Approximate Pumping Rate (gpm)	0.3

RESNA

WELL PURGE DATA SHEET

Project Name: ARCO 771 Job No. 60000.06

Date: 7/25/91 Page 1 of 1

Well No. MW-6 Time Started 12:32

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)	Turbidity (NTU)
12:32	Begin purging well MW-6				
12:33	0.5	71.5	7.33	8.99	>200
12:40	5	70.1	7.37	9.07	>200
12:45	10	71.7	7.45	9.45	>200
12:49	12	70.0	7.51	9.10	>200
12:49	Well dewatered				
12:57	13	71.1	7.56	9.08	>200
12:57	Stop purging well MW-6				

Notes:

Well diameter (inches)	4
Depth to Bottom (feet)	42.5
Depth to Water - initial (feet)	37.68
Depth to Water - final (feet)	39.18
% recovery	69
Time Sampled	16:45
Gallons per Well Casing Volume	2.9
Gallons Purged	13
Well Casing Volumes Purged	4.5
Approximate Pumping Rate (gpm)	0.5

RESNA

WELL PURGE DATA SHEET

Project Name: ARCO 771 Job No. 60000.06

Date: 7/25/91 Page 1 of 1

Well No. MW-7 Time Started 13:08

Time (hr)	Gallons (cum.)	Temp. (F)	pH	Conduct. (micromoh)	Turbidity (NTU)
13:08	Begin purging well MW-7				
13:09	0.5	74.4	7.39	12.35	>200
13:13	6	71.5	7.72	10.27	>200
13:17	9	70.3	7.59	11.80	>200
13:20	10	70.7	7.66	11.21	>200
13:20	10	Well dewatered, stop purging MW-7			

Notes:

Well diameter (inches)	4
Depth to Bottom (feet)	40
Depth to Water - initial (feet)	34.88
Depth to Water - final (feet)	38.46
% recovery	30
Time Sampled	16:56
Gallons per Well Casing Volume	3.1
Gallons Purged	10
Well Casing Volumes Purged	3.2
Approximate Pumping Rate (gpm)	0.9

RESNA

APPENDIX C

WELLHEAD SURVEY

JOHN E. KOCH
Land Surveyor
CA. State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(415)655-9956
FAX(415)655-9745

Applied GeoSystems
3315 Almaden Expressway, Suite 34
San Jose, CA 95118
(408)264-7723
FAX(408)264-2435

07/31/91

Tabulation of Elevations as of
01:00 p.m. 07/29/91

Job #91047
AGS Project 60000.06
Assistant Project Geologist:Joel Coffman
Site: Arco Station 771
899 Rincon Ave.
@ Pine St.
Livermore, CA

BENCHMARK: Top of pin in standard monument, West side of intersection of Rincon Ave. and Pine St. Elevation taken as 448.741'. City of Livermore Datum.

MONITOR WELL DATA TABLE

Well Designation	Elevation	Description
MW-1	451.80	Top of PVC Casing
	452.08	Top of Box
MW-2	449.51	Top of PVC Casing
	450.05	Top of Box
MW-3	450.28	Top of PVC Casing
	450.56	Top of Box
MW-4	451.56	Top of PVC Casing
	451.80	Top of Box
MW-5	451.41	Top of PVC Casing
	452.10	Top of Box
MW-6	451.38	Top of PVC Casing
	451.65	Top of Box

JOHN E. KOCH, P.L.S. AGS PROJECT #60000.06 JEK JOB #91047

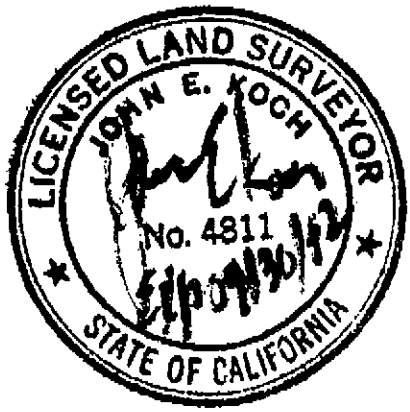
Well Designation	Elevation	Description
MW-7	450.65	Top of PVC Casing
	451.34	Top of Box

