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TRANSMITTAL

TO: Ms. Susan Hugo
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80 Swan Way, Room 200
Oakland, California 94621

DATE: February 26, 1993
PROJECT NUMBER: 60000.09
SUBJECT: ARCO Station 771, 899 Rincon Avenue, Livermore, California

FROM: Barbara Sieminski
TITLE: Assistant Project Geologist

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ADDITIONAL ONSITE AND INITIAL OFFSITE SUBSURFACE INVESTIGATION

at

ARCO Station 771
899 Rincon Avenue
Livermore, California

60000.09 Feb 1993

Report prepared for

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

by

RESNA Industries Inc.

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February 26, 1993

RESNA
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ADDITIONAL ONSITE AND INITIAL OFFSITE SUBSURFACE INVESTIGATION at ARCO Station 771 889 Rincon Avenue Livermore, California

For ARCO Products Company

INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA Industries Inc. (RESNA) performed an additional onsite and initial offsite 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. The purpose of this investigation was to further delineate the lateral and vertical extent of gasoline hydrocarbons at the site, to investigate the presence and extent of gasoline hydrocarbons in the vicinity of the site, to further evaluate the groundwater gradient of the first water-bearing zone beneath the site, and to provide future extraction points for soil and groundwater remediation systems.

The work for this investigation was proposed in the Work Plan (RESNA/Applied GeoSystems [AGS], May 15, 1991), and Addendum Three to Work Plan (RESNA, March 5, 1992), which were approved by the Alameda County Health Care Services Agency (ACHCSA) prior to commencement of the investigation. Except for the proposed pumping test, the work was performed as outlined in the documents mentioned above. The pumping test was not performed because newly constructed recovery well RW-1 did not contain a sufficient amount of water to sustain a prolonged test. The locations of offsite groundwater monitoring wells MW-8 through MW-10 were changed from those originally proposed, because the owner of the property immediately adjacent to the ARCO site did not allow access to install wells on his property. ARCO is continuing to attempt to gain an access to

install wells on the property located south and west of the site. However, as the property owner has demanded for ARCO to accept blanket responsibility for any type contamination found on the property, whether from ARCO or not, it is unlikely ARCO will reach agreement for installation of monitoring wells on this property at this time. New well locations were verbally approved by Ms. Susan Hugo of the ACHCSA and Mr. Eddy So of the Regional Water Quality Control Board (RWQCB) during a meeting held at ACHCSA on November 19, 1992. Offsite groundwater monitoring wells MW-8 through MW-11 were completed as 2-inch-diameter wells instead of proposed 4-inch-diameter wells, which meets the Tri-Regional guidelines for construction of monitoring wells.

Work performed for this investigation included drilling four offsite soil borings (B-12 through B-15) and two onsite (B-16 and B-17) soil borings; collecting soil samples from the borings; constructing 2-inch-diameter groundwater monitoring wells (MW-8 through MW-11) in borings B-12 through B-15, respectively, a 4-inch-diameter vapor extraction well (VW-1) in boring B-16, and a 6-inch-diameter recovery well (RW-1) in boring B-17; developing and sampling monitoring wells MW-8 through MW-11, and recovery well RW-1; surveying wellhead elevations; submitting soil and water samples for laboratory analyses; and preparing this report that presents field procedures, results and conclusions of this investigation.

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 sells leaded, unleaded, and supreme unleaded gasoline. Residential homes are situated to the north of the site and east of the site across Rincon Avenue. A shopping center is situated 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.

Four former single-wall underground gasoline-storage tanks (USTs) including one fiberglass 10,000-gallon UST (T1), one fiberglass 6,000-gallon UST (T2) and two steel 4,000-gallon UST's [T3 and T4] and associated product lines were excavated and removed from the site during December 1991 through March 1992 by Golden West Environmental Services of Brentwood, California (Golden West). Roux Associates of Concord, California (Roux), observed removal of the USTs and product lines and collected soil samples from the tank pit and product line trenches (Roux, July 10, 1992). A 240-gallon waste-oil tank was removed from the site in 1987 (Brown and Caldwell, 1987). Four new double-wall 10,000-gallon fiberglass USTs were installed south of the station building in the vicinity of the former tank pit. Construction of an interim vapor extraction system at the site is in progress. The location of old and new 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 located approximately 1/10 mile south-southwest of the site and Arroyo Valley is located approximately 2-3/4 miles southwest of the site.

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, 1991).

PREVIOUS WORK

Previous subsurface environmental investigations performed at the site are summarized in Appendix A.

FIELD WORK

Drilling

Field work at the site was conducted in accordance with RESNA's field protocol and the Site Safety Plan (RESNA, March 18, 1992). A description of the field methods is included in Appendix B, Field Protocol. Well construction permits were acquired from the Alameda County Flood Control and Water Conservation District, Zone 7 (ACFCWCD) prior to drilling at the site. Copies of these permits are included in Appendix C. Street encroachment permits were obtained from the City of Livermore prior to drilling offsite wells. During April 8 through 10, 1992, one offsite boring (B-15) and two onsite borings (B-16 and B-17) were drilled, and offsite groundwater monitoring well MW-11, vapor extraction well VW-1 and recovery well RW-1 were constructed in borings B-15 through B-17, respectively. Drilling of offsite borings B-12 through B-14 was postponed because the owner of the adjoining property did not allow access to install wells on his property. New locations for these borings were approved by the ACHCSA and the RWQCB. On January 14 and 15, 1993, three offsite borings (B-12 through B-14) were drilled, and three groundwater monitoring wells (MW-8 through MW-10) were installed in these borings, respectively. The locations of borings/wells are shown on Plate 2.

Offsite soil borings B-12 through B-14 were drilled on the eastern site of Rincon Avenue (northeast, east, and southeast of the site, respectively), and offsite soil boring B-15 was drilled on the northern site of Pine Street (northwest of the site). Groundwater monitoring wells MW-8 through MW-11 were installed in these borings to investigate the presence and extent of gasoline hydrocarbons in the soil and groundwater in the immediate vicinity of the site, and to further evaluate the groundwater gradient of the first water-bearing zone beneath the site. Soil boring B-16 was drilled in the northeastern portion of the site, and vapor extraction well VW-1 was installed in the boring to provide an extraction point for a

future vapor extraction system. Soil boring B-17 was drilled in the southwestern portion of the site and recovery well RW-1 was installed in the boring. RW-1 was installed to be used as a pumping well during an aquifer pumping test and as a possible extraction point for future groundwater recovery, should sufficient water for pumping be found in the well in the future.

Soil borings B-12 through B-15 and B-17 were drilled to depths between approximately 40 and 45½ feet, and soil boring B-16 was drilled to a depth of 33½ feet.

Soil Sampling and Description

Fifty one soil samples were collected from soil borings B-12 through B-17. A summary of the Unified Soil Classification System used to identify the soil encountered during drilling is presented on Plate 3, and the description of the soil encountered in the borings is presented on the Logs of Borings, Plates 4 through 15. Soil samples from the borings were collected at intervals of 5 feet or less from the ground surface to the total depth of the borings. Sampling procedures are described in Appendix B. Field monitoring of organic vapor concentrations in soil samples was performed during drilling using an organic vapor meter (OVM), which provides order of magnitude field measurements only.

Soil cuttings generated from the borings were temporarily stored onsite along the western property line, and placed on and covered with plastic sheeting pending proper disposal. Soil cuttings generated during April drilling were stockpiled in two separate piles based on OVM readings. Soil pile (SP1) contained soil cuttings with OVM measurements less than 100 parts per million (ppm), and the other soil pile (SP2) contained soil cuttings with OVM measurements greater than 100 ppm. Soil cuttings generated during January drilling were stored in one soil pile (SP) because all OVM measurements were nondetectable. After the completion of drilling on April 21, 1992, and January 15, 1993, four soil samples were collected from each stockpile and submitted for compositing and laboratory analyses. The methods used to obtain these samples is described in Appendix B.

Well Construction and Development

As mentioned previously, four groundwater monitoring wells (MW-8 through MW-11) were constructed in borings B-12 through B-15, respectively; a vapor extraction well (VW-1) was constructed in boring B-16; and a recovery well (RW-1) was constructed in boring B-17. The groundwater monitoring wells MW-8 through MW-11 were constructed with 2-inch-diameter schedule 40 polyvinyl chloride (PVC) casing, and the screened interval consisted of 2-inch-diameter, 0.020 inch machine slotted PVC. Well casings were set in these groundwater monitoring wells to depths between approximately 37 and 42½ feet. The screened casings in these monitoring wells were set from the total depths of the wells to depths between approximately 27½ and 29½ feet. Vapor extraction well VW-1 was constructed using 4-inch-diameter schedule 40 polyvinyl chloride (PVC) casing, and the screened interval consisted of 4-inch-diameter, 0.100 inch machine slotted PVC. The well casing in the vapor extraction well was set to a depth of about 28½ feet, and the screened portion was set from the total depth of the well to a depth of 18½ feet. Recovery well RW-1 was constructed using 6-inch-diameter schedule 80 PVC blank casing, and 6-inch-diameter, 0.020-inch slot stainless steel screen. The well casing in the recovery well was set to a depth of approximately 40½ feet and the screened portion was set from the total depth of the well to a depth of 25½ feet.

Groundwater monitoring well MW-11 and recovery well RW-1 were developed on April 20 and 21, 1992, and groundwater monitoring wells MW-8 through MW-10 were developed on January 21, 1993, to remove fine-grained sediments and to allow better communication between the water-bearing zone and the 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 Measuring and Sampling

Groundwater monitoring well MW-11 and recovery well RW-1 have been monitored and sampled in conjunction with monthly monitoring and quarterly sampling of the other onsite wells, by EMCON Associates of San Jose, California (EMCON), since April 1992. The

results of these monitoring and sampling events are reported in the quarterly monitoring reports listed in the References section.

Groundwater monitoring wells MW-8 through MW-10 were monitored in conjunction with the monthly monitoring of wells MW-1 through MW-7, MW-11 and RW-1 on January 29, 1993, by EMCON field personnel. Depths-to-water (DTW) were measured in the wells and water samples were collected and visually inspected for the presence of floating product. Wells MW-1 through MW-4, MW-6 through MW-11 and RW-1 were also purged and sampled on that date. Groundwater monitoring well MW-5 was not sampled due to the new L-shape fitting installed at wellhead for use in interim remediation system, which made it impossible to lower a pump or bailer in the well for purging or collecting samples.

Evaluation of Groundwater Elevations

The wellheads for the newly installed and pre-existing wells were surveyed to a local National Geodetic Vertical Datum benchmark on May 8, 1992, and January 23, 1993, by John E. Koch, a licensed surveyor. The results of these wellhead surveys are included in Appendix D, Wellhead Survey. Groundwater elevations for the wells were calculated by subtracting the measured DTW from the elevation of the wellhead.

LABORATORY METHODS

Soil Samples

Twenty four soil samples collected from borings B-12 through B-17 were analyzed in accordance with ACHCSA requirements for total petroleum hydrocarbons as gasoline (TPHg) and the gasoline constituents benzene, toluene, ethylbenzene, and total xylenes (BTEX) using Environmental Protection Agency (EPA) Methods 5030/8015/8020. The analyses were performed by Sequoia Analytical of Redwood City, California (Hazardous Waste Testing Laboratory Certification # 1210).

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; and
- Areas where the presence of gasoline hydrocarbons was suspected based on OVM readings;

Two soil samples collected from soil stockpiles SP1 and SP2 on April 9, 1992, were composited in the laboratory and analyzed for TPHg and BTEX using EPA Method 5030/8015/8020. Soil samples collected from the soil stockpile SP on January 15, 1993, were composited in the laboratory and analyzed for TPHg using EPA Method 5030/8015/8020, BTEX using EPA 5030/8015/8020 TCLP, STLC lead using EPA 7421, corrosivity using EPA 9045, ignitability using EPA 1010, and reactivity using EPA 9010 and 9030.

Two soil samples from the groundwater bearing zone (one sample collected from boring B-15 at a depth of 35½ feet, and one sample collected from boring B-17 at a depth of 36 feet) were sent to Johnson Filtration System Inc. (Johnson) of St. Paul, Minnesota for grain size analyses.

Groundwater Samples

Groundwater samples obtained from monitoring wells MW-1 through MW-4, MW-6 through MW-11 and recovery well RW-1 were analyzed for BTEX and TPHg using modified EPA Methods 5030/8020/California DHS LUFT Method. Well MW-6, the nearest downgradient well to the former waste-oil tank pit, was also analyzed for total petroleum hydrocarbons as diesel (TPHd) and total oil and grease (TOG) using EPA Methods 3510/California DHS LUFT Method and SM 5520C&F, respectively. The groundwater analyses were performed under the direction of EMCON, by Columbia Analytical Services, Inc., of San Jose, California (Hazardous Waste Testing Laboratory Certification # 1426).

FIELD WORK RESULTS

Drilling Observations

The earth materials encountered at the site consisted primarily of clayey to sandy gravel interbedded with some silty sand and sandy silt to clay. Groundwater was first encountered within sandy gravel in borings B-12, B-13, B-16 and B-17, and within clayey to silty sand overlying sandy gravel in borings B-15 and B-14 at the depths between approximately 27½ and 33 feet. Groundwater stabilized at depths of approximately 29 and 31 feet in wells MW-11 and RW-1 (drilled in April during long term drought), and at depths between 19½ and 26½ feet in wells MW-8 through MW-10 (drilled in January after heavy rains). A stratum at least 3 feet thick of damp sandy clay, which appears to be a perching or confining layer beneath the shallowest groundwater, was encountered at depths between approximately 37 and 42½ feet in borings B-12 through B-15 and B-17. This apparent confining stratum was not encountered in boring B-16 because it was terminated at a depth of 33½ feet. 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 16 through 19). The locations of the geologic cross sections are shown on Plate 2.

A product odor was noted from the soil samples collected from borings B-16 and B-17 at depths greater than about 21 feet. No product odor was noted from the soil samples collected from offsite borings B-12 through B-15. Field organic vapor (OVM) readings of soil samples from borings B-12 through B-17 are shown on the boring logs in the column labeled PID (photoionization detector). OVM readings are considered to be order of magnitude field measurements only.

Subjective Groundwater Analyses

According to EMCON's Field Reports, initial water samples collected from wells MW-1 through MW-11 and RW-1 showed no evidence of floating hydrocarbon product on January 29, 1993. DTW measurements and subjective analyses results for floating product in groundwater are summarized in Table 1, Cumulative Groundwater Monitoring Data. The results of EMCON's field work on the site, including DTW measurements, well purge data

sheets, and subjective analyses for the presence of floating product in the groundwater in the wells are presented on EMCON's Field Reports and their Summary of Groundwater Monitoring Data, which are included in Appendix E.

Groundwater Gradient

Based on groundwater elevations obtained from wells MW-1 through MW-4, MW-6 through MW-11 and RW-1 on January 29, 1993, the inferred groundwater gradient and flow direction for the first-encountered groundwater beneath the site is approximately 0.04 (ft/ft) toward the northwest. The flow direction changed from northeast during the second, third, and fourth quarters of 1992 to northwest during January 1993. The groundwater elevations in the pre-existing wells increased an average of 9 feet between December 14, 1992, and January 29, 1993. This significant increase in groundwater elevation appears to be due to the precipitation in December 1992 and January 1993. Depths to groundwater and groundwater elevations for monitoring wells MW-1 through MW-11 and recovery well RW-1 are summarized in Table 1. Plate 20, Groundwater Gradient Map, is a graphic interpretation of the groundwater elevations measured on January 29, 1993.

LABORATORY ANALYSES RESULTS

Soil Samples

Laboratory analytical results of soil samples collected from offsite borings B-12 through B-15 indicated nondetectable concentrations of TPHg (less than 1 ppm) and BTEX (less than 0.005 ppm). Laboratory analytical results of soil samples collected from onsite boring B-16 located in the northeastern portion of the site indicated nondetectable of TPHg and BTEX, except for the presence of minor benzene concentration (0.0080 ppm) detected in the sample collected at a depth of 21 feet. Laboratory analytical results of soil samples collected from onsite boring B-17 located in the southwestern portion of the site indicated nondetectable TPHg and BTEX, except for the presence of minor BTEX concentration (up to 0.021 ppm) detected in the sample collected at a depth of 21 feet, and minor TPHg concentrations (7 ppm) and BTEX concentrations (up to 1.1 ppm) detected in the sample collected at the depth of 43 feet.

Laboratory analytical results of a composite soil sample collected from soil stockpile SP1 on April 9, 1992, indicated nondetectable TPHg and BTEX. Laboratory analytical results of a composite soil sample collected from soil stockpile SP2 on April 9, 1992, reported 6.4 ppm of TPHg and up to 0.12 ppm BTEX. Laboratory analytical results of a composite soil sample collected from soil stockpile SP on January 15, 1993, indicated nondetectable TPHg, BTEX, and STLC lead. Corrosivity, ignitability and reactivity results were within acceptable limits for disposal at BFI landfill. RESNA understands that, soil stockpiles were removed from the site and transported to BFI Landfill in Livermore, California by ARCO's contractor, Dillard Trucking Inc. of Byron, California, on May 8, 1992 (SP1 and SP2), and on February 18, 1993 (SP).