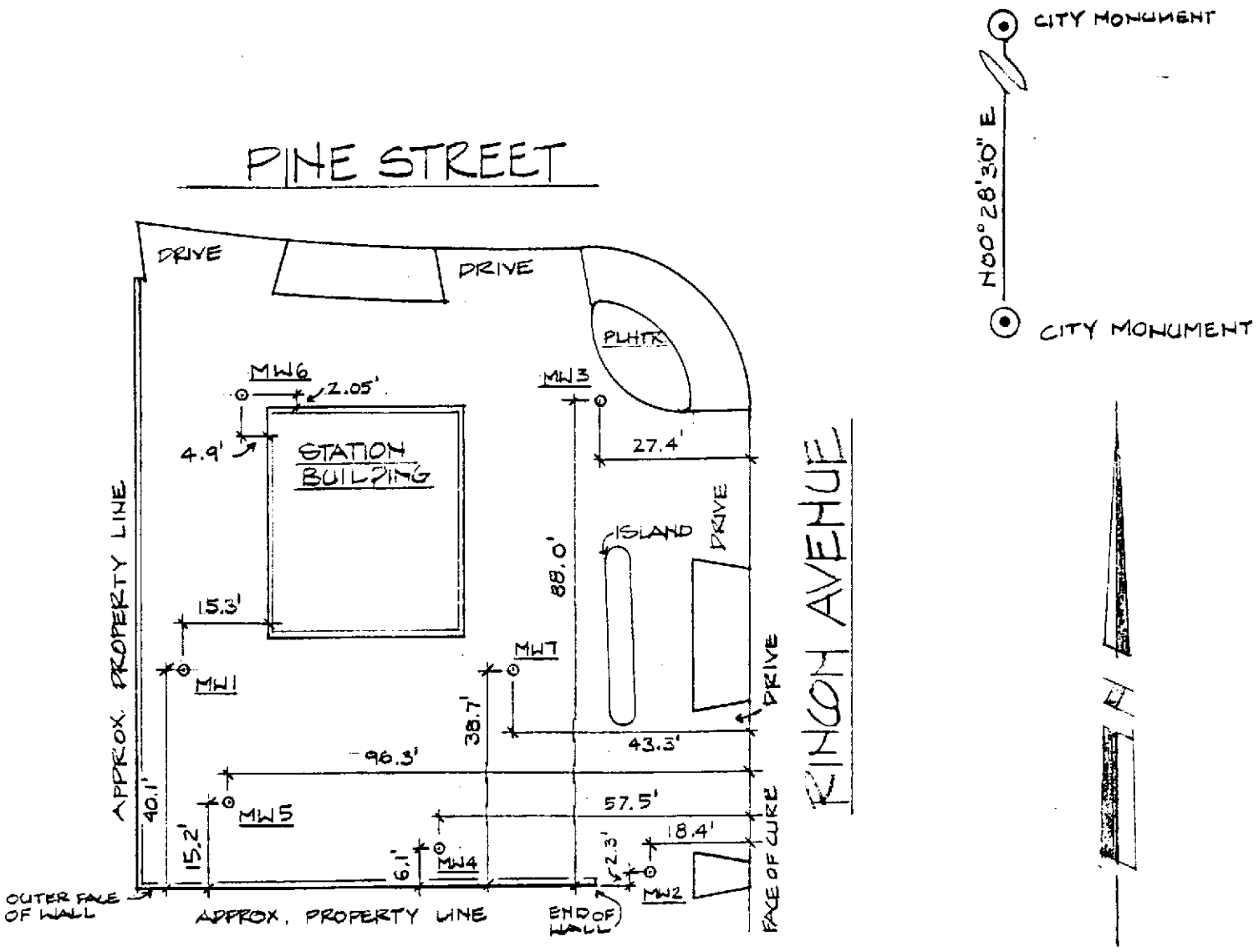
NOTES:

1. Datum is City of Livermore= USGS

2. Top of PVC Casing elevation taken at mark at top of 4" PVC for all wells. Mark bearing N for MW's 4-7, NE for MW's 1 & 3, and NNE for MW-2.

3. Top of Box elevation is at set mark bearing N for all wells.





ELEVATIONS

WELL NUMBER	TOP OF CASING	TOP OF BOX
MW1	451.80'	452.08'
MW2	449.51'	450.05'
MW3	450.28'	450.56'
MW4	451.56'	451.80'
MW5	451.41'	452.10'
MW6	451.38'	451.65'
MW7	450.65'	451.34'

LICENSED LAND SURVEYOR
JOHN E. KOCH
No. 4811
STATE OF CALIFORNIA

SITE

ARCO STATION #771
899 RINCON AVE. @ PINE
LIVERMORE, CA ASG. PROJECT 60000.06

CLIENT

APPLIED GEOSYSTEMS
3315 ALMADEN EXPRESSWAY, SUITE 34
SAN JOSE, CA 95118 (408) 264-2435

JOHN E. KOCH
Land Surveyor
CA State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(415) 655-9956
FAX (415) 655-9745