The results of soil samples analyses are summarized in Table 2, Cumulative Results of Laboratory Analyses of Soil Samples. Graphic interpretations of TPHg in soil at depths of 26 to 36½ and 38 to 43½ feet are shown on Plates 21 and 22, respectively. Interpretations of TPHg concentrations in soil are also summarized in the geologic cross sections on Plates 16 through 19. Chain of Custody forms and copies of laboratory reports for soil samples are included in Appendix F.

Based on sieve analyses results, Johnson reported the sample collected from boring B-17 at a depth of 36 feet to be silt to fine gravel, and the sample collected from boring B-15 at a depth of 35½ feet to be gravelly clay. The sieve analyses report is included in Appendix G.

Groundwater Samples

Laboratory analytical results for water samples indicate TPHg concentrations ranged from 380 parts per billion (ppb) (MW-3) to 360,000 ppb (MW-1), and benzene concentrations ranged from 0.8 ppb (MW-3) to 4,600 ppb (MW-2) in the samples collected from onsite wells MW-1 through MW-4, MW-6, MW-7 and RW-1; and nondetectable concentrations of TPHg (less than 50 ppb) and benzene (less than 0.5 ppb) in the samples collected from offsite monitoring wells MW-8 through MW-11. The laboratory reported that the sample collected from groundwater monitoring well MW-3 contained components eluting in the gasoline range that were quantitated as gasoline, although the chromatogram did not match

the typical gasoline fingerprint. It appears, that these results might be within the weathered gasoline range.

Laboratory analytical results for water sample collected from MW-6, the nearest downgradient well to the former waste-oil tank pit, indicated 3.6 ppm of TOG (petroleum fraction). A lower boiling point fuel mixture quantified as TPHd was detected in the groundwater sample from MW-6 at a concentration of 2,300 ppm. According to ARCO, diesel has not been stored at the site.

Benzene, ethylbenzene and total xylenes concentrations were greater than the State Maximum Contaminant Levels (MCL) of 1 ppb, 680 ppb, and 1,750 ppb, respectively, in wells MW-1, MW-2, MW-4, MW-6 (except ethylbenzene), MW-7, and RW-1. Toluene concentrations were greater the State Recommended Drinking Water Action Level (DWAL) of 100 ppb in wells MW-1, MW-2, MW-4, MW-6, MW-7 and RW-1.

The results of laboratory analyses are summarized in Table 3, Cumulative Results of Laboratory Analyses of Groundwater Samples. Chain of Custody records and laboratory analyses reports for groundwater samples are included in Appendix E. Graphic interpretations of the extent of TPHg and benzene in the groundwater are shown on Plate 23, TPHg Concentrations in Groundwater, and Plate 24, Benzene Concentrations in Groundwater.

DISCUSSION OF RESULTS

Hydrocarbon-Impacted Soil

The presently interpreted extent of hydrocarbon impacted soil beneath the site is presented on the Geologic Cross Sections, Plates 16 through 19, and TPHg Concentrations in Soil, Plates 21 and 22. The greatest concentrations of hydrocarbons in soil appear to be in the southwestern portion of the site.

Hydrocarbon-Impacted Groundwater

Groundwater in the shallow aquifer beneath the site appears to have been impacted by gasoline-related hydrocarbons as indicated by the presence of concentrations of TPHg and benzene (up to 360,000 ppb and 4,600 ppb, respectively) detected in water samples collected from onsite wells. The groundwater in the shallow aquifer northwest, northeast and southeast of the site does not appear to be impacted by gasoline-related hydrocarbons as indicated by nondetectable TPHg and BTEX in the four offsite wells.

SUMMARY AND CONCLUSIONS

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

- Gasoline hydrocarbons appear to have impacted soil beneath the site. The majority of gasoline hydrocarbons at concentrations greater than 100 ppm in the soil appear to be limited to the southwestern portion of the site at depths between 32 and 43 feet.

- The lateral extent of gasoline hydrocarbons in the soil appears to have been delineated north and east of the site. The vertical extent of gasoline hydrocarbons in the soil at the site appears to have been delineated to nondetectable or less than 10 ppm TPHg at depths between 43 and 45½ feet in a potential confining sandy clay layer beneath the shallow water bearing unit.

- Groundwater beneath the site appears to have been impacted by gasoline hydrocarbons as indicated by concentrations of TPHg and BTEX (up to 360,000 ppb and 41,000 ppb, respectively) in groundwater samples collected from onsite wells.

- The lateral extent of gasoline hydrocarbons in groundwater at the site has been delineated in the northern and eastern portions of the site as indicated by nondetectable concentrations of TPHg and BTEX in offsite wells.

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 hydrocarbons beneath the subject site. No soil engineering or geotechnical references are implied 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.

DISTRIBUTION

It is recommended that copies of this report be sent to the following regulatory agencies:

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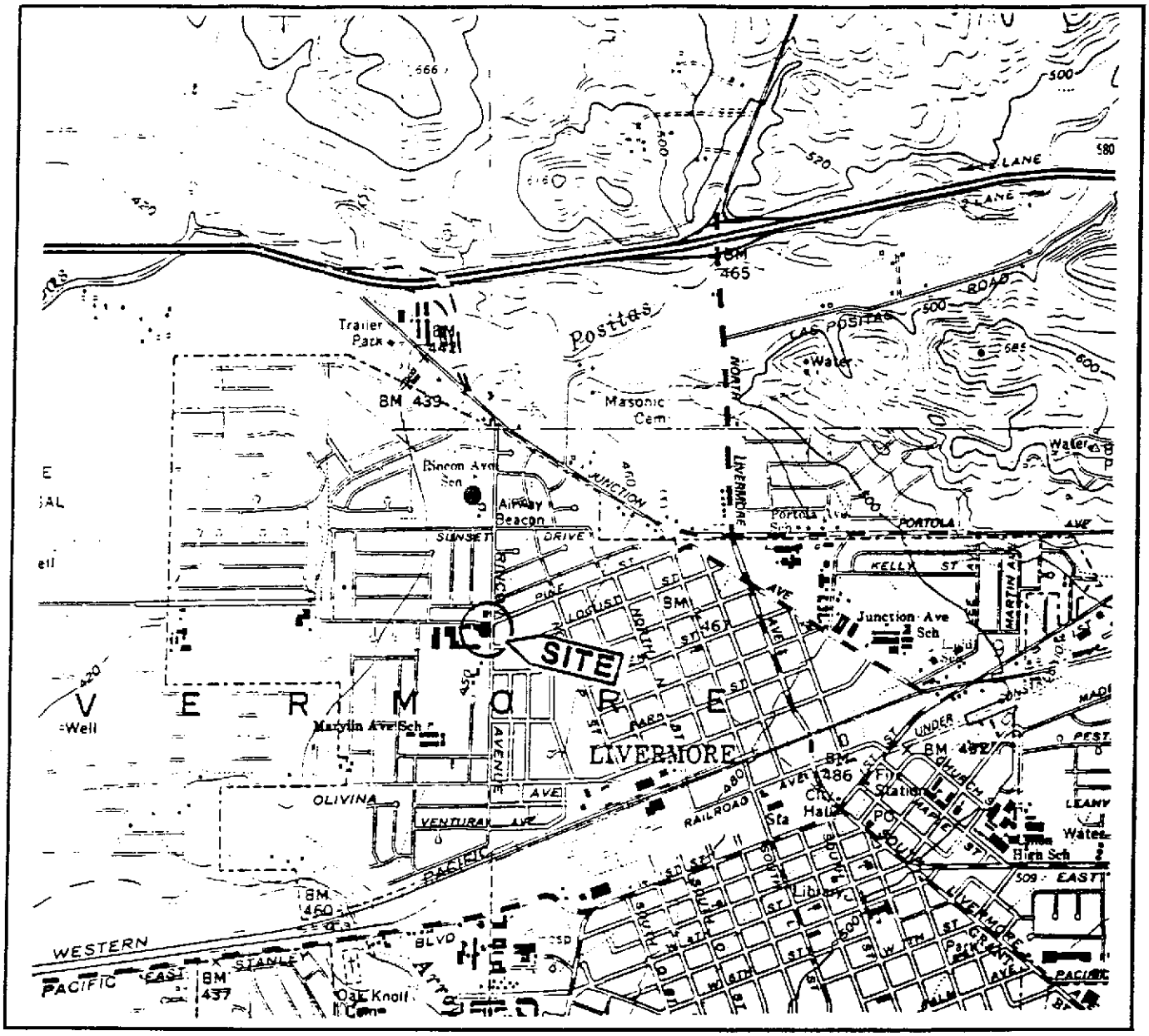


Base: U.S. Geological Survey
7.5-Minute Quadrangle
Livermore, California
Photorevised 1980

LEGEND

⊙ = Site Location

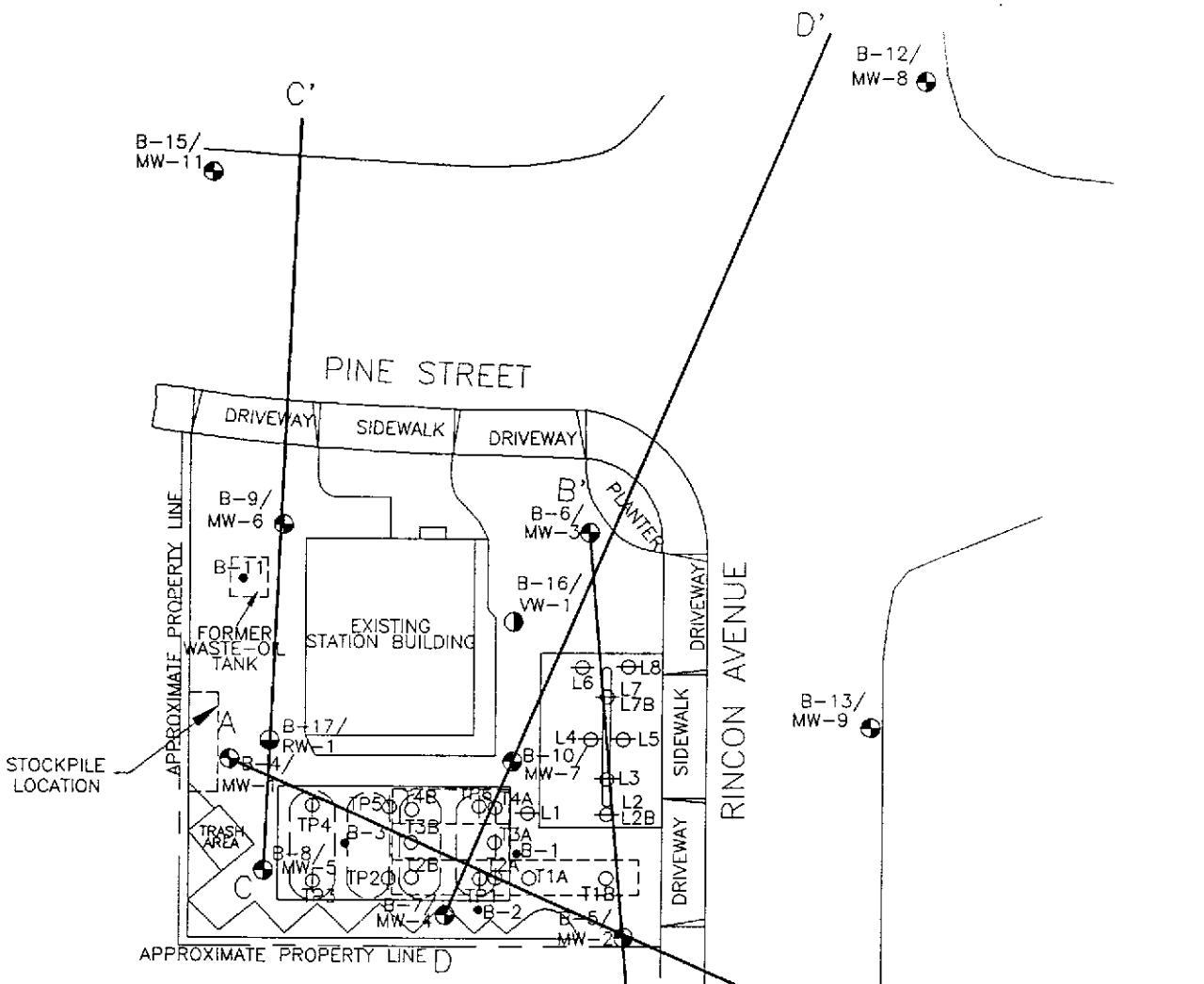
N

Approximate Scale

2000 1000 0 2000 4000

feet

RESNA **PROJECT** 60000.09	**SITE VICINITY MAP** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **1**



EXPLANATION

- T4B ○ = Former tank pit soil sample (Roux, 12/30/91)
- TP6 ϕ = New tank pit excavation soil sample (Roux, 1/21/92)
- L8 ⊖ = Product line trench soil sample (Roux, 2/7/92 and 2/18/92)
- D–D' = Geologic cross section
- B-11 ● = Soil boring (RESNA, February 1990 and July 1991)
- B-15/ MW-15 ◓ = Monitoring well (RESNA, 1991, 1992 and 1993)
- B-17/ RW-1 ◒ = Recovery well (RESNA, April 1992)
- B-16/ VW-1 ◑ = Vapor extraction well (RESNA, April 1992)
- = Former underground gasoline-storage tank
- = Existing underground gasoline-storage tank

Source: Surveyed by John Koch, Licensed Land Surveyor.

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GENERALIZED SITE PLAN
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 2

PROJECT 60000.09

DRAWN: DVW 2/11

CAD FILE: 60000901

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.				
	SAND AND SANDY SOILS	SW	Well-graded Sand or Gravelly Sands, little or no fines.		SILTS AND CLAYS LL>50	MH	Inorganic Silts, micaceous or diatomaceous fine Sandy or Silty Soils, Elastic Silts.
		SP	Poorly-graded Sands or Gravelly Sands, little or no fines.			CH	Inorganic Clays of high plasticity, fat Clays.
		SM	Silty Sands, Sand-Silt mixtures.			OH	Organic Clays of medium to high plasticity, organic Silts.
		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

PROJECT 60000.09

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 3

Depth of boring: 45 1/2 feet Diameter of boring: 8 inches Date drilled: 01/15/93

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

Screen interval: 27 1/2 to 42 1/2 feet Slot size: 0.020-inch

Drilling Company: Exploration GeoServices Driller: John and Mike

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

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
				GP	Sandy gravel, gray, damp, dense; baserock.	
2				GW	Sandy gravel, brown, damp, very dense; fine- to coarse-grained sand.	
4	S-4.5	26 38 50/6"	0			
6						
8						
	S-9	50/5"	0			
10						
12						
14	S-14.5	27 50/6"	0		Becoming very moist.	
16				GC	Clayey gravel with sand, brown, damp, very dense	
	S-17	50/6"	0			
18						
	S-19.5	48 39 37	0		Becoming moist	
20						

(Section continues downward)

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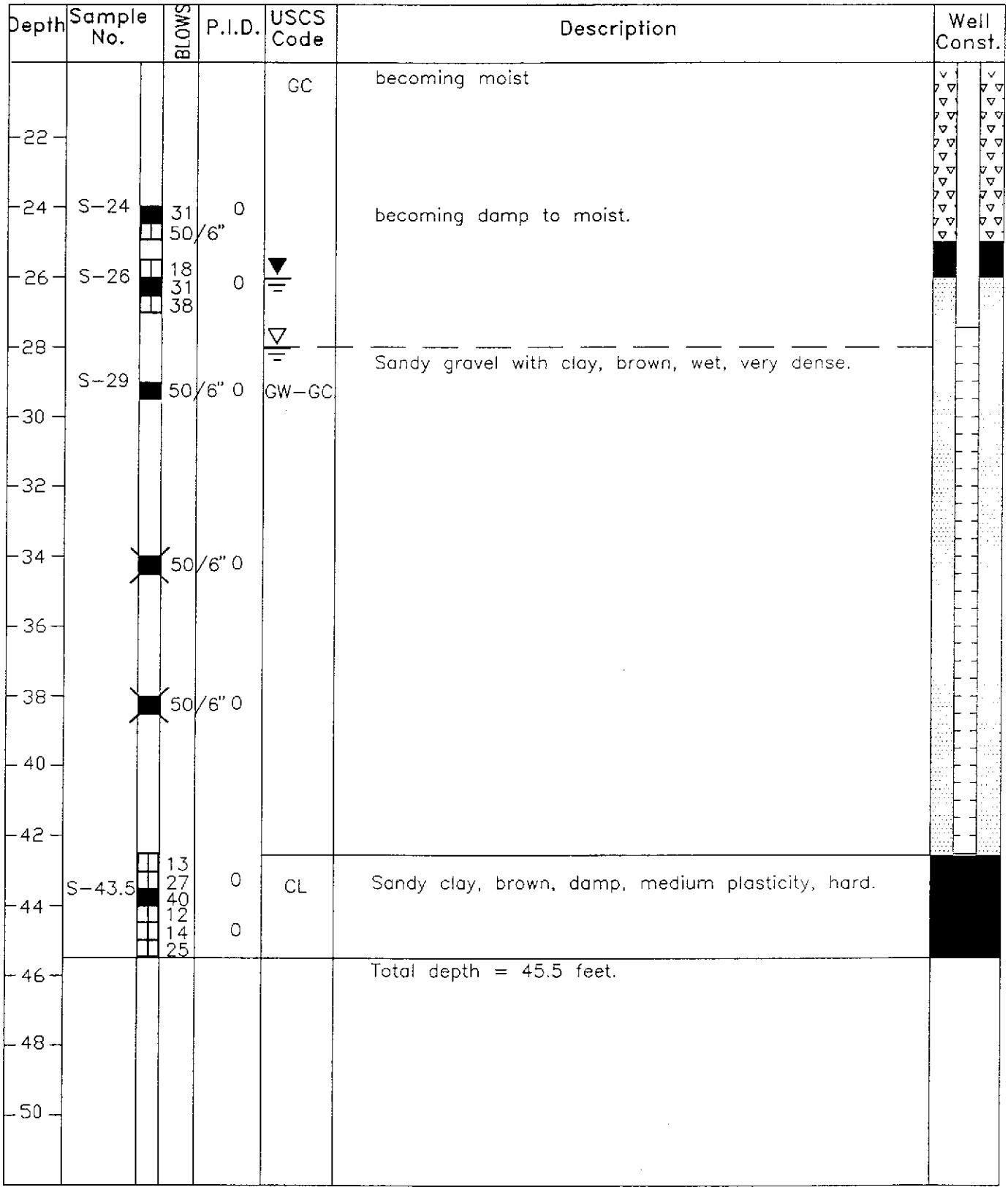
PROJECT: 60000.09

LOG OF BORING B-12/MW-8

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 4



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PROJECT 60000.09

LOG OF BORING B-12/MW-8
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
5

Depth of boring: 42 feet Diameter of boring: 8 inches Date drilled: 01/14/93

Well depth: 39 1/2 feet Material type: Sch 40 PVC Casing diameter: 2 inches

Screen interval: 29 1/2 to 39 1/2 feet Slot size: 0.020-inch

Drilling Company: Exploration GeoServices Driller: John and Mike

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

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
				GP	Sandy gravel, gray, damp, dense; baserock.	
2				GW	Sandy gravel, brown, moist, dense; fine- to coarse-grained sand.	
4	S-4.5	10 13 34	0			
6						
8						
10	S-9.5	34 50/3"	0		Very dense, gravel up to 3" diameter with cobbles	
12						
14	S-14.5	35 50/5"	0		with clay becoming very moist.	
16						
18					Trace water at 18.5'	
20	S-19	50/6"	0			
				GC	Clayey gravel with sand, brown, moist to wet, very dense.	