JOB#	91007	DATE	8-1-91
DRWN.	R LP, K		

APPENDIX E

SIEVE ANALYSIS REPORT

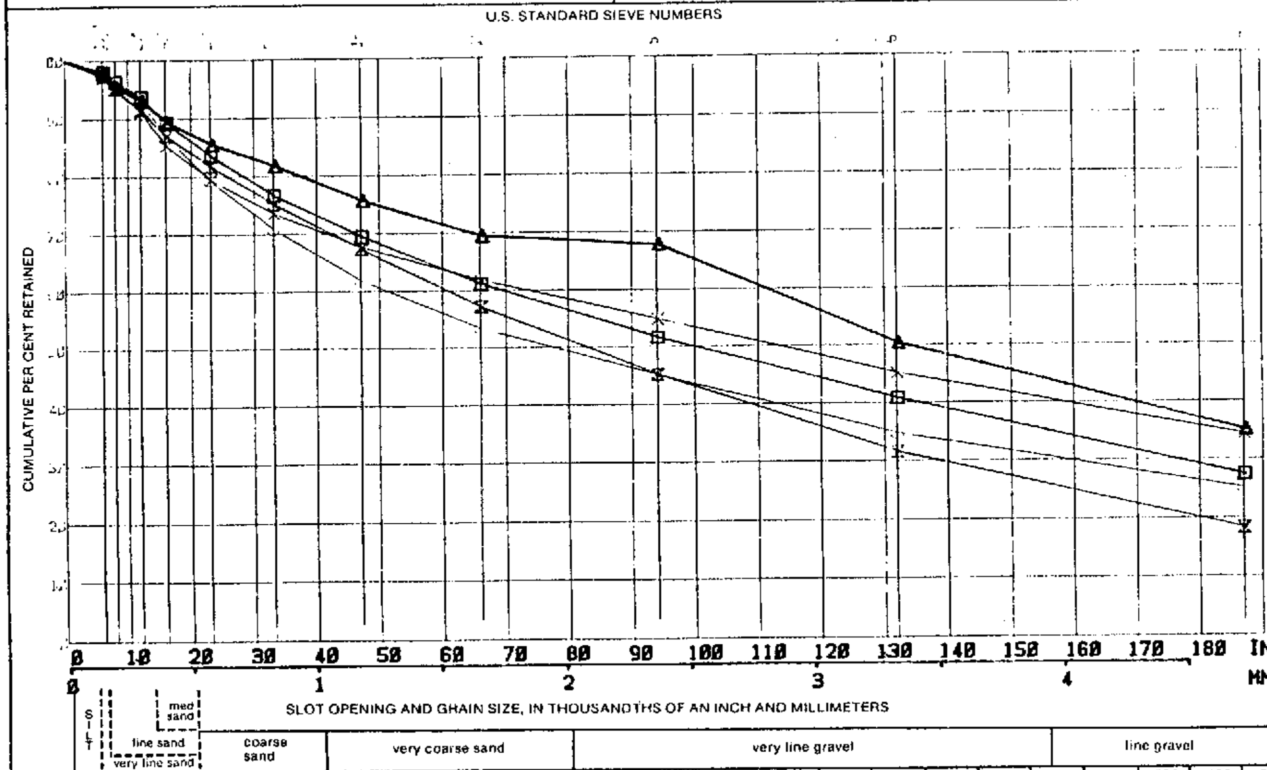
RECEIVED
AUG 1 1991
APPLIED GEOSYSTEMS
SAN JOSE STATION

DRILLER	JOB NAME ARCO STATION #771	
ENGINEER APPLIED GEOSYSTEMS SAN JOSE CA, 95118	LOCATION LIVERMOOR, CA	
ANALYSIS BY BILL SCHAFER DATE August 6, 1991	JOHNSON I.D. NUMBER 91217 SAMPLE SENT IN BY APPLIED GEOSYSTEMS	

SAND ANALYSIS REPORT

Johnson Filtration Systems Inc.

P.O. Box 64118 • St. Paul, Minnesota 55164-0118 • Telephone 612-636-3900
Telex: 29-7451 • FAX 1-612-636-0889 • Call Toll Free 1-800-VEE-WIRE



TEST HOLE DATA

DIAMETER 10.000

DEPTH 47

DRILLING METHOD AUGER

DRILLING FLUID

GEOPHYSICAL LOGS

STATIC WATER LEVEL 35

COMMENTS

WELL DATA

CASING DIAMETER 4.000

DESIRED YIELD

WELL APPLICATION

DESIGN RECOMMENDATIONS

RECOMMEND :
JOHNSON SS SCREEN
80 SLOT (0.080IN)
NATURALLY DEVELOPED
OR
100 SLOT (0.100IN)
WITH TRONA 4X8 GRAVEL
OR EQUIVALENT.

SCREEN RECOMMENDATIONS

DIAMETER		
SLOT	LENGTH	SETTING

COMBINED SAMPLE DEPTHS	PHYSICAL SAMPLE DESCRIPTION (mm / Inches / U.S. Sieve #)	4.76 / .187 / 4	3.36 / .123 / 6	2.38 / .094 / 8	1.68 / .066 / 12	1.19 / .047 / 16	.840 / .033 / 20	.590 / .023 / 30	.420 / .016 / 40	.297 / .012 / 50	.210 / .008 / 70	.149 / .006 / 100	.074 / .003 / 200	.053 / .002 / 270	TOTAL WT.
[illegible]	SILT TO FINE GRAVEL WITH [illegible] OVER 3/8	25.2	34.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
S-15.5-88	☐ SILT TO FINE GRAVEL WITH 28% OVER 3/8	27.4	48.9	51.8	61.2	69.6	76.7	83.5	89.4	93.8	96.5	98.1			369.0
S-30-88	△ SILT TO FINE GRAVEL WITH 17% OVER 3/8	35.1	50.4	67.9	69.5	75.6	81.7	85.5	89.3	93.1	95.4	97.7			131.0
S-30.5-89	⧖ SILT TO FINE GRAVEL WITH 10% OVER 3/8	18.3	31.6	45.2	57.3	67.3	75.2	81.7	87.0	91.6	95.1	97.4			431.0
S-46.5-89	× SILT TO FINE GRAVEL WITH 5% OVER 3/8	34.3	45.1	54.9	61.8	67.6	73.5	79.[illegible]	85.3	91.2	95.1	97.3			102.0

(Cumulative % retained)