(Section continues downward)

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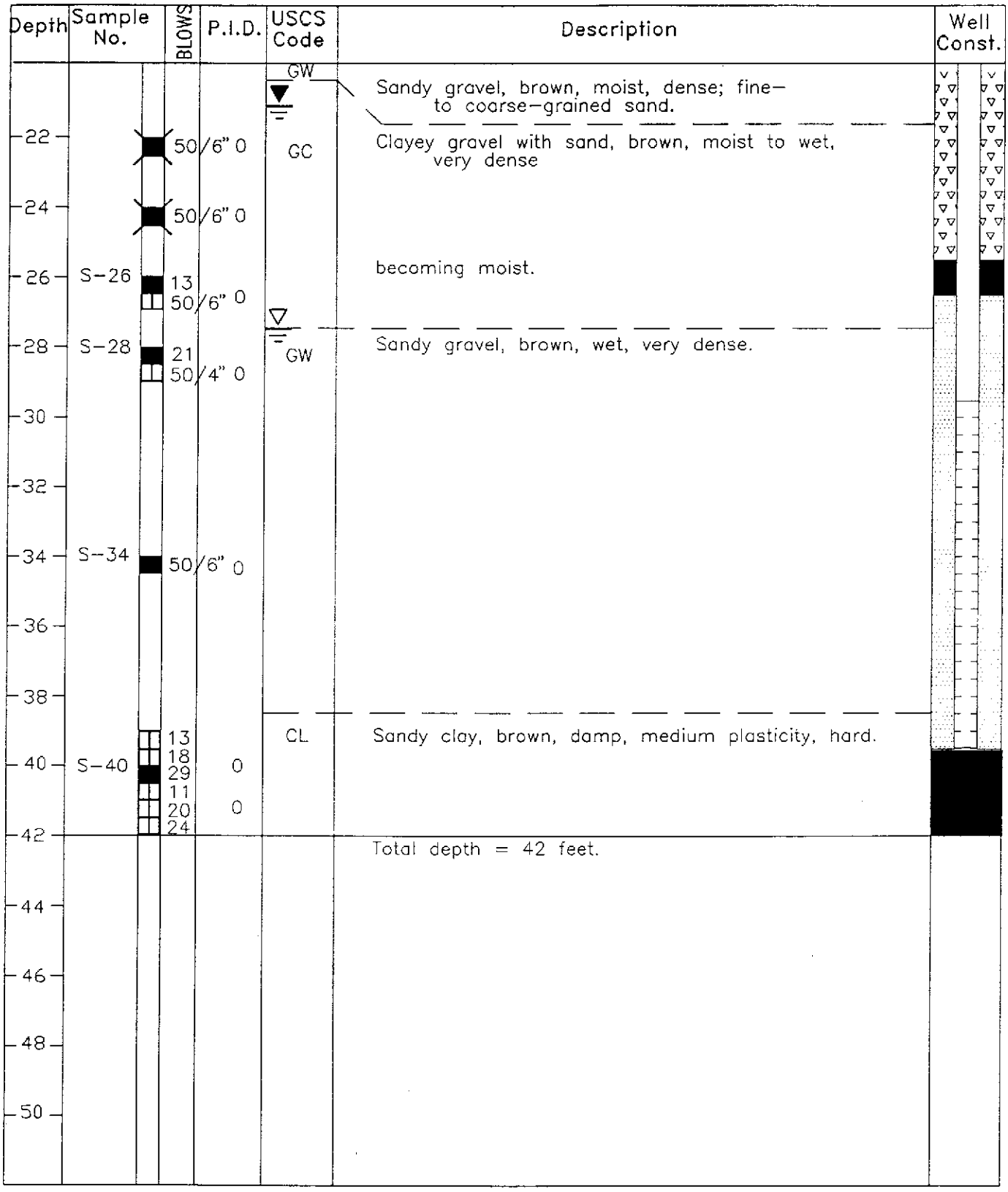
PROJECT: 60000.09

LOG OF BORING B-13/MW-9
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
6



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LOG OF BORING B-13/MW-9

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 7

Depth of boring: 40 feet Diameter of boring: 8 inches Date drilled: 01/14/93

Well depth: 37 feet Material type: Sch 40 PVC Casing diameter: 2 inches

Screen interval: 29 to 37 feet Slot size: 0.020-inch

Drilling Company: Exploration GeoServices Driller: John and Mike

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

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
				GP	Sandy gravel, gray, damp, dense; baserock.	
2				GW	Sandy gravel, brown, damp, very dense; fine- to coarse-grained sand; gravel up to 3" diameter; roots.	
4	S-4.5	26 28 50/5"	0			
6						
8						
10	S-9.5	28 50/2"	0			
12						
14	S-14.5	27 50/5"	0		With clay, becoming moist.	
16						
	S-17	50/5"	0			
18					Trace water at 17.5'	
				GC	Clayey gravel with sand, brown, moist to wet, very dense.	
	S-19	50/5"	0			
20						

(Section continues downward)

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PROJECT: 60000.09

LOG OF BORING B-14/MW-10

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 8

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				GC	Clayey gravel with sand, brown, moist to wet, very dense.	
24		50/5"				
26		15 20 36		CL	Sandy clay with fine gravel, brown, damp, medium plasticity, hard.	
28	S-27.5	20 32 50/3	0			
30	S-29.5	20 30 35	0	SC	Clayey sand, fine- to medium- grained, brown, wet, dense.	
32				GW-GC	Sandy gravel with clay, brown, wet, very dense.	
34		50/5"				
36						
38	S-38	15 16 26 13 18 27	0 0	CL	Sandy clay, brown, damp, medium plasticity, hard.	
40					Total depth = 40 feet.	
42						
44						
46						
48						
50						

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LOG OF BORING B-14/MW-10
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
9

Depth of boring: 43 feet Diameter of boring: 8 inches Date drilled: 04/09/92

Well depth: 39 feet Material type: Sch 40 PVC Casing diameter: 2 inches

Screen interval: 29 to 39 feet Slot size: 0.020-inch

Drilling Company: HEW Drilling Driller: Phil and Perfecto

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

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt-covered surface.	
					Asphalt (4 inches).	
				GW	Sandy gravel, dark brown, damp, medium dense: fill.	
2				GW-GC	Sandy gravel with clay, brown, damp, dense; gravel up to 3" diameter.	
4						
6	S-5.5	17 17 39	0			
8						
10	S-10.5	24 34 50	0		Becoming moist, very dense.	
12						
14						
	S-15	50/6"	0		Increasing clay.	
16						
18						
20	S-20.5	30 38 40	0			

(Section continues downward)

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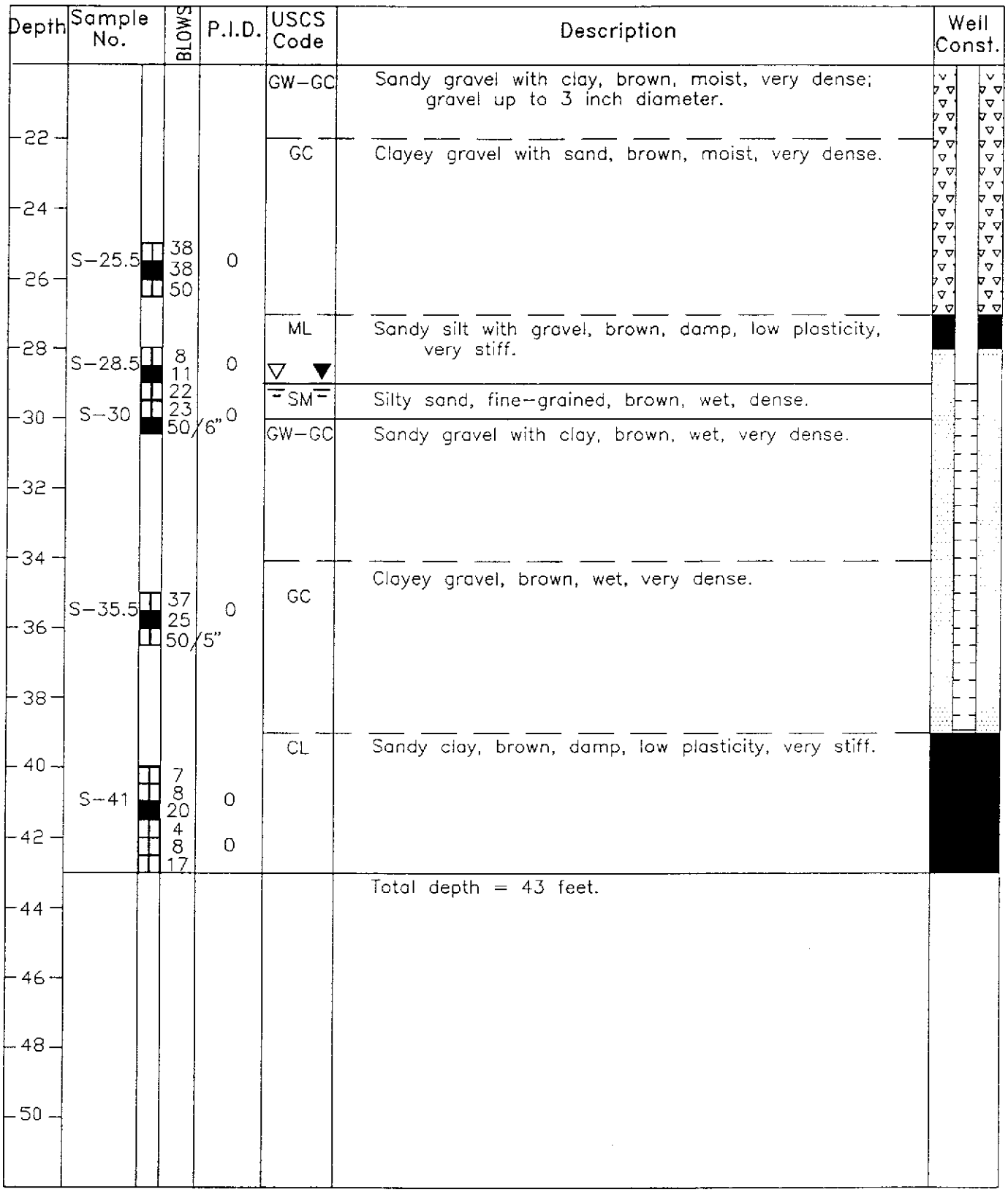
PROJECT: 60000.09

LOG OF BORING B-15/MW-11
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
10



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LOG OF BORING B-15/MW-11

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 11

Depth of boring: 33-1/2 feet Diameter of boring: 12 inches Date drilled: 04/08/92

Well depth: 28-1/2 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 18-1/2 to 28-1/2 feet Slot size: 0.100-inch

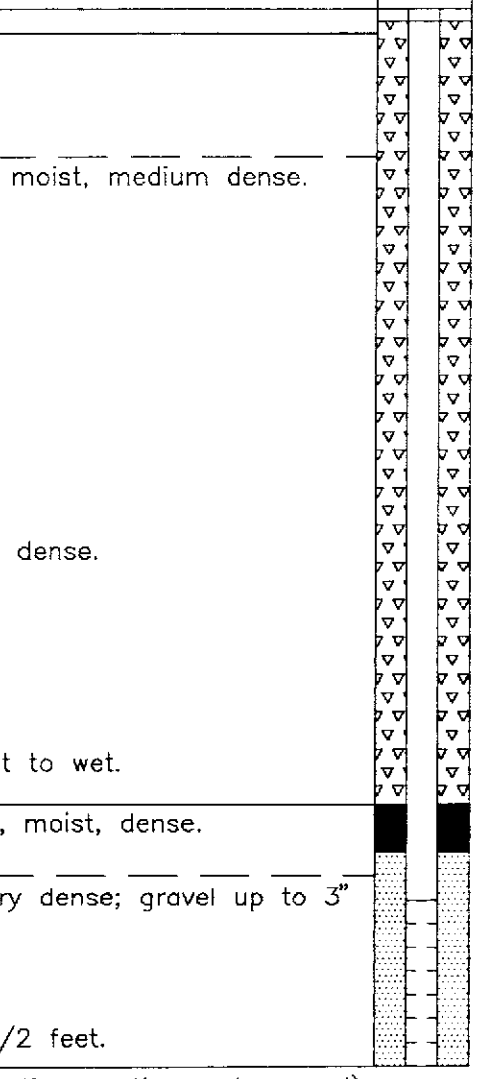
Drilling Company: HEW Drilling Driller: Phil and Perfecto

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

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
					Asphalt-covered surface.	
0					Asphalt (4 inches).	
					Sump.	
2						
				GW-GC	Sandy gravel with clay, brown, moist, medium dense.	
4						
6	S-6	9 10 17	0			
8						
10						
	S-11	24 30 26	0		Becoming damp to moist, very dense.	
12						
14						
16	S-16	12 10 21	0		Increasing clay, becoming moist to wet.	
				GC	Clayey gravel with sand, brown, moist, dense.	
18				GW	Sandy gravel, brown, moist, very dense; gravel up to 3" diameter.	
20						
	S-21	13 30 28	120		Product odor at 21 feet. Color change to gray at 21-1/2 feet.	



(Section continues downward)

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LOG OF BORING B-16/VW-1

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, gray, moist, very dense; gravel up to 3" diameter. Product odor at 21 feet.	
24				GC	Clayey gravel with sand, brown, moist, very dense.	
26	S-26	11 25 27	320		Product odor at 26 feet.	
28				ML	Sandy silt with fine gravel, brown, damp, low plasticity, very stiff.	
30	S-29.5	7 11 16	58		Product odor at 30 feet.	
	S-31	11 13 15	33		Increasing sand, becoming moist.	
32	S-32.5	14 30 30	34▽	GW-GC	Sandy gravel with clay, brown, wet, very dense.	
34					Total depth = 33-1/2 feet.	
36						
38						
40						
42						
44						
46						
48						
50						

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LOG OF BORING B-16/VW-1
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
13

Depth of boring: 45 feet Diameter of boring: 12 inches Date drilled: 04/08/92

Well depth: 40 1/2 feet Material type: Sch 80 PVC/Steel Casing diameter: 6 inches

Screen interval: 25 1/2 to 40 1/2 feet Slot size: 0.020-inch

Drilling Company: HEW Drilling Driller: Phil and Perfecto

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

Signature of Registered Professional:

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
					Asphalt-covered surface.	
0					Asphalt (4 inches).	
				SP	Gravelly sand, gray, damp, medium dense; fill.	
2				GC	Clayey gravel with sand, dark brown, damp, medium dense.	
4						
6	S-6	6 8 8	0			
8				GW-GC	Sandy gravel with clay, brown, damp, medium dense; gravel up to 3" diameter.	
10						
12	S-11	11 16 17	0		Becoming dense, damp to moist, with increasing clay.	
14						
16		50/6"			Large cobble	
18						
20						
	S-21	38 31 30	105		Color change to gray, moist; product odor at 21 feet.	

(Section continues downward)

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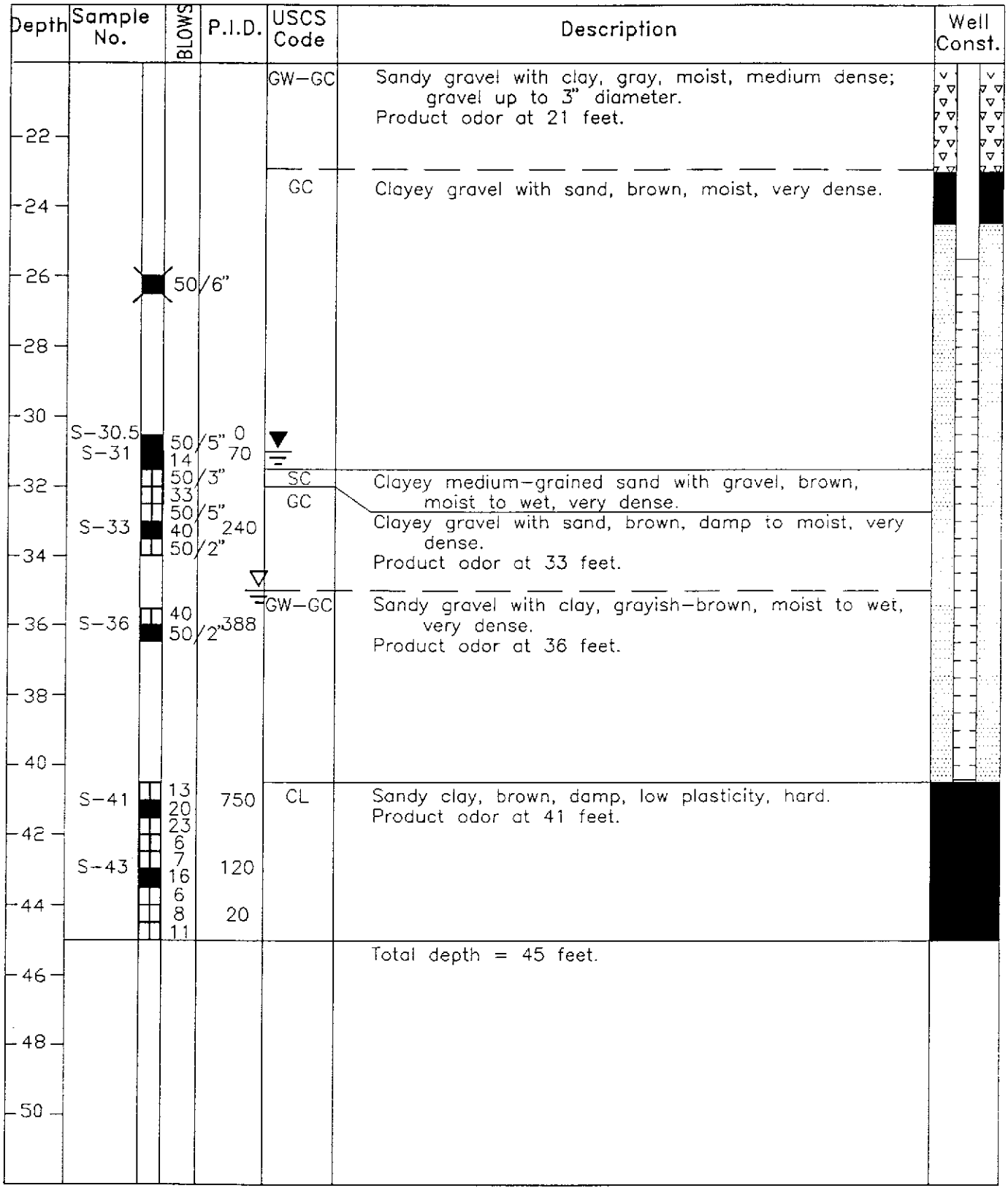
PROJECT: 60000.09

LOG OF BORING B-17/RW-1

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 14



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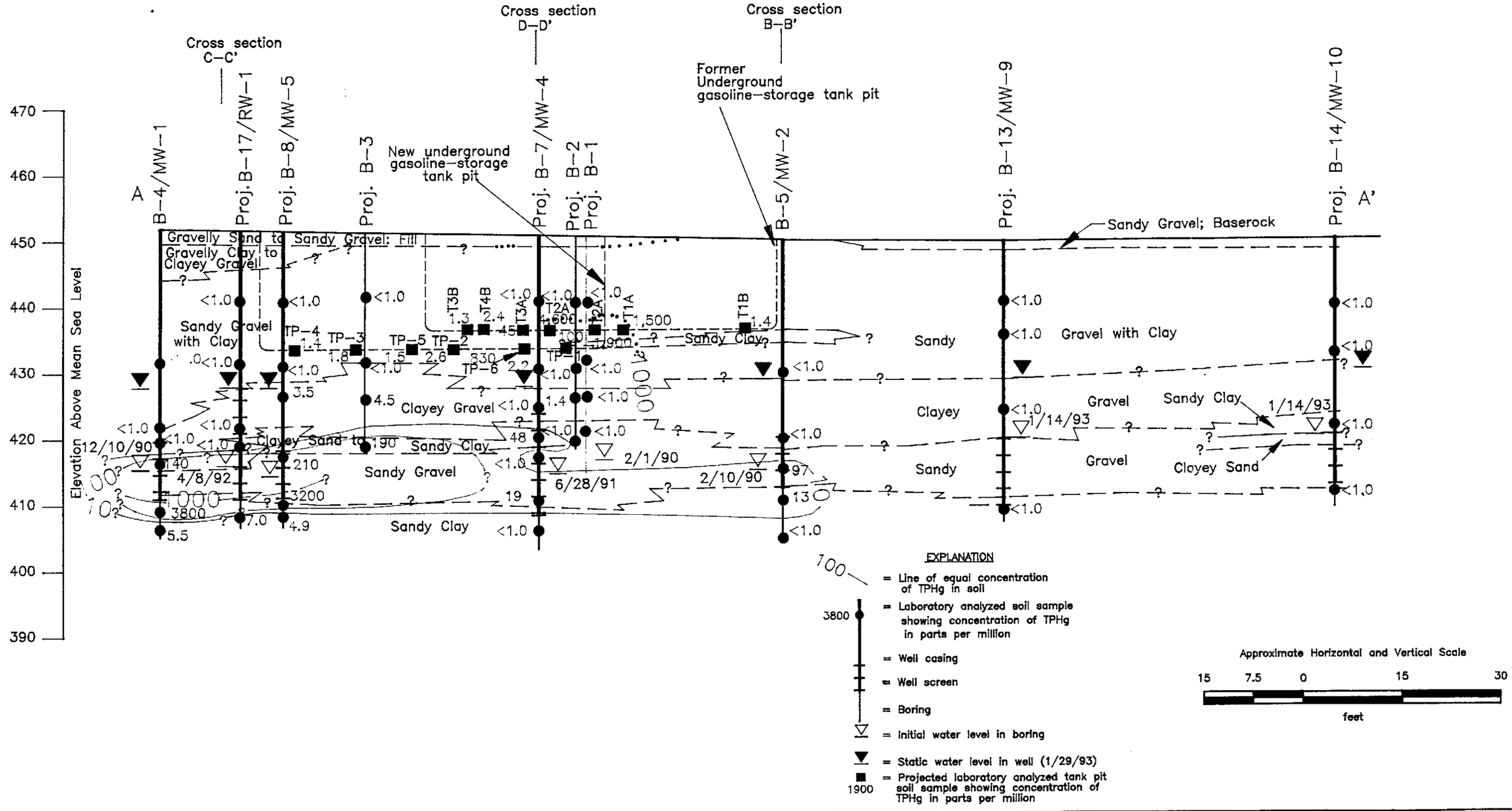
PROJECT 60000.09

LOG OF BORING B-17/RW-1

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
15



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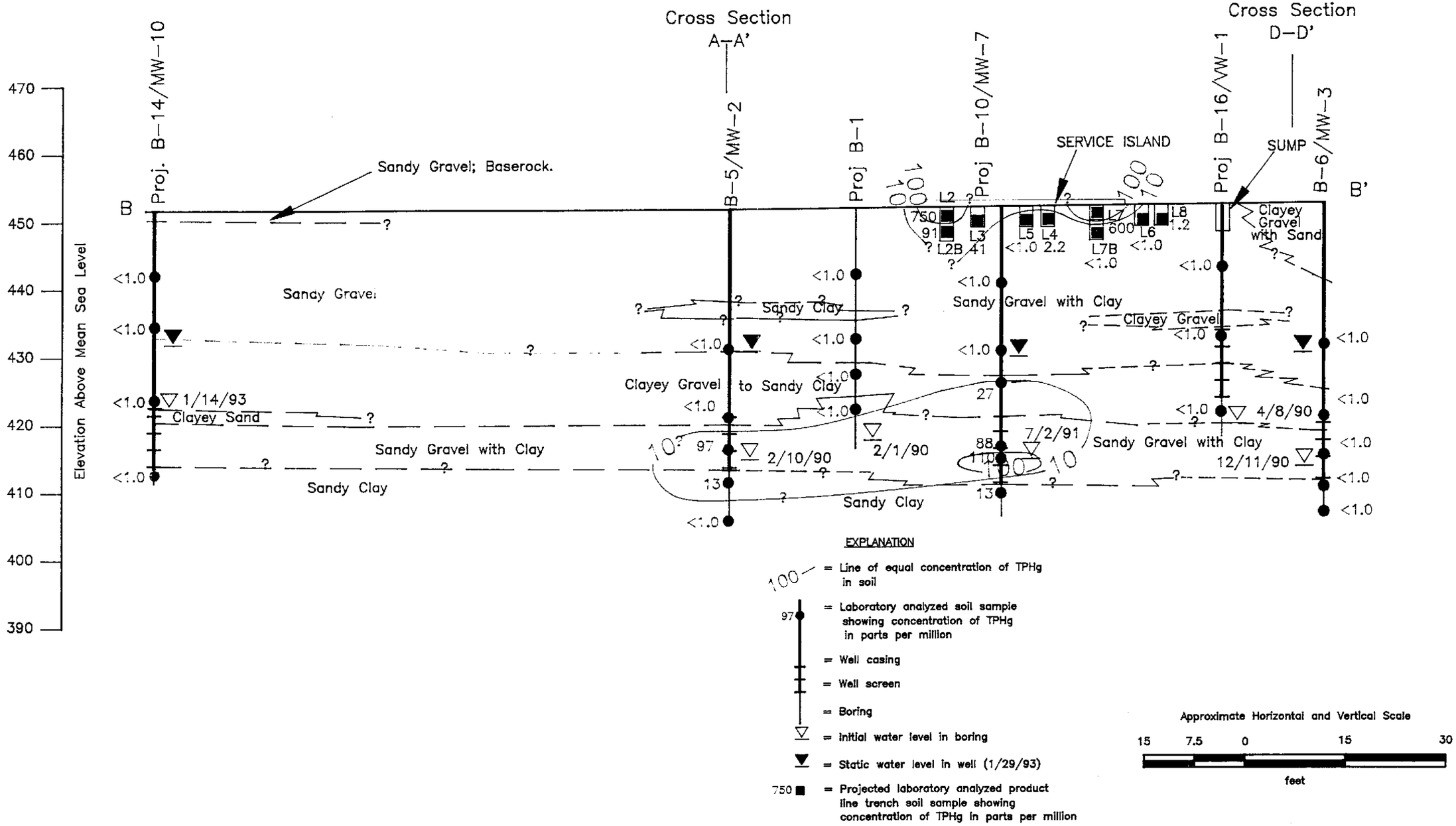
PROJECT 60000.09 DRAWN: DVW 2/12

GEOLOGIC CROSS SECTION A - A'
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 16

CAD FILE: 600009A



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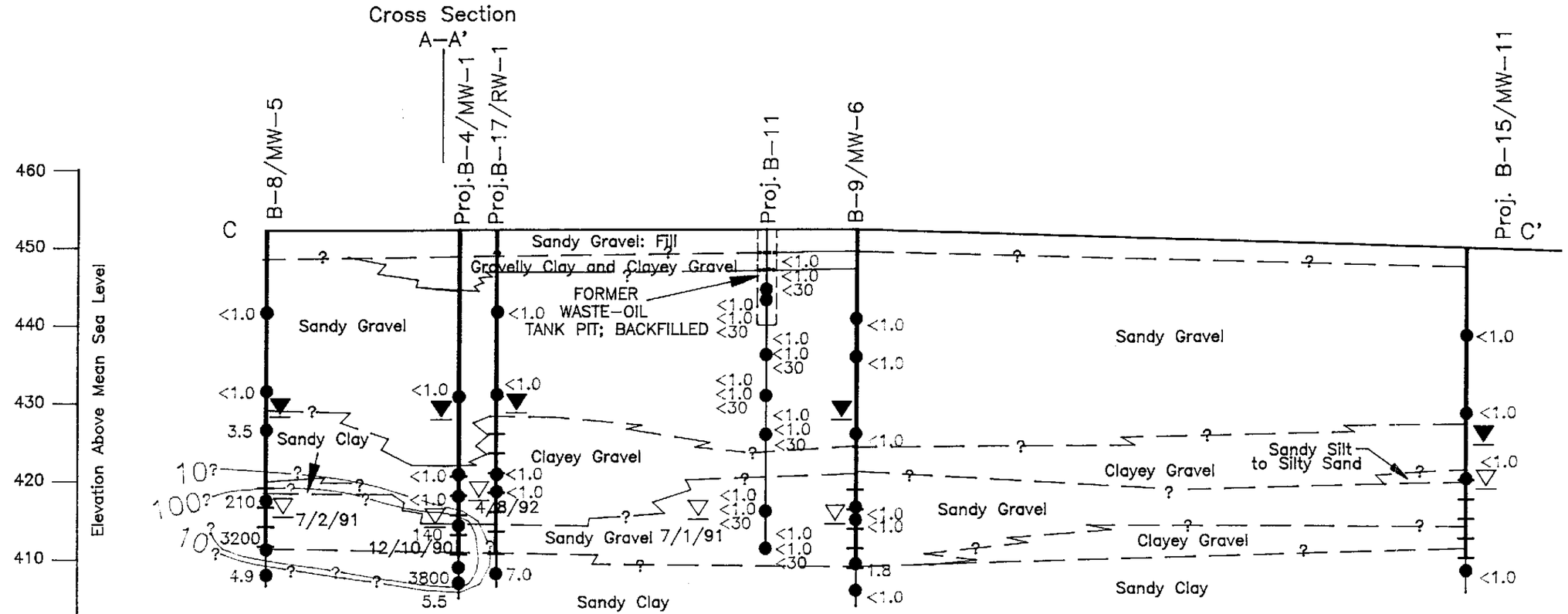
PROJECT 60000.09

GEOLOGIC CROSS SECTION B - B'
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
17

Cross Section
A–A'



EXPLANATION

100 = 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 (1/29/93)

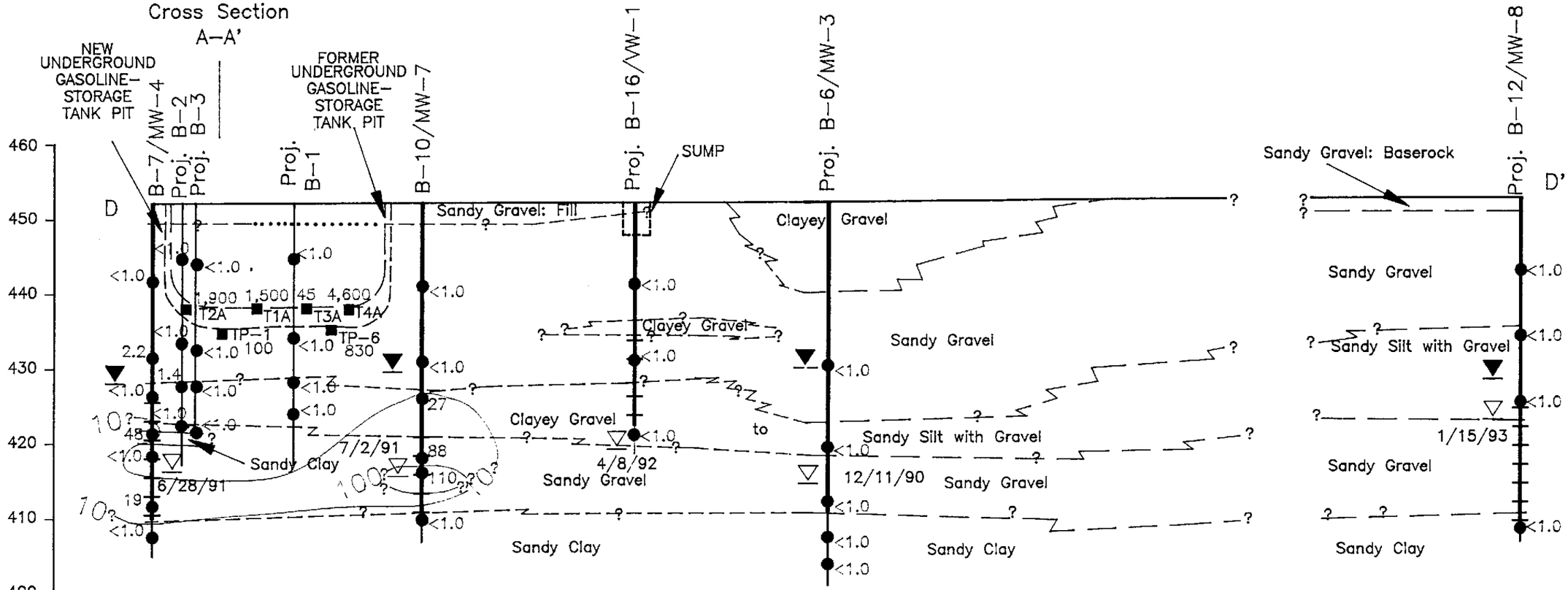
Approximate Horizontal and Vertical Scale