SO MANY CONSIDERATIONS ENTER INTO THE MAKING OF A GOOD WELL THAT WHILE WE BELIEVE SLOT SIZES FURNISHED OR RECOMMENDED

DRILLER

ENGINEER APPLIED GEOSYSTEMS
SAN JOSE CA, 95118

ANALYSIS BY BILL SCHAFER
DATE August 6, 1991

JOB NAME ARCO STATION #771

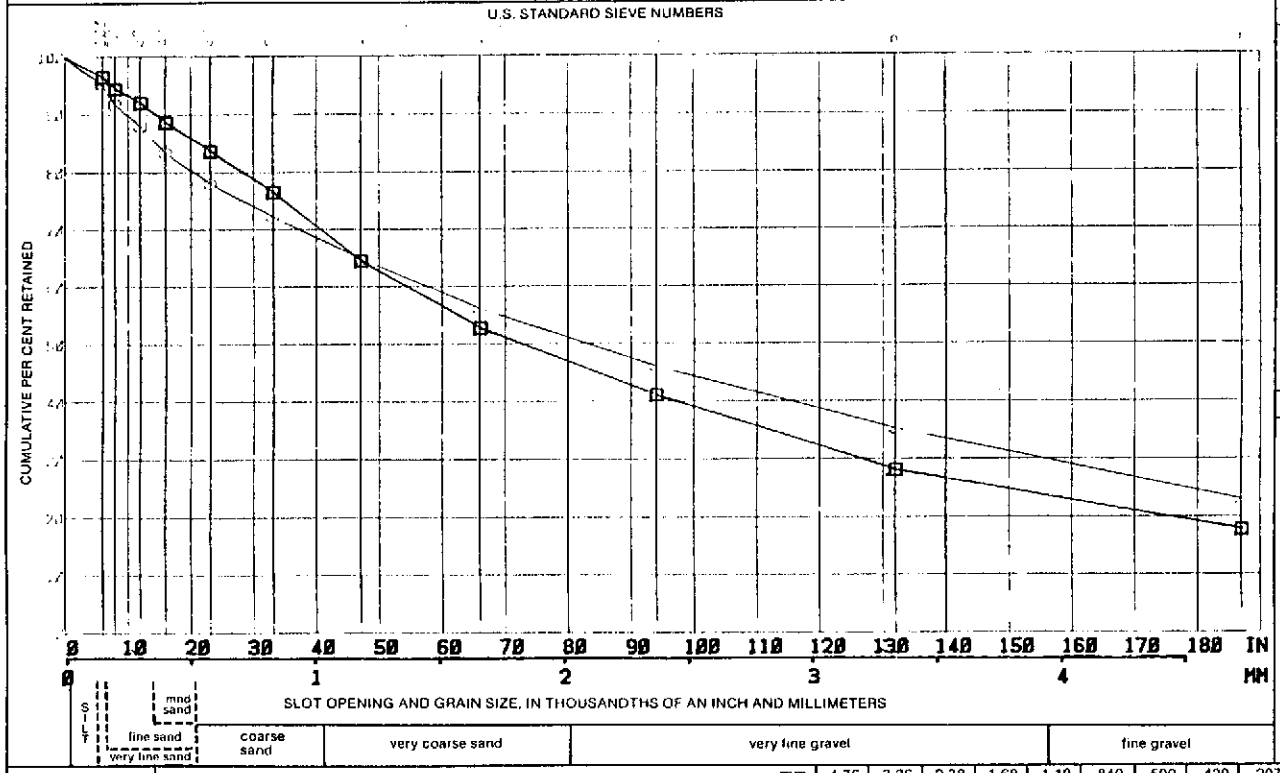
LOCATION LIVERMOOR, CA

JOHNSON I.D. NUMBER 91217
SAMPLE SENT IN BY APPLIED GEOSYSTEMS

SAND ANALYSIS REPORT

Johnson Filtration Systems Inc.

P.O. Box 64118 • St. Paul, Minnesota 55164-0118 • Telephone: 612-636-3900
Telex: 29-7451 • FAX 1-612-636-0889 • Call Toll Free 1-800-VEE WIRE



TEST HOLE DATA

DIAMETER 10.000

DEPTH 47

DRILLING METHOD
AUGER

DRILLING FLUID

GEOPHYSICAL LOGS

STATIC WATER LEVEL
35

COMMENTS

WELL DATA

CASING DIAMETER 4.000

DESIRED YIELD

WELL APPLICATION

DESIGN RECOMMENDATIONS

RECOMMEND :
30 FT OF 90 SLOT
(0.090IN) TELE SCREEN
SET FROM 51-81'

SCREEN RECOMMENDATIONS

DIAMETER

COMBINED SAMPLE DEPTHS	PHYSICAL SAMPLE DESCRIPTION		mm	4.76	3.36	2.38	1.68	1.19	.840	.590	.420	.297	.210	.149	.074	.053	TOTAL WT.
			Inches	.187	.123	.094	.066	.047	.033	.023	.016	.012	.008	.006	.003	.002	
			U.S. Sieve #	4	6	8	12	16	20	30	40	50	70	100	200	270	
[illegible]	[illegible]	CUMULATIVE % RETAINED		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
S-38.5-811	☐ SILT TO FINE GRAVEL WITH 22% OVER 3/8			17.9	28.2	41.2	52.9	64.6	76.6	83.8	88.7	92.1	94.5	96.6			291.8

SCREEN RECOMMENDATIONS		
SLOT	LENGTH	SETTING

SO MANY CONSIDERATIONS ENTER INTO THE MAKING OF A GOOD WELL THAT, WHILE WE BELIEVE SLOT SIZES FURNISHED OR RECOMMENDED FROM SAND SAMPLES ARE CORRECT WE ASSUME NO RESPONSIBILITY FOR THE SUCCESSFUL OPERATION OF JOHNSON WELL SCREENS.

APPENDIX D

CHAIN-OF-CUSTODY RECORDS
LABORATORY ANALYSIS DATA SHEETS

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-91-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Chuck Carmel	Telephone no. (ARCO) (415) 571-2769	Telephone no (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435	Contract number 60000.06 AGS
Consultant name Applied Geo Systems	Address (Consultant) 3315 Almaden Expy #37 San Jose, 95118		Method of shipment

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH 9015 EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐
S-10, B7			✓			✓		6-28-91	—		✓							1070908		
S-20, B7			✓			✓		6-28-91			✓								0909	
S25, B7			✓			✓		6-28-91			✓								0910	
S30, B7			✓			✓		6-28-91			✓								0911	
S33, B7			✓			✓		6-28-91			✓								0912	
S40, B7			✓			✓		6-28-91			✓								0913	
S44, B7			✓			✓		6-28-91			✓								0914	
S10½ B8			✓			✓		7-2-91			✓								0915	
S20½ B8			✓			✓		7-2-91			✓								0916	
S25½ B8			✓			✓		7-2-91			✓								0917	
S34½ B8			✓			✓		7-2-91			✓								0918	
S41 B8			✓			✓		7-2-91			✓								0919	
S43 B8			✓			✓		7-2-91			✓								0920	
S10½ B9			✓			✓		7-1-91			✓								0921	
S25½ B9			✓			✓		7-1-91			✓								0922	
S25½ B9			✓			✓		7-1-91			✓							✓	0923	

Special detection Limit/reporting

Special QA/QC

Remarks: BTEX and TPHg

Lab number

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☑

Condition of sample:		Temperature received:	
Relinquished by sampler: Barbara Sieminski	Date: 7/3/91 Time: 15:05	Received by: J E Bonke	
Relinquished by: J E Bonke	Date: Time:	Received by:	
Relinquished by:	Date: Time:	Received by laboratory: [illegible]	Date: 7-3 Time: 1630

White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-91-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Chuck Carmel	Telephone no. (ARCO) (415) 571-2469	Telephone no (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name Applied Geo Systems	Address (Consultant) 3315 Almaden Expy #34 San Jose, 95118		Contract number 60000.06 AGS