15 7.5 0 15 30

feet

RESNA Working to Restore Nature PROJECT 600006.09 DRAWN: DVW 2/12	**GEOLOGIC CROSS SECTION C - C'** **ARCO Station 771** **899 Rincon Avenue** **Livermore, California**	**PLATE** **18** CAD FILE: 600009C

Cross Section
A–A'



EXPLANATION

- 100 = Line of equal concentration of TPHg in soil
- 110 = 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 (1/29/93)
- 4,600 = Projected laboratory analyzed tank pit soil sample showing concentration of TPHg in parts per million

Approximate Horizontal and Vertical Scale

15 7.5 0 15 30

feet

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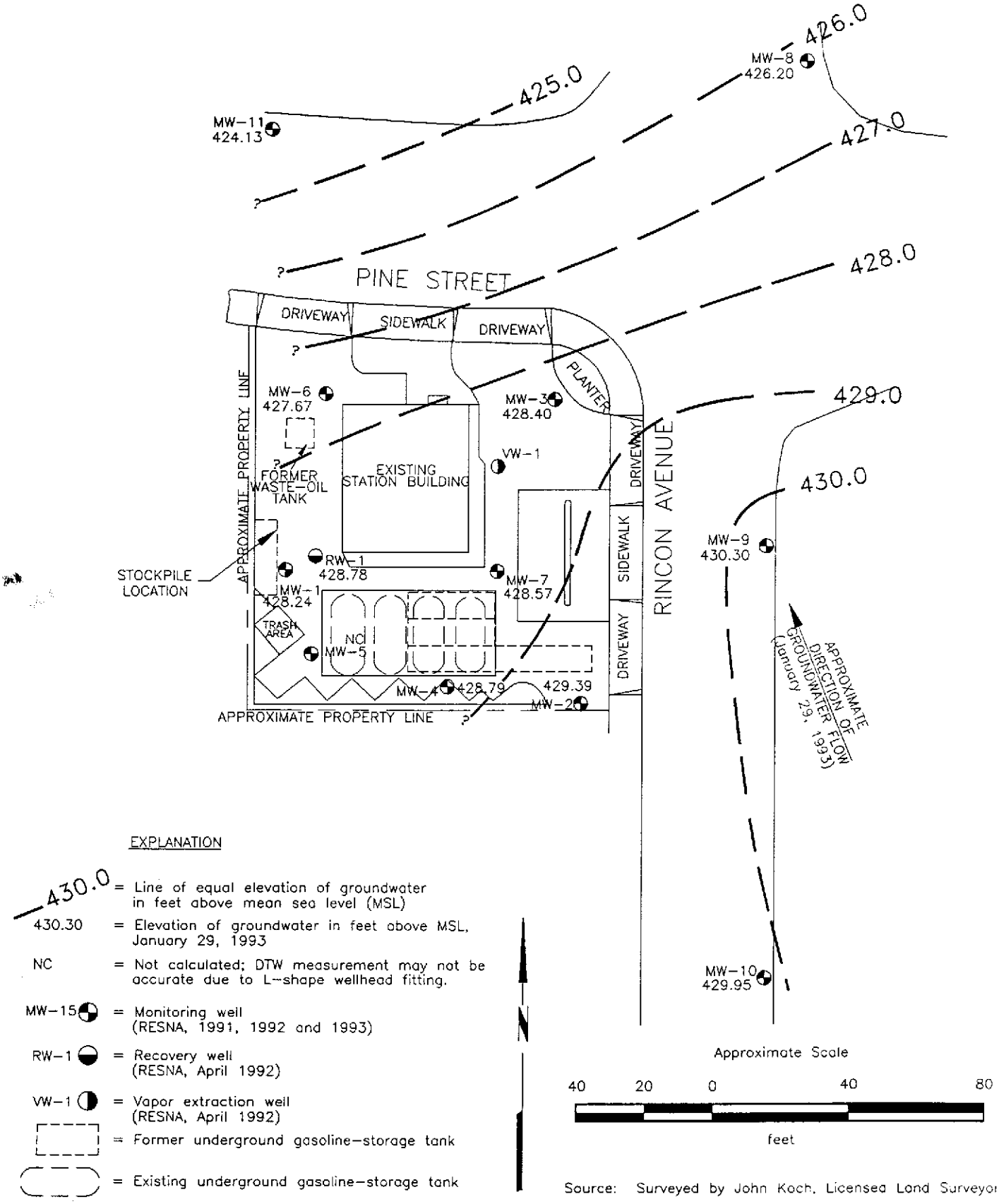
Working to Restore Nature

PROJECT 60000.09 DRAWN: DVW–2/11

GEOLOGIC CROSS SECTION D - D'
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
19
CAD FILE: 600009D



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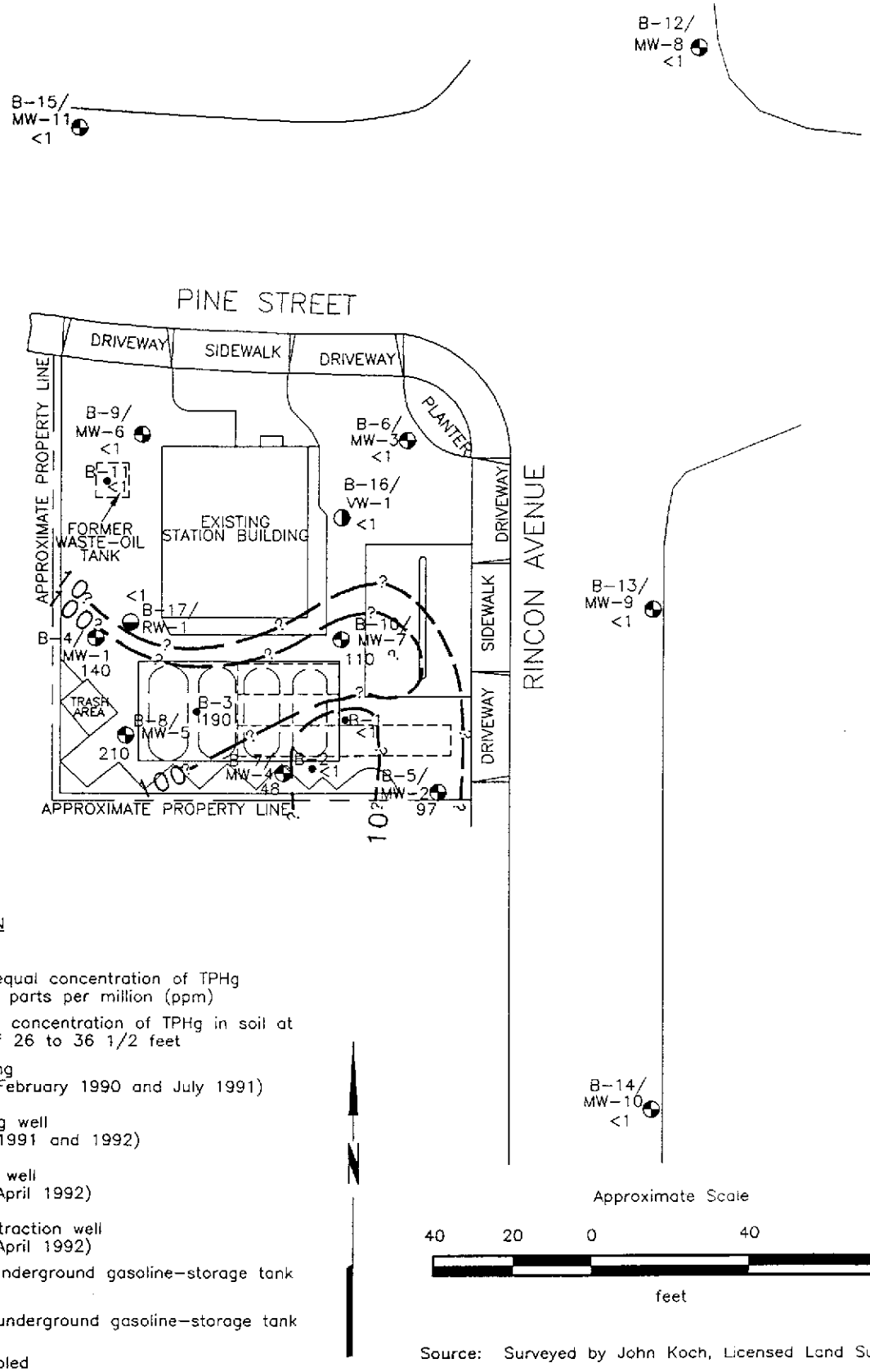
PROJECT 60000.09 DRAWN: DVW 2/11

GROUNDWATER GRADIENT MAP
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 20

CAD FILE: 60000901



Source: Surveyed by John Koch, Licensed Land Surveyor.

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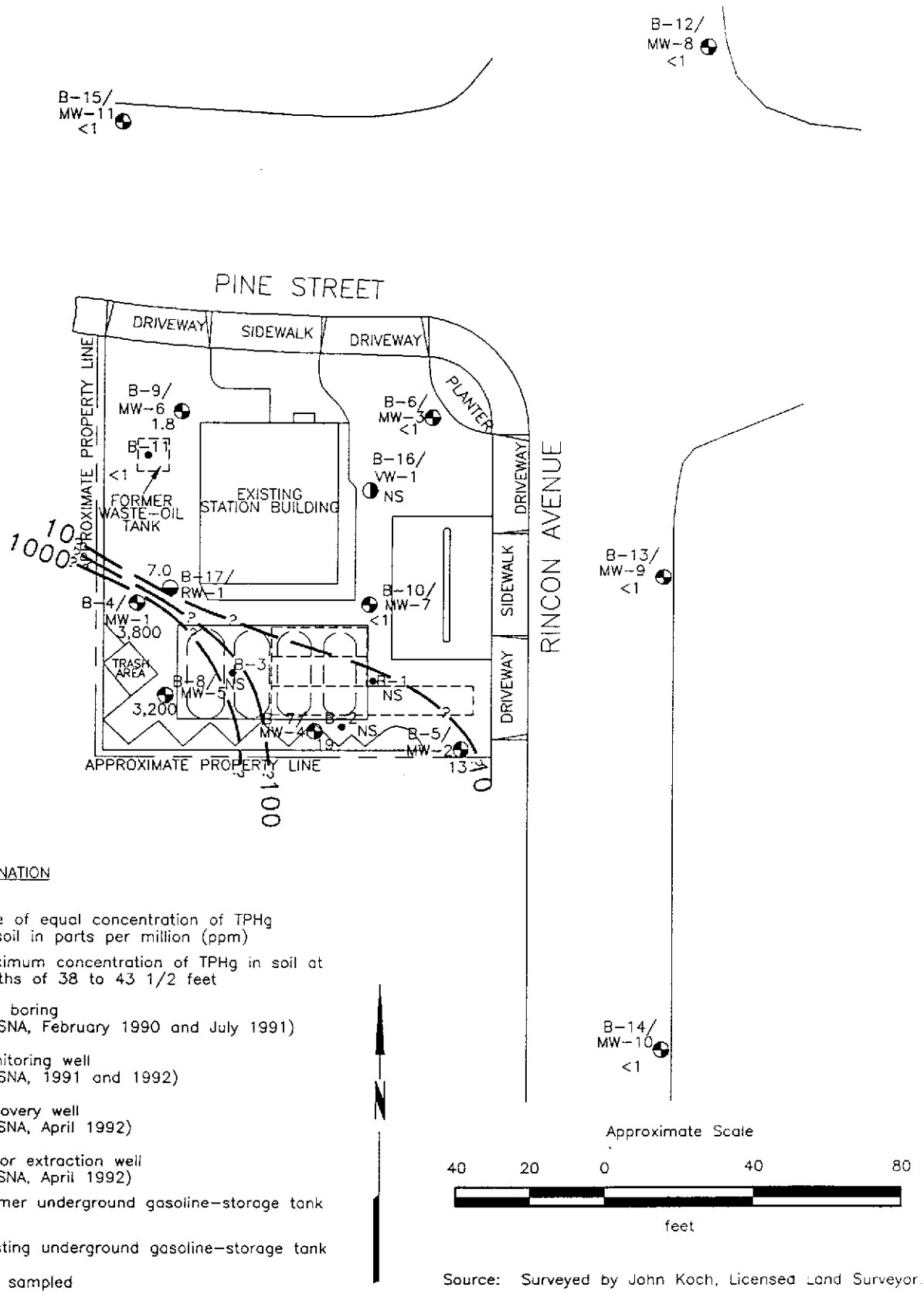
PROJECT 60000.09 DRAWN: DVW 2/11

TPHg CONCENTRATIONS IN SOIL AT DEPTHS OF 26 TO 36 1/2 FEET
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 21

CAD FILE: 600009TG



Source: Surveyed by John Koch, Licensed Land Surveyor.

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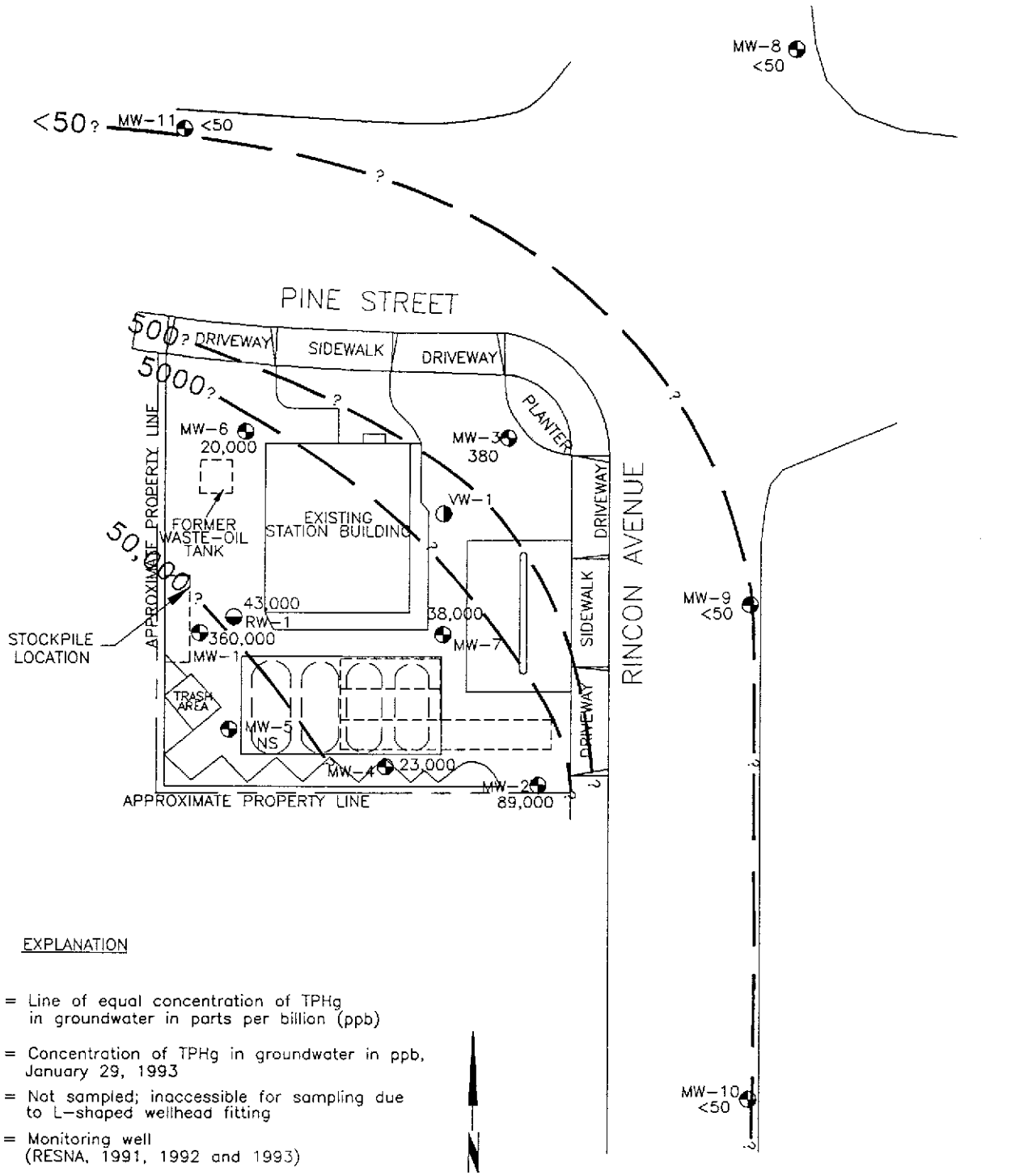
TPHg CONCENTRATIONS IN SOIL AT DEPTHS OF 38 TO 43 1/2 FEET
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 22

PROJECT 60000.09 DRAWN: DVW 2/11

CAD FILE: 600009TG



EXPLANATION

—50,000 = Line of equal concentration of TPHg in groundwater in parts per billion (ppb)

360,000 = Concentration of TPHg in groundwater in ppb, January 29, 1993

NS = Not sampled; inaccessible for sampling due to L-shaped wellhead fitting

MW-15 = Monitoring well (RESNA, 1991, 1992 and 1993)

RW-1 = Recovery well (RESNA, April 1992)

VW-1 = Vapor extraction well (RESNA, April 1992)

= Former underground gasoline-storage tank

= Existing underground gasoline-storage tank

N

Approximate Scale

40 20 0 40 80

feet

Source: Surveyed by John Koch, Licensed Land Surveyor.