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Water	Other	Preservation: Ice	Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH 90/5 EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./IDHS ☐ Lead EPA 7420/7421 ☐	
S-10, B7			✓			✓		6-28-91	—		✓							1	070908		
S-20, B7			✓			✓		6-28-91			✓								0909		
S25, B7			✓			✓		6-28-91			✓								0910		
S30 B7			✓			✓		6-28-91			✓								0911		
S33, B7			✓			✓		6-28-91			✓								0912		
S40, B7			✓			✓		6-28-91			✓								0913		
S44, B7			✓			✓		6-28-91			✓								0914		
S10½ B8			✓			✓		7-2-91			✓								0915		
S20½ B8			✓			✓		7-2-91			✓								0916		
S25½ B8			✓			✓		7-2-91			✓								0917		
S34½ B8			✓			✓		7-2-91			✓								0918		
S41 B8			✓			✓		7-2-91			✓								0919		
S43 B8			✓			✓		7-2-91			✓								0920		
S10½ B9			✓			✓		7-1-91			✓								0921		
S25½ B9			✓			✓		7-1-91			✓								0922		
S25½ B9			✓			✓		7-1-91			✓							✓	0923		

Special detection Limit/reporting

Special QA/QC

Remarks: BTEX ~~and TPHg~~ and TPHg

Lab number

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☑

Condition of sample:

Temperature received:

	Date	Time		Date	Time
Relinquished by sampler: Barbara Sieminski	7/3/91	15:05	Received by: J E Bonke		
Relinquished by: J E Bonke			Received by:		
Relinquished by:			Received by laboratory: Johnny	7-3	1630

ARCO Environmental Engineering

ARCO Products Company
Division of AtlanticRichfieldCompany

Chain of Custody

Task Order No. 771-91-2

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Chuck Carmel	Telephone no. (ARCO) (415)571-2469	Telephone no. (Consultant) (408)264-7723	Fax no. (Consultant) (408)264-2435	Contract number 60000.06 AGS
Consultant name Applied GeoSystems	Address (Consultant) 3315 Almaden Exp. #34, San Jose, 95118		Method of shipment

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015 gas	TPH Modified 8015 Gas ☐ Diesel ☒	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
S40 B11			✓			✓		7-1-91			✓	✓	✓				1070940					

Special detection Limit/reporting

Special QA/QC

Remarks
BTEX, TPHg
TPHd and
TOG by method
Similar to
5520 D&F

Lab number

Turnaround time
- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☑

Condition of sample:

Temperature received:

	Date	Time		Date	Time
Relinquished by sampler Barbara Sieminski	07/03/91	15:05	Received by J E Bonk		
Relinquished by J E Bonk			Received by		
Relinquished by			Received by laboratory	7-3	1636

White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-91-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Chuck Carmel	Telephone no. (ARCO) (415)571-2469	Telephone no. (Consultant) (408)264-7723	Fax no. (Consultant) (408)264-2435	Contract number 60000.06 AES
Consultant name Applied GeoSystems	Address (Consultant) 3315 Almaden Exp. #34, San Jose, 95118		Method of shipment

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH gas EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☑	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
540 B1			✓			✓		7-1-91			✓	✓	✓				10709		40			

Special detection Limit/reporting

Special QA/QC

Remarks
BTEX, TPHg
TPHd and
TOG by method
similar to
5520 D&F

Lab number

Turnaround time
- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☑

Condition of sample:

Temperature received:

	Date	Time		Date	Time
Relinquished by sampler Barbara Sieminski	07/03/91	15:05	Received by		
Relinquished by			Received by		
Relinquished by			Received by laboratory	7-3	1636

White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
1070929	S-20.5 B10	7/2/91	EPA 5030/8015/8020
1070930	S-25.5 B10	7/2/91	EPA 5030/8015/8020
1070931	S-34.5 B10	7/2/91	EPA 5030/8015/8020
1070932	S-36 B10	7/2/91	EPA 5030/8015/8020
1070933	S-42 B10	7/2/91	EPA 5030/8015/8020
1070934	S-7 B11	7/1/91	EPA 5030/8015/8020 EPA 5030/8015 SM 5520 E&F (Gravimetric)
1070935	S-8.5 B11	7/1/91	EPA 5030/8015/8020 EPA 5030/8015 SM 5520 E&F (Gravimetric)
1070936	S-15.5 B11	7/1/91	EPA 5030/8015/8020 EPA 5030/8015 SM 5520 E&F (Gravimetric)
1070937	S-20.5 B11	7/1/91	EPA 5030/8015/8020 EPA 5030/8015 SM 5520 E&F (Gravimetric)
1070938	S-25.5 B11	7/1/91	EPA 5030/8015/8020 EPA 5030/8015 SM 5520 E&F (Gravimetric)
1070939	S-35.5 B11	7/1/91	EPA 5030/8015/8020 EPA 5030/8015 SM 5520 E&F (Gravimetric)
1070940	S-40 B11	7/1/91	EPA 5030/8015/8020 EPA 5030/8015 SM 5520 E&F (Gravimetric)

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	6/28 to 7/2
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	7/ 9-12 /91
Attention: Joel Coffman	First Sample #:	107-0908	Reported:	Jul 17, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
107-0908	S-10 B7	N.D.	N.D.	N.D.	N.D.	N.D.
107-0909	S-20 B7	2.2	0.074	0.12	0.061	0.43
107-0910	S-25 B7	N.D.	N.D.	N.D.	N.D.	N.D.
107-0911	S-30 B7	48	0.064	0.15	0.41	1.9
107-0912	S-33 B7	N.D.	N.D.	0.0060	N.D.	0.010
107-0913	S-40 B7	19	0.019	0.059	0.14	0.74
107-0914	S-44 B7	N.D.	0.049	0.020	0.021	0.024
107-0915	S-10.5 B8	N.D.	N.D.	N.D.	N.D.	N.D.
107-0916	S-20.5 B8	N.D.	0.013	N.D.	N.D.	N.D.
107-0917	S-25.5 B8	3.5	N.D.	0.0070	0.015	0.028
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	6/28 to 7/2
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	7/ 9-11 /91
Attention: Joel Coffman	First Sample #:	107-0918	Reported:	Jul 17, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
107-0918	S-34.5 B8	210	0.27	1.0	2.0	12
107-0919	S-41 B8	3,200	10	70	37	170
107-0920	S-43 B8	4.9	0.26	1.2	0.13	0.67
107-0921	S-10.5 B9	N.D.	N.D.	N.D.	N.D.	N.D.
107-0922	S-15.5 B9	N.D.	N.D.	N.D.	N.D.	N.D.
107-0923	S-25.5 B9	N.D.	N.D.	N.D.	N.D.	N.D.
107-0924	S-34.5 B9	N.D.	N.D.	N.D.	N.D.	N.D.
107-0925	S-36 B9	N.D.	N.D.	N.D.	N.D.	N.D.
107-0926	S-42 B9	1.8	0.049	0.0060	0.020	0.030
107-0927	S-45 B9	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	6/28 to 7/2
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	7/ 9-10 /91
Attention: Joel Coffman	First Sample #:	107-0928	Reported:	Jul 17, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
107-0928	S-10.5 B10	N.D.	N.D.	N.D.	N.D.	N.D.
107-0929	S-20.5 B10	N.D.	0.042	N.D.	0.0070	N.D.
107-0930	S-25.5 B10	27	0.44	0.74	0.36	2.0
107-0931	S-34.5 B10	88	0.20	0.50	0.84	0.96
107-0932	S-36 B10	110	0.28	0.51	0.86	2.7
107-0933	S-42 B10	N.D.	0.0080	N.D.	N.D.	0.021
107-0934	S-7 B11	N.D.	N.D.	N.D.	N.D.	N.D.
107-0935	S-8.5 B11	N.D.	N.D.	N.D.	N.D.	N.D.
107-0936	S-15.5 B11	N.D.	N.D.	N.D.	N.D.	N.D.
107-0937	S-20.5 B11	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	6/28 to 7/2
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Jul 9, 1991
Attention: Joel Coffman	First Sample #:	107-0938	Reported:	Jul 17, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
107-0938	S-25.5 B11	N.D.	N.D.	N.D.	N.D.	N.D.
107-0939	S-35.5 B11	N.D.	N.D.	N.D.	N.D.	N.D.
107-0940	S-40 B11	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 1070908-40

Reported: Jul 17, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	S. Gill	S. Gill	S. Gill	S. Gill
Reporting Units:	ng	ng	ng	ng
Date Analyzed:	Jul 9, 1991	Jul 9, 1991	Jul 9, 1991	Jul 9, 1991
QC Sample #:	GBLK070991	GBLK070991	GBLK070991	GBLK070991
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	100	100	100	300
Conc. Matrix Spike:	88	87	88	250
Matrix Spike % Recovery:	88	87	88	83
Conc. Matrix Spike Dup.:	95	95	95	280
Matrix Spike Duplicate % Recovery:	95	95	95	93
Relative % Difference:	7.7	8.8	7.7	11

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

SEQUOIA ANALYTICAL

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Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 1070908-40

Reported: Jul 17, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	L. Gonzales	L. Gonzales	L. Gonzales	L. Gonzales
Reporting Units:	ng	ng	ng	ng
Date Analyzed:	Jul 9, 1991	Jul 9, 1991	Jul 9, 1991	Jul 9, 1991
QC Sample #:	GBLK070991 (A) MS/MSD	GBLK070991 (A) MS/MSD	BLK070991 (A MS/MSD	BLK070991 (A) MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	100	100	100	300
Conc. Matrix Spike:	97	97	98	290
Matrix Spike % Recovery:	97	97	98	97
Conc. Matrix Spike Dup.:	88	89	90	270
Matrix Spike Duplicate % Recovery:	88	89	90	90
Relative % Difference:	9.7	8.6	8.5	7.1

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

SEQUOIA ANALYTICAL

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Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 1070908-40

Reported: Jul 17, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	L. Gonzales	L. Gonzales	L. Gonzales	L. Gonzales
Reporting Units:	ng	ng	ng	ng
Date Analyzed:	Jul 9, 1991	Jul 9, 1991	Jul 9, 1991	Jul 9, 1991
QC Sample #:	GBLK070991 (A) MS/MSD	GBLK070991 (A) MS/MSD	BLK070991 (A MS/MSD	BLK070991 (A) MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	100	100	100	300
Conc. Matrix Spike:	97	97	98	290
Matrix Spike % Recovery:	97	97	98	97
Conc. Matrix Spike Dup.:	88	89	90	270
Matrix Spike Duplicate % Recovery:	88	89	90	90
Relative % Difference:	9.7	8.6	8.5	7.1

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

SEQUOIA ANALYTICAL

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Applied GeoSystems
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San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 1070908-40

Reported: Jul 17, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	S. Gill	S. Gill	S. Gill	S. Gill
Reporting Units:	ng	ng	ng	ng
Date Analyzed:	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991
QC Sample #:	GBLK070991 MS/MSD	GBLK070991 MS/MSD	GBLK070991 MS/MSD	GBLK070991 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	100	100	100	300
Conc. Matrix Spike:	98	98	98	280
Matrix Spike % Recovery:	98	98	98	93
Conc. Matrix Spike Dup.:	90	90	90	270
Matrix Spike Duplicate % Recovery:	90	90	90	90
Relative % Difference:	8.5	8.5	8.5	3.6

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

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Applied GeoSystems
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San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 1070908-40

Reported: Jul 17, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	S. Gill	S. Gill	S. Gill	S. Gill
Reporting Units:	ng	ng	ng	ng
Date Analyzed:	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991	Jul 12, 1991
QC Sample #:	GBLK070991 MS/MSD	GBLK070991 MS/MSD	GBLK070991 MS/MSD	GBLK070991 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	100	100	100	300
Conc. Matrix Spike:	98	98	98	280
Matrix Spike % Recovery:	98	98	98	93
Conc. Matrix Spike Dup.:	90	90	90	270
Matrix Spike Duplicate % Recovery:	90	90	90	90
Relative % Difference:	8.5	8.5	8.5	3.6

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

SEQUOIA ANALYTICAL

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Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	6/28 to 7/2
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015	Analyzed:	Jul 11, 1991
Attention: Joel Coffman	First Sample #:	107-0934	Reported:	Jul 17, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
107-0934	S-7 B11	N.D.
107-0935	S-8.5 B11	N.D.
107-0936	S-15.5 B11	N.D.
107-0937	S-20.5 B11	N.D.
107-0938	S-25.5 B11	N.D.
107-0939	S-35.5 B11	N.D.
107-0940	S-40 B11	N.D.