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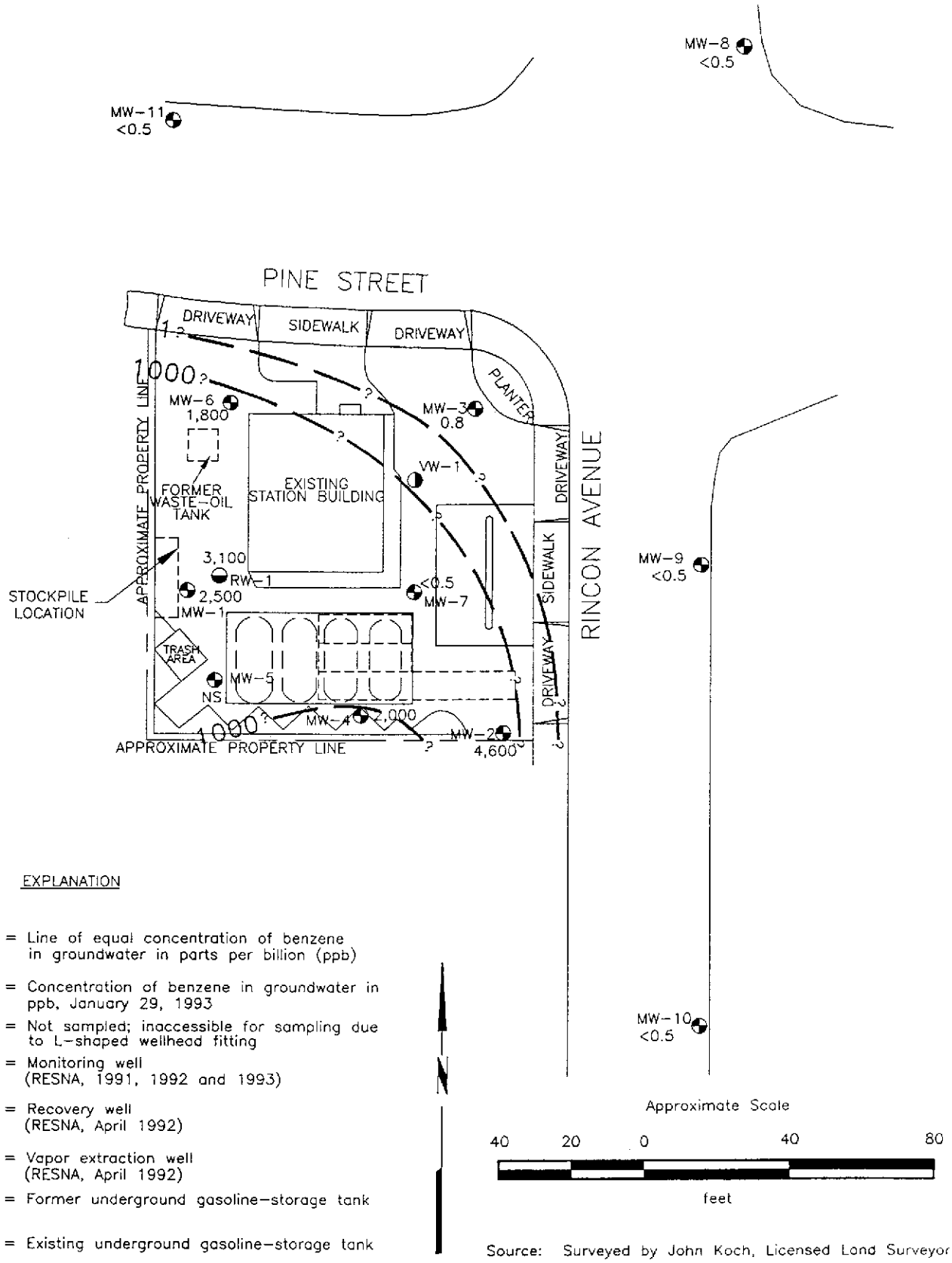
PROJECT 60000.09 DRAWN: DVW 2/11

TPHg CONCENTRATIONS IN GROUNDWATER
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 23

CAD FILE: 60000901



EXPLANATION

1000 = Line of equal concentration of benzene in groundwater in parts per billion (ppb)

4,600 = Concentration of benzene in groundwater in ppb, January 29, 1993

NS = Not sampled; inaccessible for sampling due to L-shaped wellhead fitting

MW-15 = Monitoring well (RESNA, 1991, 1992 and 1993)

RW-1 = Recovery well (RESNA, April 1992)

VW-1 = Vapor extraction well (RESNA, April 1992)

= Former underground gasoline-storage tank

= Existing underground gasoline-storage tank

N

Approximate Scale

40 20 0 40 80

feet

Source: Surveyed by John Koch, Licensed Land Surveyor.

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PROJECT 60000.09

DRAWN: DVW 2/11

BENZENE CONCENTRATIONS IN GROUNDWATER
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 24

CAD FILE: 60000901

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California
(Page 1 of 5)

Well Date	Well Elevation	Depth-to-Water	Water Elevation	Floating Product
MW-1				
01-15-91	451.80[a]	32.77	419.03	Sheen
02-27-91		32.23	419.57	None
03-20-91		27.38	424.42	Sheen
04-10-91		26.49	425.31	None
05-20-91	451.80[b]	Not measured - interface probe failure		
06-20-91		33.95	417.85	Sheen
07-25-91		36.59*	415.21*	0.10
08-13-91		37.72*	414.08*	0.20
09-12-91		39.25*	412.55*	0.23
10-30-91		39.14*	412.66*	0.20
11-13-91		Dry	Dry	None
12-26-91		39.30*	412.50	0.01
01-18-92		37.81**	NC	Skimmer
02-21-92		Well inaccessible due to construction		
03-31-92		31.90**	NC	Skimmer
04-24-92	451.42[c]	Well inaccessible due to construction		
05-20-92		33.00	418.42	Skimmer
06-12-92		33.25	418.17	0.02
07-28-92		32.31	419.11	None
08-24-92		30.87	420.55	None
09-15-92		32.24*	419.18*	0.01
10-29-92		32.29	419.13	None
11-25-92	451.73[d]	32.15	419.58	Floating product**
12-14-92		30.54	421.19	None
01-29-93		23.49	428.24	None
MW-2				
01-15-91	449.52[a]	30.89*	418.63*	0.16
02-27-91		29.11*	420.41*	0.02
03-20-91		24.57*	424.95*	0.02
04-10-91		22.85*	426.67*	0.05
05-20-91	449.51[b]	NM	NM	NM
06-20-91		31.42*	418.09*	0.15
07-25-91		33.69*	415.82*	0.49
08-13-91		34.80*	414.71*	0.47
09-12-91		36.39*	413.12*	0.45
10-30-91		Dry	Dry	None
11-13-91		Dry	Dry	None
12-26-91		36.45	413.06	Sheen
01-18-92		Well inaccessible due to construction		
02-21-92		26.27	NC	Skimmer
03-31-92		28.85	NC	Skimmer

See notes on Page 5 of 5.

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California
(Page 2 of 5)

Well Date	Well Elevation	Depth-to-Water	Water Elevation	Floating Product
MW-2 (cont')				
04-24-92	449.51[b]	30.95	418.56	Skimmer
05-20-92		30.69	418.82	Skimmer
06-12-92		31.25	418.26	None
07-28-92		30.31	419.20	None
08-24-92		29.83	419.68	None
09-15-92		30.06	419.45	Sheen
10-29-92		30.90	418.61	None
11-25-92	449.49[d]	31.13	418.36	Floating Product**
12-14-92		29.24	420.25	None
01-29-93		20.12	429.39	None
MW-3				
01-15-91	450.29[a]	32.34	417.95	None
02-27-91		31.78	418.51	None
03-20-91		27.74	422.55	None
04-10-91		25.05	425.24	None
05-20-91	450.28[b]	27.06	423.22	None
06-20-91		32.35	417.93	None
07-25-91		35.02	415.26	None
08-13-91		36.50	413.78	None
09-12-91		38.47	413.81	None
10-30-91		Dry	Dry	None
11-13-91		Dry	Dry	None
12-26-91		38.53	411.75	None
01-18-92		Well inaccessible due to construction		
02-21-92		Well inaccessible due to construction		
03-31-92		30.61	NC	None
04-24-92	450.28[c]	32.83	417.45	None
05-20-92		33.85	416.43	None
06-12-92		34.51	415.77	None
07-28-92		34.42	415.86	None
08-24-92		32.46	417.82	None
09-15-92		34.29	415.99	None
10-29-92		33.40	416.88	None
11-25-92		33.67	416.61	None
12-14-92		34.26	416.02	None
01-29-93		21.88	428.40	None
MW-4				
07-25-91	451.56[b]	36.07	415.49	None
08-13-91		37.54	414.02	None
09-12-91		38.73	412.83	None

See notes on Page 5 of 5.

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California
(Page 3 of 5)

Well Date	Well Elevation	Depth-to- Water	Water Elevation	Floating Product
MW-4 (cont')				
10-10-91	451.56[b]	39.90	411.66	None
11-13-91		40.56	411.00	None
12-26-91	450.99[e]	38.78	412.78	None
01-18-92		38.71	NC	None
02-21-92		31.91	NC	None
03-31-92		30.36	NC	None
04-24-92		32.65	418.34	None
05-20-92		32.62	418.37	None
06-12-92		32.73	418.26	None
07-28-92		31.48	419.51	None
08-24-92		32.84	418.15	None
09-15-92		31.37	419.62	None
10-29-92		32.58	418.41	None
11-25-92	451.09[d]	32.37	418.72	None
12-14-92		30.99	420.10	None
01-29-93		22.30	428.79	None
MW-5				
07-25-91	451.41[b]	36.67	414.74	Sheen
08-13-91		37.98*	413.43*	0.01
09-12-91		39.01*	412.40*	0.05
10-30-91		38.28	412.13	Sheen
11-13-91		39.24	412.17	Sheen
12-26-91		39.11	412.30	Sheen
01-18-92		38.15	NC	Skimmer
02-21-92		30.59	NC	Skimmer
03-18-92		30.84	NC	Skimmer
04-24-92	451.40[e]	33.00	418.40	Skimmer
05-20-92		32.86	418.54	Skimmer
06-12-92		33.03	418.37	None
07-28-92		31.92	419.48	None
08-24-92		32.17	419.23	None
09-15-92		31.90	419.50	None
10-29-92		32.94	418.46	None
11-25-92	Not measured - new L-shape wellhead fitting prevented sounder from going down well			
12-14-92		30.90***	NC	None
01-29-93		23.25***	NC	None
MW-6				
07-25-91	451.38[b]	37.68	413.70	None
08-13-91		39.17	412.21	None
09-12-91		41.14	410.24	None

See notes on Page 5 of 5.

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California
(Page 4 of 5)

Well Date	Well Elevation	Depth-to-Water	Water Elevation	Floating Product
MW-6(cont')				
10-30-91	451.38[b]	42.10	409.28	None
11-13-91		41.45	409.93	None
12-26-91		41.23	410.15	None
01-18-92		38.23	NC	None
02-21-92	451.37[c]	35.21	NC	None
03-31-92		32.26	NC	None
04-24-92		33.24	418.13	None
05-20-92		33.14	418.23	None
06-12-92		33.43	417.94	None
07-28-92		32.52	418.85	None
08-24-92		32.57	418.80	None
09-15-92		32.58	418.79	None
10-29-92		32.33	419.04	None
11-25-92		32.43	418.94	None
12-14-92		31.52	419.85	None
01-29-93		23.70	427.67	None
MW-7				
07-25-91	450.65[b]	34.88	415.77	Sheen
08-13-91		36.17	414.48	None
09-12-91		37.81	412.84	None
10-30-91		38.50	412.15	None
11-13-91		38.31	412.34	None
12-26-91		37.90	412.75	None
01-18-92		Well inaccessible due to construction		
02-21-92		31.50	NC	None
03-31-92		29.40	NC	None
04-24-92	450.63[c]	32.14	418.49	None
05-20-92		32.51	418.12	None
06-12-92		32.45	418.18	None
07-28-92		32.08	418.55	None
08-24-92		32.29	418.34	None
09-15-92		31.93	418.70	None
10-29-92		32.37	418.26	None
11-25-92	450.33[d]	31.80	418.53	None
12-14-92		30.44	419.89	None
01-29-93		21.76	428.57	None
MW-8				
01-29-93	449.43[d]	23.23	426.20	None

See notes on Page 5 of 5.

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 771
Livermore, California
(Page 5 of 5)

Well / Date	Well Elevation	Depth-to-Water	Water Elevation	Floating Product
MW-9				
01-29-93	449.21[d]	18.91	430.30	None
MW-10				
01-29-93	449.22[d]	19.27	429.95	None
MW-11				
04-24-92	448.02[c]	35.06	412.96	None
05-20-92		34.10	413.92	None
06-12-92		34.48	413.54	None
07-28-92		35.13	412.89	None
08-24-92		33.32	414.70	None
09-15-92		35.72	412.30	None
10-29-92		35.26	412.76	None
11-25-92		36.44	411.58	None
12-14-92		33.18	414.84	None
01-29-93		23.89	424.13	None
RW-1				
04-24-92	451.44[c]	32.85	418.59	None
05-20-92		32.60	418.84	None
06-12-92		32.72	418.72	None
07-28-92		31.94	419.50	None
08-24-92		31.73	419.71	None
09-15-92		31.94	419.50	None
10-29-92		32.15	419.29	None
11-25-92	451.67[d]	32.21	419.46	None
12-14-92		30.58	421.09	None
01-29-93		22.89	428.78	None

Measurements in feet.

* = Floating product present in well; DTW with floating product present was calculated using the following: The recorded thickness of the floating product was multiplied by 0.80 to obtain an approximate value for the displacement of water by the floating product. This approximate displacement value was then subtracted from the measured depth to water to obtain an adjusted depth to water. These adjusted groundwater depths were subtracted from wellhead elevations to calculate the differences in groundwater elevations.

** = Floating product not initially present but came into well during purging.

*** = DTW measurement may not be accurate due to L-shape wellhead fitting.

[a] = Surveyed by Ron Archer, Civil Engineer, in January 1991.

[b] = Surveyed by John Koch, Licensed Land Surveyor, in July 1991.

[c] = Surveyed by John Koch, Licensed Land Surveyor, in May 1992.

[d] = Surveyed by John Koch, Licensed Land Surveyor, in January 1993.

Wellhead elevations based on benchmark: top of pin in standard monument, west side of intersection of Rincon Avenue and Pine Street. Elevation taken as 448.741 feet. City of Livermore Datum.

NC = Not calculated; wellhead elevations may no longer be correct due to construction of remediation system.

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 771
Livermore, California
(Page 1 of 4)

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-32.5-B4	<1.0	NA	<0.005	<0.005	<0.005	<0.005	NA
S-36.5-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-45.5-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-34.5-B5	97	NA	<0.005	0.13	0.087	0.22	NA
S-39.5-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-36.5-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-44.5-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 4 of 4.

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 771
Livermore, California
(Page 2 of 4)

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
April 1992							
S-10.5-B15	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-20.5-B15	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-28.5-B15	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-41-B15	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA

See notes on page 4 of 4.

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 771
Livermore, California
(Page 3 of 4)

Sample Identification	TPHg	TPHd	B	T	E	X	TOG
April 1992 cont.							
S-11-B16	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-21-B16	<1.0	NA	0.0080	<0.0050	<0.0050	<0.0050	NA
S-31-B16	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-11-B17	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-21-B17	<1.0	NA	0.021	<0.0050	0.017	0.0080	NA
S-30.5-B17	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-33-B17	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-43-B17	7.0	NA	0.30	0.77	0.15	1.1	NA
S-0409-SP1-A-D*	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-0409-SP2-A-D*	6.4	NA	0.0070	0.015	0.020	0.12	
January 1993							
S-9-B12	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-17-B12	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-26-B12	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-43.5-B12	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-9.5-B13	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-14.5-B13	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-26-B13	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-40-B13	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-9.5-B14	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-17-B14	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-27.5-B14	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-38-B14	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA
S-0115-SP-A-D**	<1.0 [<0.050]	NA [NA]	<0.0050 [0.00050]	<0.0050 [0.00050]	<0.0050 [0.00050]	<0.0050 [0.00050]	NA [NA]

See notes on page 4 of 4.

TABLE 2
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 771
Livermore, California
(Page 4 of 4)

Sample Identification	TPHg	TPHd	B	T	E	X	TOG

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 was also analyzed for:
STLC lead by EPA Method 7421 - < 0.10 ppm;
corrosivity by EPA Method 9045 - pH = 7.1;
ignitability by EPA Method 1010 - flashpoint >100°C;
and reactivity by EPA Methods 9030, 9010 and 9045 - sulfide <10 ppm,
cyanide <0.50 ppm,reaction with water - negative.
[]: TPHg and BTEX analyzed by EPA Method 5030/8015/8020 TCLP extract of soil.

Sample Identification: S-43-B17
S = Soil sample
43 = Depth of boring in feet
B17 = Boring number

TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF GROUNDWATER SAMPLES
ARCO Station 771
Livermore, California
(Page 1 of 3)

Sample	TPHg	B	T	E	X	TPHd	TOG
MW-1							
01-15-91	Not sampled--sheen						
04-10-91	98,000	11,000	18,000	2,800	20,000	NA	NA
07-25-91	Not sampled--floating product						
10-30-91	Not sampled--floating product						
03-31-92	Not sampled--floating product						
06-12-92	Not sampled--floating product						
09-16-92	Not sampled--floating product						
11-25-92	Not sampled--floating product						
01-29-93	360,000	2,500	9,300	5,100	41,000	NA	NA
MW-2							
01-15-91	Not sampled--floating product						
04-10-91	Not sampled--floating product						
07-25-91	Not sampled--floating product						
10-30-91	Not sampled--sheen						
03-31-92	270,000	7,000	12,000	4,400	40,000	NA	NA
06-12-92	110,000	8,900	13,000	2,800	16,000	NA	NA
09-16-92	Not sampled--sheen						
11-25-92	Not sampled--floating product						
01-29-93	89,000	4,600	5,700	1,800	15,000	NA	NA
MW-3							
01-15-91	230	<0.5	<0.5	2.2	2.1	NA	NA
04-10-91	530	12	8.4	4.0	7.0	NA	NA
07-25-91	110	0.32	0.75	1.2	1.0	NA	NA
10-30-91	Not sampled--dry						
03-31-92	670	12	1.1	7.4	27	NA	NA
06-12-92	280	<0.5	<0.5	2.1	2.0	NA	NA
09-15-92	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
11-25-92	220	1.0	<0.5	4.9	1.2	NA	NA
01-29-93	380***	0.8	0.6	2.1	2.0	NA	NA
MW-4							
07-25-91	23,000	590	730	360	3,500	NA	NA
10-30-91	19,000	320	340	230	180	NA	NA
03-31-92	30,000	1,300	740	770	4,800	NA	NA
06-12-92	28,000	990	440	550	3,200	NA	NA
09-16-92	21,000	740	240	350	1,300	NA	NA
11-25-92	26,000	1,200	300	350	730	NA	NA
01-29-93	23,000	2,000	580	770	2,500	NA	NA

See notes on Page 3 of 3.

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

Sample	TPHg	B	T	E	X	TPHd	TOG
MW-5							
07-25-91	57,000	2,300	4,200	77	14,000	NA	NA
10-30-91		Not sampled–sheen					
03-31-92	80,000	7,100	9,100	2,000	16,000	NA	NA
06-12-92	69,000	4,000	5,300	2,200	12,000	NA	NA
09-16-92	65,000	2,300	2,600	1,700	9,900	NA	NA
11-25-92	Inaccessible for sampling, L-shape fitting installed at wellhead for use in interim remediation system						
01-29-93	Inaccessible for sampling, L-shape fitting installed at wellhead for use in interim remediation system						
MW-6							
07-25-91	10,000	3,000	200	340	1,000	NA	NA
10-30-91	970	150	4.4	4.9	6.6	NA	NA
03-31-92	16,000	3,600	1,500	660	1,700	2,400*	2.5[a], 4.0[b]
06-12-92	2,900	480	17	190	170	1,100*	1.2[c]
09-16-92	2,300	220	<5**	92	43	810*	1.5[d]
11-25-92	2,700	240	11	103	32	720*	1.6[a], 1.8[b]
01-29-93	20,000	1,800	1,700	490	2,600	2,300*	3.6[a], 4.0[b]
MW-7							
07-25-91	45,000	1,500	2,700	1,200	9,200	NA	NA
10-30-91	93,000	1,800	770	780	6,700	NA	NA
03-31-92	35,000	960	350	300	5,900	NA	NA
06-12-92	27,000	900	270	340	4,800	NA	NA
09-16-92	39,000	1,900	410	470	5,000	NA	NA
11-25-92	49,000	2,900	810	750	5,300	NA	NA
01-29-93	38,000	3,200	1,100	740	4,300	NA	NA
MW-8							
01-29-93	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
MW-9							
01-29-93	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
MW-10							
01-29-93	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
MW-11							
06-12-92	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
09-15-92	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
11-25-92	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
01-29-93	<50	<0.5	<0.5	<0.5	<0.5	NA	NA

See notes on Page 3 of 3.

TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF GROUNDWATER SAMPLES
ARCO Station 771
Livermore, California
(Page 3 of 3)

Sample	TPHg	B	T	E	X	TPHd	TOG
RW-1							
06-12-92	54,000	2,300	4,400	1,200	12,000	NA	NA
09-15-92	49,000	1,500	2,200	870	6,900	NA	NA
11-25-92	32,000	1,500	2,500	1,000	5,500	NA	NA
01-29-93	43,000	3,100	2,500	990	7,400	NA	NA
MCLs	—	1	—	680	1,750		
DWAL	—	—	100	—	—		

Results in parts per billion (ppb), except TOG, which is reported in parts per million (ppm).

TPHg: Total petroleum hydrocarbons as gasoline (measured by EPA Method 5030/8015).

B: Benzene T: toluene E: ethylbenzene X: total xylene isomers

BTEX: Measured by EPA Method 5030/8020.

TPHd: Total petroleum hydrocarbons as diesel (measured by EPA Method 3510). May be weathered gasoline.

TOG: Total oil and grease: [a] by method 5520F-IR; [b] by method 5520C; [c] by method 413.2; [d] by method 418.1

NA: Not analyzed.

<: Less than the laboratory detection limit.

*: Sample contains a lower boiling point hydrocarbon mixture quantified as diesel. The chromatogram does not match the typical diesel fingerprint.

**: Method Reporting Limit raised due to high analyte concentration requiring sample dilution.

***: Sample contained components eluting in the gasoline range that were quantitated as gasoline. The chromatogram did not match the typical gasoline fingerprint.

MCL: State Maximum Contaminant Level in ppb (October 1990).

DWAL: State Recommended Drinking Water Action Level in ppb (October 1990).

APPENDIX A

PREVIOUS WORK

PREVIOUS WORK

Waste-Oil Tank Removal

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 (BTEX), 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, September 16, 1987). Table 1A summarizes the analytical results from August and September 1987.

Limited Environmental Site Assessment

AGS performed a limited environmental site assessment (AGS, June 22, 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. 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 in the main body of this report. 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.

Supplemental Subsurface Investigation

In December 1990, RESNA performed an Supplemental Subsurface Investigation (RESNA, April 12, 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. 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.

Additional Subsurface Investigation

In June and July 1991 RESNA performed an Additional Subsurface Investigation 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 (RESNA, October 17, 1991). This investigation included drilling five soil borings (B-7 through B-11); collecting and describing soil samples from the borings; installing four 4-inch diameter groundwater monitoring wells (MW-4 through MW-7) in borings B-7 through B-10, respectively; developing and sampling the monitoring wells; surveying wellhead elevations; and submitting groundwater samples for laboratory analyses. RESNA concluded that the majority of gasoline hydrocarbons at concentrations above 100 parts per million (ppm) in the soil at the site appeared 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 had 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). 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. 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 extent of gasoline hydrocarbons in groundwater at the site has not been delineated.

Vapor Extraction Test

In December 1991 RESNA performed a vapor extraction test (VET) at the site in order to evaluate the feasibility and engineering design criteria for a soil vapor extraction system (RESNA, January 13, 1992). Based on VET results RESNA concluded that vapor extraction would be a viable soil remediation alternative for the remediation of gasoline hydrocarbons from onsite soils. Air samples collected from the wells contained TPHg concentrations ranging from 8,600 to 62,000 milligrams per cubic meter (mg/m^3). Effective radius of influence was estimated to be 30 feet achieved at a vacuum of 50 inches of water column and an air flow of approximately 60 cubic feet per minute (cfm) from each well.

UST and Product Line Removal and Replacement

Four former single-wall USTs including one fiberglass 10,000-gallon UST (T1), one fiberglass 6,000-gallon UST (T2) and two steel 4,000-gallon USTs [T3 and T4] and associated product lines were excavated and removed from the site in December 1991 through March 1992 by Golden West. Roux observed removal of the USTs and product lines and collected soil samples from the tank pit and product line trenches (Roux, July 10, 1992). Four new double-wall 10,000-gallon fiberglass USTs were installed south of the station building, in an area which overlaps and extends west of the former gasoline tank pit.

Laboratory analyses of eight soil samples collected from below the removed USTs at a depth of 14 to 16 feet below the ground surface indicated TPHg concentrations ranging from nondetectable to 4,600 ppm, and BTEX concentrations ranging from nondetectable to 1,100 ppm. The highest concentrations of TPHg and BTEX were present in the soil beneath the eastern ends of T4 (4,600 ppm) and T2 (1,900 ppm), and western end of T1 (1,500 ppm).

Laboratory analyses of six soil samples collected from the base of the new UST cavity at a depth of 18 feet below the ground surface indicated TPHg concentrations ranging from 1.4 ppm to 830 ppm, and BTEX concentrations ranging from nondetectable to 47 ppm. The highest concentrations were present in the eastern portion of the tank pit, located near the fill ends of the former T2 and T4.

Concentrations of TPHg in soil samples collected from below the removed product lines at depths of 0.5 to 1.5 feet below the ground surface ranged from nondetectable to 750 ppm, and BTEX ranged from nondetectable to 200 ppm. Two areas corresponding to the highest TPHg concentrations (southern and northern ends of the service island) were overexcavated to five feet below the ground surface and resampled. The sample collected at the depth of 5 feet below the ground surface at the northern end of the service island contained nondetectable TPHg, and the sample collected at the depth of 5 feet below the ground surface at the southern end of the service island contained 91 ppm of TPHg.

Laboratory analyses results of soil samples from former and new tank pits and product line trenches are summarized in Table 2A. Sample locations are shown on Plate 2.

Conductor casings, vault boxes and PVC piping between the volt boxes were installed with the installation of the new USTs and associated piping so that the wells could be connected to remediation system in the future.

Monthly Monitoring and Quarterly Sampling

In January 1991 RESNA began monthly monitoring and quarterly sampling of the onsite wells. The presence of floating product was observed in groundwater monitoring wells MW-1 (up to 0.23 feet), MW-2 (up to 0.49 feet) and MW-5 (up to 0.05 feet). Monthly product removal by hand bailing or use of Horner EZY Skimmers (installed in January 1992) reduced the floating product to a sheen in these wells. The highest concentrations of TPHg in groundwater monitoring wells MW-3, MW-4 and MW-6 were noted in March 1992 (670 ppb, 30,000 ppb, 16,000 ppb, respectively) and in MW-7 in October 1991 (93,000 ppb). Groundwater gradient was generally less than 0.01 ft/ft and the gradient direction fluctuated from northwest in 1991 to northeast in 1992. Results of groundwater monitoring and sampling are reported in Table 1 and 2 in the main body of this report and are summarized in the reports listed in the References section.

TABLE 1A
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 2A
ANALYTICAL RESULTS OF SOIL SAMPLES
FROM FORMER AND NEW TANK PITS AND PRODUCT LINE TRENCHES
BY ROUX
ARCO Station 771
Livermore, California

Sample/Date	Sample depth (feet bgs*)	TPHg	B	T	E	X	Organic lead
Former Tank Pit							
12/30/91							
T1A	15	1,500	1.3	28	24	210	NA
T1B	15	1.4	0.019	0.015	0.0089	0.2	NA
T2A	16	1,900	1.3	9.4	8.6	94	NA
T2B	16	ND	ND	ND	ND	ND	NA
T3A	14	45	0.089	1.2	0.52	4.7	NA
T3B	14	1.3	0.0097	0.045	0.023	0.24	NA
T4A	14	4,600	28	470	170	1,100	NA
T4B	14	2.4	0.0095	0.050	0.041	0.33	NA
New Tank Pit							
1/21/92							
TP-1	18	100	ND	0.59	ND	1.4	ND
TP-2	18	2.6	0.0057	0.012	0.012	0.12	ND
TP-3	18	1.8	0.0058	0.011	0.0071	0.053	ND
TP-4	18	1.4	0.0052	0.02	0.0094	0.092	ND
TP-5	18	1.5	0.0062	0.036	0.016	0.14	ND
TP-6	18	830	ND	2.5	1.5	47	ND
Product Line Trenches							
2/7/92							
L1	1.5	ND	ND	0.035	ND	ND	ND
L2	1.5	750	0.35	30	26	200	ND
L3	0.5	41	0.091	0.28	0.1	0.93	ND
L4	1.5	2.2	0.0093	0.52	0.011	0.061	ND
L5	1.5	ND	ND	ND	ND	ND	ND
L6	1.5	ND	ND	ND	ND	ND	ND
L7	0.5	600	ND	0.21	ND	26	ND
L8	1.5	1.2	ND	0.027	ND	0.0068	ND
2/18/92							
L2B	5	91	ND	ND	ND	2.4	ND
L7B	1.5	ND	ND	ND	ND	ND	ND

Results in parts per billion (ppb).
*: Below ground surface.
TPHg: Total petroleum hydrocarbons as Low/Medium Boiling Point Hydrocarbons (USEPA Method 8015).
B: Benzene T: toluene E: ethylbenzene X: total xylene isomers
BTEX: Measured by USEPA Method 8020.
Organic Lead by method described in California LUFT Manual 12/87.
NA: Not analyzed.
ND: Not detected.

APPENDIX B

FIELD PROTOCOL

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 analyses 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.

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 analyses and/or well development data. The screened sections in groundwater monitoring wells are placed to allow monitoring during seasonal fluctuations of groundwater levels. Vapor extraction wells are constructed using the same protocol for monitoring wells, mentioned above, however the screened portions of the wells are constructed with much slotted PVC casing (0.100-inch-wide slots). This is to allow greater air-flow communication between the stratigraphic units and the well. Recovery wells are constructed using the same protocol for monitoring wells, mentioned above, however the well diameter is larger (usually 6-inch) to allow installation of pumping equipment, and stronger materials (Schedule 80 PVC blank casing and stainless steel screen) is used, so the well can withstand long term pumping.

The annular space of each well is backfilled with No. 2 by 12 sand, or similar sorted sand (groundwater monitoring and recovery wells), or pea gravel (vapor extraction wells) 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 analyses 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.

Well Development

The groundwater monitoring and recovery 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.

APPENDIX C

WELL PERMITS

ZONE 7 WATER AGENCY

5997 PARKSIDE DRIVE PLEASANTON, CALIFORNIA 94588 VOICE (510) 484-2600
FAX (510) 462-3914

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT ARCO 771
399 Rincon Ave, Livermore, CA

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

APPLICANT
Name RESNA Industries Inc for ARCO
3315 Almaden Exp. Fax (408) 264-2435
Address Suite 34 Voice (408) 264-7723
City San Jose Zip 95118

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection		General	
Water Supply		Contamination	
Monitoring	V	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. C-57 # 434288

WELL PROJECTS

Drill Hole Diameter	10	in.	Maximum		
Casing Diameter	2	in.	Depth	50	ft.
Surface Seal Depth	25	ft.	Number	3	

GEOTECHNICAL PROJECTS

Number of Borings			Maximum		
Hole Diameter		in.	Depth		ft.

ESTIMATED STARTING DATE 01/14/93
ESTIMATED COMPLETION DATE 01/15/93

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

APPLICANT'S SIGNATURE

FOR OFFICE USE

PERMIT NUMBER 93014
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 12 Jan 93
Wyman Hong

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94588 • (510) 484-2600

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT ARCO Station 771
899 Rincon Avenue
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 Industries Inc
Barbara Sieminski
Address 3315 Almaden Exp Suite 34 Phone (408) 264-
City San Jose Zip CA 95118

TYPE OF PROJECT
Well Construction
Cathodic Protection ___
Water Supply ___
Monitoring V
Geotechnical Investigation
General ___
Contamination ___
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. 484288 (C-57)

WELL PROJECTS
Drill Hole Diameter 10 in. Maximum
Casing Diameter 2 way 4 in. dual 6" Depth 45 ft.
Surface Seal Depth 30 ft. Number 3

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

ESTIMATED STARTING DATE 4/02/92
ESTIMATED COMPLETION DATE 4/03/92

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

APPLICANT'S SIGNATURE Barbara Sieminski Date 3/19/92

FOR OFFICE USE

PERMIT NUMBER 92132
LOCATION NUMBER ___

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A.) GENERAL
1. A permit application should be submitted so as t arrive at the Zone 7 office five days prior t proposed starting date.
2. Submit to Zone 7 within 60 days after completic of permitted work the original Department c Water Resources Water Well Drillers Report c equivalent for well projects, or drilling log and location sketch for geotechnical projects.
3. Permit is void if project not begun within 9 days of approval date.