Detection Limits:	**1.0**

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

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Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	6/28 to 7/2
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015	Analyzed:	Jul 11, 1991
Attention: Joel Coffman	First Sample #:	107-0934	Reported:	Jul 17, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
107-0934	S-7 B11	N.D.
107-0935	S-8.5 B11	N.D.
107-0936	S-15.5 B11	N.D.
107-0937	S-20.5 B11	N.D.
107-0938	S-25.5 B11	N.D.
107-0939	S-35.5 B11	N.D.
107-0940	S-40 B11	N.D.

Detection Limits:	**1.0**

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

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Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	Jul 1, 1991
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	SM 5520 E&F (Gravimetric)	Extracted:	Jul 10, 1991
Attention: Joel Coffman	First Sample #:	107-0934	Analyzed:	Jul 11, 1991
			Reported:	Jul 17, 1991

TOTAL RECOVERABLE PETROLEUM OIL

Sample Number	Sample Description	Oil & Grease mg/kg (ppm)
107-0934	S-7 B11	N.D.
107-0935	S-8.5 B11	N.D.
107-0936	S-15.5 B11	N.D.
107-0937	S-20.5 B11	N.D.
107-0938	S-25.5 B11	N.D.
107-0939	S-35.5 B11	N.D.
107-0940	S-40 B11	N.D.

Detection Limits:	30

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	Jul 1, 1991
3315 Almaden Expressway, Ste 34	Matrix Descript:	Soil	Received:	Jul 3, 1991
San Jose, CA 95118	Analysis Method:	SM 5520 E&F (Gravimetric)	Extracted:	Jul 10, 1991
Attention: Joel Coffman	First Sample #:	107-0934	Analyzed:	Jul 11, 1991
			Reported:	Jul 17, 1991

TOTAL RECOVERABLE PETROLEUM OIL

Sample Number	Sample Description	Oil & Grease mg/kg (ppm)
107-0934	S-7 B11	N.D.
107-0935	S-8.5 B11	N.D.
107-0936	S-15.5 B11	N.D.
107-0937	S-20.5 B11	N.D.
107-0938	S-25.5 B11	N.D.
107-0939	S-35.5 B11	N.D.
107-0940	S-40 B11	N.D.

Detection Limits:	**30**

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

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ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-91-2

Chain of Custody

ARCO Facility no. 771 | City (Facility) LIVERMORE | Project manager (Consultant) JOEL COFFMAN | Laboratory name Sequoia

ARCO engineer Chuck Carmel | Telephone no. (ARCO) (415) 571-2469 | Telephone no. (Consultant) (408) 264-7723 | Fax no. (Consultant) (408) 264-2435 | Contract number 07-073

Consultant name RESNA/AGS | Address (Consultant) 3315 Almaden Exwy #34, San Jose, CA 95118

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH (Gas) EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ VOA ☐ Semi VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
SP1-A			✓			✓		8-12-91			✓					108 1825						
SP1-B			✓			✓		8-12-91			✓											
SP1-C			✓			✓		8-12-91			✓											
SP1-D			✓			✓		8-12-91			✓											

Method of shipment: PRIME COURIER

Special detection Limit/reporting

Special QA/QC: 1 Composite Sample for BTEX / TPHg.

Remarks: COMPOSITE SOIL ANALYSIS FOR ALL SAMPLES 4 to 1

Lab number

Turnaround time
- Priority Rush 1 Business Day ☑
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample: good | Temperature received: cool

Relinquished by sampler	Date	Time	Received by
Eyvind Q. [signature]	8-12-91	17:00	[signature]

Relinquished by	Date	Time	Received by

Relinquished by	Date	Time	Received by laboratory	Date	Time
	8/12/91	1805	Beth Pauper [signature]	8-12	[illegible]

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

6000.06

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-91-2

Chain of Custody

ARCO Facility no.	771
City (Facility)	LIVERMORE
Project manager (Consultant)	JOEL COFFMAN
Laboratory name	Sequoia
ARCO engineer	Chuck Carmel
Telephone no. (ARCO)	(415) 571-2469
Telephone no. (Consultant)	(408) 264-7723
Fax no. (Consultant)	(408) 264-2435
Contract number	07-073
Consultant name	RESNA/AGS
Address (Consultant)	3315 Almaden Exy #34, San Jose, CA 95118
Method of shipment	PRIME COURIER

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH Gasoline EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ VOA ☐ Semi VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
SP1-A			✓			✓		8-12-91			✓					108 1825						
SP1-B			✓			✓		8-12-91			✓											
SP1-C			✓			✓		8-12-91			✓											
SP1-D			✓			✓		8-12-91			✓											

Special detection Limit/reporting

Special QA/QC: 1 Composite Sample for BTEX/TPHg.

Remarks: COMPOSITE SOIL ANALYSIS FOR ALL SAMPLES 4 to 1

Lab number

Turnaround time
- Priority Rush 1 Business Day ☑
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample: good

Temperature received: cool

Relinquished by sampler: [signature]	Date 8-12-91	Time 17:00	Received by: [signature]	
Relinquished by	Date	Time	Received by	
Relinquished by	Date 8/12/91	Time 1805	Received by laboratory: [signature]	Date 8-12 Time [illegible]

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, 95118
Attention: Joel Coffman

Project: ARCO 771, Livermore

Enclosed are the results from 1 soil samples received at Sequoia Analytical on August 12,1991. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
1081825	Soil, SP1-(A-D)	8/12/91	EPA 5030/8015/8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

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RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Aug 12, 1991
3315 Almaden Expwy., Suite 34	Matrix Descript:	Soil	Received:	Aug 12, 1991
San Jose, 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Aug 12, 1991
Attention: Joel Coffman	First Sample #:	108-1825 A-D	Reported:	Aug 13, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
108-1825	SP1-(A-D)	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**1.0**	**0.0050**	**0.0050**	**0.0050**	**0.0050**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

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RESNA
3315 Almaden Expwy., Suite 34
San Jose, 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore
QC Sample Group: 108-1825

Reported: Aug 13, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	B. Cox	B. Cox	B. Cox	B. Cox
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Aug 12, 1991	Aug 12, 1991	Aug 12, 1991	Aug 12, 1991
QC Sample #:	GBLK081291 MS/MSD	GBLK081291 MS/MSD	GBLK081291 MS/MSD	GBLK081291 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	200	200	200	600
Conc. Matrix Spike:	170	170	170	500
Matrix Spike % Recovery:	85	85	85	83
Conc. Matrix Spike Dup.:	190	190	180	560
Matrix Spike Duplicate % Recovery:	95	95	90	93
Relative % Difference:	11	11	5.7	11

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Elizabeth W. Hackl
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-91-2

Chain of Custody

ARCO Facility no. 771-6000206 | City (Facility) LIVERMORE | Project manager (Consultant) JOEL COFFMAN | Laboratory name SEQUOIA

ARCO engineer CHUCK CARMEL | Telephone no. (ARCO) | Telephone no. (Consultant) (408) 264-7723 | Fax no. (Consultant) (408) 264-2435

Consultant name RESNA/APPLIED GEOSYSTEMS | Address (Consultant) 3315 ALMADEN EXPRESSWAY, SUITE 34, SAN JOSE, CA

Contract number 07-073

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH gas EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ VOA ☐ Semi VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
W-39-MW6		4	✓	X		X	X	7-25-91	16:45		X											
W-38-MW7		4	✓	X		X	X	⟆	16:56		X											
W-36-MW3		4	✓	X		X	X	⟆			X											
W-39-MW4		4	✓	X		X	X	⟆			X											
W-39-MW5		4	✓	X		X	X	⟆			X											

Method of shipment

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 1074899-903

Condition of sample: good | Temperature received: cool

Relinquished by sampler	Date	Time	Received by
E. Cardena	7-26-91	10:00	

Relinquished by	Date	Time	Received by

Relinquished by	Date	Time	Received by laboratory	Date	Time
			K. Walters	7/26	11:33 am

Turnaround time

Priority Rush 1 Business Day ☐

Rush 2 Business Days ☐

Expedited 5 Business Days ☐

Standard 10 Business Days ☒

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SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
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Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Joel Coffman

Project: ARCO 771, Livermore

Enclosed are the results from 5 water samples received at Sequoia Analytical on July 26,1991. The requested analyses are listed below:

1074899	Water, W-39-MW6	7/25/91	EPA 5030/8015/8020
1074900	Water, W-39-MW7	7/25/91	EPA 5030/8015/8020
1074901	Water, W-39-MW3	7/25/91	EPA 5030/8015/8020
1074902	Water, W-39-MW4	7/25/91	EPA 5030/8015/8020
1074903	Water, W-39-MW5	7/25/91	EPA 5030/8015/8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems	Client Project ID:	ARCO 771, Livermore	Sampled:	Jul 25, 1991
3315 Almaden Expressway, Ste 34	Matrix Descript:	Water	Received:	Jul 26, 1991
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Jul 31, 1991
Attention: Joel Coffman	First Sample #:	107-4899 A-D	Reported:	Aug 7, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
107-4899	W-39-MW6	10,000	3,000	200	340	1,000
107-4900	W-39-MW7	45,000	1,500	2,700	1,200	9,200
107-4901	W-39-MW3	110	0.32	0.75	1.2	1.0
107-4902	W-39-MW4	23,000	590	730	360	3,500
107-4903	W-39-MW5	57,000	2,300	4,200	77	14,000
Detection Limits:		**30**	**0.30**	**0.30**	**0.30**	**0.30**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore

QC Sample Group: 1074899-900, 902

Reported: Aug 7, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	M. Nguyen	M. Nguyen	M. Nguyen	M. Nguyen
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Jul 31, 1991	Jul 31, 1991	Jul 31, 1991	Jul 31, 1991
QC Sample #:	GBLK073191 MS/MSD	GBLK073191 MS/MSD	GBLK073191 MS/MSD	GBLK073191 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	11	11	11	32
Matrix Spike % Recovery:	110	110	110	110
Conc. Matrix Spike Dup.:	11	11	11	33
Matrix Spike Duplicate % Recovery:	110	110	110	110
Relative % Difference:	0.0	0.0	0.0	3.1

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Elizabeth W. Hackl
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Applied GeoSystems
3315 Almaden Expressway, Ste 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 771, Livermore
QC Sample Group: 1074901, 903
Reported: Aug 7, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	L. Laikhtman	L. Laikhtman	L. Laikhtman	L. Laikhtman
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Jul 31, 1991	Jul 31, 1991	Jul 31, 1991	Jul 31, 1991
QC Sample #:	GBLK073191 MS/MSD	GBLK073191 MS/MSD	GBLK073191 MS/MSD	GBLK073191 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	11	11	11	32
Matrix Spike % Recovery:	110	110	110	110
Conc. Matrix Spike Dup.:	10	10	10	32
Matrix Spike Duplicate % Recovery:	100	100	100	110
Relative % Difference:	9.5	9.5	9.5	0.0

SEQUOIA ANALYTICAL

Elizabeth W. Hackl
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100