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

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

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

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 20 Mar 9
Wyman Hong

51

APPENDIX D

WELLHEAD SURVEY

JOHN E. KOCH
Land Surveyor
CA State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(510) 655-9956
FAX (510) 655-9745

TRANSMITTAL LETTER

TO:Barbara Sieminski/Joel Coffman FROM:John Koch

Job No.:92035

COMPANY:RESNA / San Jose Re:RESNA Proj.#60000.09

FAX NO:(408) 264-2435

SUBJECT:Arco Station 771
899 Rincon Avenue
Livermore, CA

PER: _x_ Your request.

___ Our telephone conversation of:

___Other:

FIND ENCLOSED:

1. Report of monitor well data table.

2. Plot plan of site.

NO. OF PAGES (including transmittal):__4__

MESSAGE:

JOHN E. KOCH
Land Surveyor
CA. State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(510)655-9956
FAX(510)655-9745

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

05/13/92

Tabulation of Elevations as of
10:00 a.m. 05/08/92

Job #92035
RESNA Project 60000.09
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
	451.42	Top of PVC Casing
	452.06	Top of Box
MW-2	*449.51	Top of PVC Casing
	*450.05	Top of Box
	449.51	Top of PVC Casing
	450.04	Top of Box
MW-3	*450.28	Top of PVC Casing
	*450.56	Top of Box
	450.28	Top of PVC Casing
	450.54	Top of Box

JOHN E. KOCH, P.L.S. RESNA PROJ.#60000.09 JEK JOB #92035

Well Designation	Elevation	Description
MW-4	*451.56	Top of PVC Casing
	*451.80	Top of Box
	450.99	Top of PVC Casing
	451.95	Top of Box
MW-5	*451.41	Top of PVC Casing
	*452.10	Top of Box
	451.40	Top of PVC Casing
	452.09	Top of Box
MW-6	*451.38	Top of PVC Casing
	*451.65	Top of Box
	451.37	Top of PVC Casing
	451.65	Top of Box
MW-7	*450.65	Top of PVC Casing
	*451.34	Top of Box
	450.63	Top of PVC Casing
	451.28	Top of Box
MW-11	448.02	Top of PVC Casing
	448.64	Top of Box
VW-1	450.37	Top of PVC Casing
	451.18	Top of Box
RW-1	451.44	Top of PVC Casing
	452.05	Top of Box

* Elevations as shown on report of 07/29/91 (JEK JOB #91047).

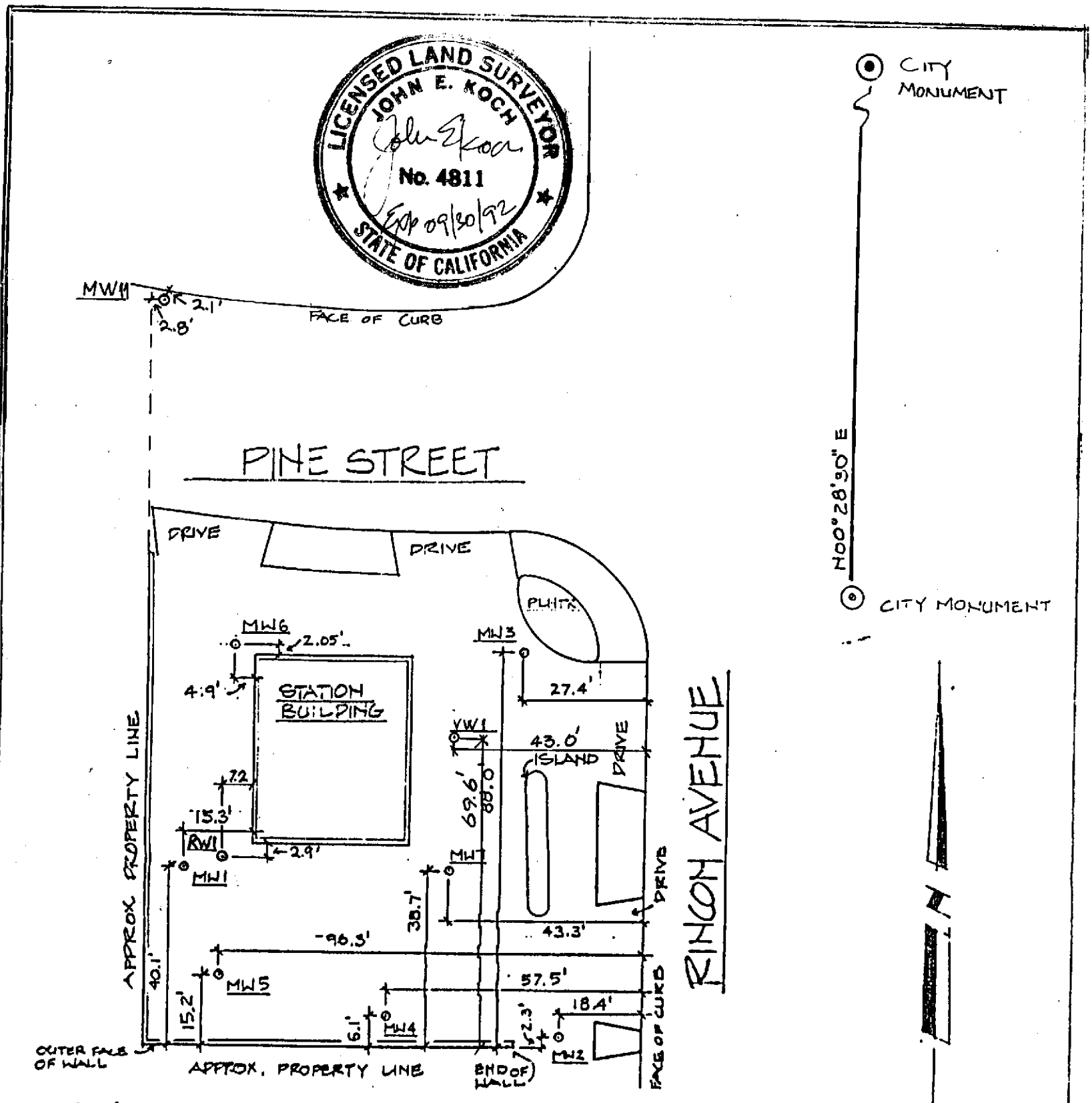
NOTES:

1. Datum is City of Livermore= USGS

2. Top of PVC Casing elevation taken at mark at top of PVC for all wells. Diameter of MW-11 is 2", RW-1 is 6", all others are 4".

LICENSED LAND SURVEYOR JOHN E. KOCH No. 4811 EXP 9/30/92

LICENSED LAND SURVEYOR
JOHN E. KOCH
No. 4811
Exp 09/30/92
STATE OF CALIFORNIA



30 16 0 30 60
SCALE 1" = 30.0'

07/29/91
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'

05/08/92
ELEVATIONS

WELL NUMBER	TOP OF CASING	TOP OF BOX
MW1	452.06	451.42
MW2	449.51	450.04
MW3	450.28	450.54
MW4	450.99	451.95
MW5	451.40	452.09
MW6	451.37	451.65
MW7	450.63	451.28
MW11	448.02	448.64
VW1	450.37	451.18
RW1	451.44	452.05

REVISED 05/12/92 TO SHOW CURRENT ELS

SITE
ARCO STATION #771
899 RINCON AVE. @ PINE
LIVERMORE, CA

ASG. PROJECT 60000.06
RESNA PROJ. 60000.09

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) 655-9955
FAX (415) 655-9745

JOB#	91047	DATE	8-1-91
DRWN. BY	K. GRAY	JOB#	92035

JOHN E. KOCH
Land Survevor
CA State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(510) 655-9956
FAX (510) 655-9745

TRANSMITTAL LETTER

TO:Barbara Sieminski/Joel Coffman FROM:John Koch

Job No.:93007

COMPANY:RESNA / San Jose Re:RESNA Proj.#60000.09

FAX NO:(408) 264-2435

SUBJECT:Arco Station 771
899 Rincon Avenue
Livermore, CA

PER: x Your request.

Our telephone conversation of:

Other:

FIND ENCLOSED:

1. Monitor well data table.
2. Plot plan of site.

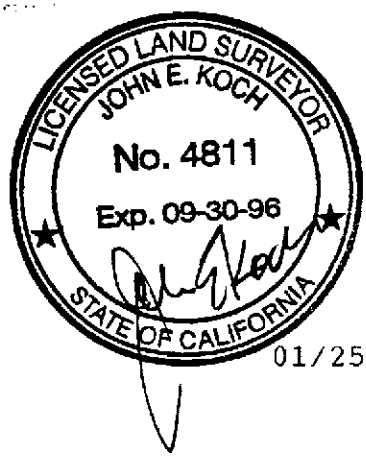
NO. OF PAGES (including transmittal): 4

MESSAGE:

The cap on MW-2 was broken and replaced.

THANK YOU

JOHN E. KOCH
Land Surveyor
CA. State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(510)655-9956
FAX(510)655-9745



01/25/93

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

Tabulation of Elevations as of 11:00 a.m. 01/23/93

Job #93007
RESNA Project 60000.09
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	451.53**	Top of PVC Casing
	451.98	Top of Box
MW-2	449.49**	Top of PVC Casing
	450.09	Top of Box
MW-3	*450.28	Top of PVC Casing
	*450.54	Top of Box
MW-4	451.09**	Top of PVC Casing
	451.82	Top of Box
MW-5	*451.40	Top of PVC Casing
	*452.09	Top of Box
MW-6	*451.37	Top of PVC Casing
	*451.65	Top of Box

JOHN E. KOCH, L.S. RESNA PROJ.#60000.9 JEK JOB #93007

Well Designation	Elevation	Description
MW-7	450.33**	Top of PVC Casing
	451.27	Top of Box
MW-8	449.43	Top of PVC Casing
	449.83	Top of Box
MW-9	449.21	Top of PVC Casing
	449.56	Top of Box
MW-10	449.22	Top of PVC Casing
	449.68	Top of Box
MW-11	*448.02	Top of PVC Casing
	*448.64	Top of Box
VW-1	*450.37	Top of PVC Casing
	*451.18	Top of Box
RW-1	451.67	Top of PVC Casing
	452.05	Top of Box

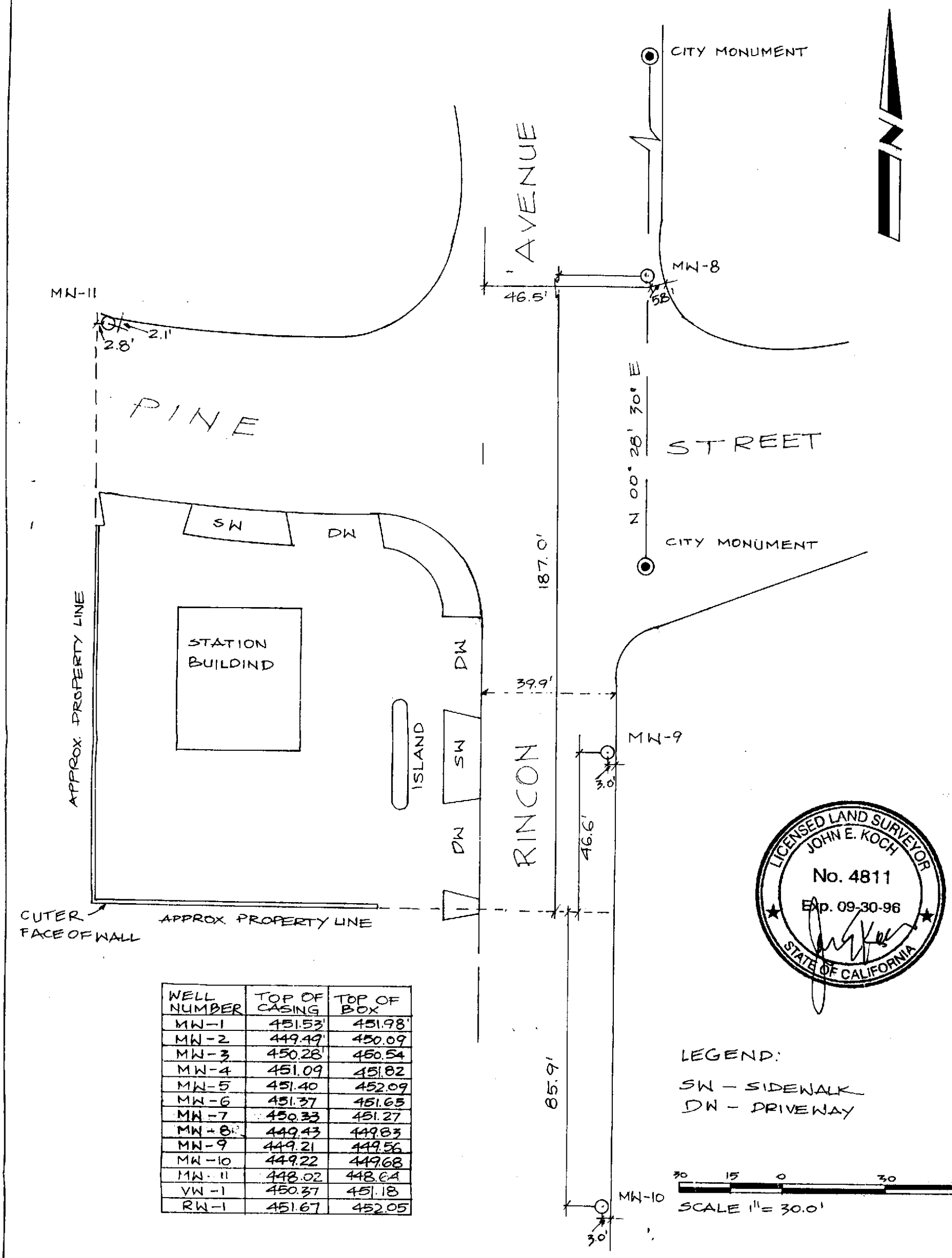
* Elevations as shown on report of 05/13/92 (JEK JOB #91035).

** TOC elevations of these wells was taken at the top of a 4" to 3" reducer. The elevation of the mark set on MW-1 is 451.73'.

NOTES:

1. Datum is City of Livermore= USGS

2. Top of PVC Casing elevation taken at mark at top of PVC for all wells. Diameter of MW-8 through MW-11 is 2", RW-1 is 6", all others are 4".



WELL NUMBER	TOP OF CASING	TOP OF BOX
MW-1	451.53'	451.98'
MW-2	449.49'	450.09
MW-3	450.28'	450.54
MW-4	451.09	451.82
MW-5	451.40	452.09
MW-6	451.37	451.65
MW-7	450.33	451.27
MW-8	449.43	449.83
MW-9	449.21	449.56
MW-10	449.22	449.68
MW-11	448.02	448.64
VW-1	450.37	451.18
RW-1	451.67	452.05

SITE:
ARCO STATION # 771
899 RINCON AVE.
LIVERMORE, CA
RESNA PROJECT

CLIENT:
RESNA
3315 ALMADEN EXPRESSWAY
SUITE 34
SAN JOSE, CA 95118

JOHN E. KOCH
LAND SURVEYOR
CA. STATE LIC. NO. LS 4811
5427 TELEGRAPH AVE., SUITEA
OAKLAND, CA. 94609
(510) 655-9956
(510) 655-9745

JOB #	DRAWN BY	DATE
93007	T.R.	01/25/93

APPENDIX E

EMCON'S GROUNDWATER MONITORING REPORT

EMCON
ASSOCIATES
Consultants in Wastes
Management and
Environmental Control

FEB 1 1993

Date February 11, 1993
Project 0G70-012.01

To:
Mr. Joel Coffman
RESNA/ Applied Geosystems
3315 Almaden Expressway, Suite 34
San Jose, California 95118

We are enclosing:

Copies	Description
1	Depth To Water / Floating Product Survey Results
1	Summary of Groundwater Monitoring Data
1	Certified Analytical Reports with Chain-of-Custody
12	Water Sample Field Data Sheets

For your: X Information Sent by: X Mail

Comments:

Enclosed are the data from the first quarter 1993 monitoring event at ARCO service station 771, located at 899 Rincon Avenue, Livermore,CA. Groundwater monitoring is conducted consistent with applicable regulatory guidelines. Please call if you have any questions. (408) 453-2266.

Jim Butera JB

Reviewed by:

REGISTERED PROFESSIONAL ENGINEER ROBERT PORTER No: 4031 Exp. 6/30/96 STATE OF CALIFORNIA

Robert Porter, Senior Project Engineer.

FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : 0G70-012.01 STATION ADDRESS : 899 Rincon Avenue, Livermore, CA DATE : 1-29-93

ARCO STATION # : 771 FIELD TECHNICIAN : MAdler DAY : Friday

DTW Order	WELL ID	Well Box Seal	Well Lid Secure	Gasket	Lock	Locking Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	MW-8	OK	Yes	OK	Dolphin	OK	23.23	23.23	ND	ND	41.9	water in box
2	MW-9	OK	Yes	OK	Dolphin	OK	18.91	18.91	ND	ND	39.2	—
3	MW-10	OK	Yes	OK	Dolphin	OK	19.27	19.2[illegible]	ND	ND	3[illegible]	—
4	MW-11	OK	Yes	OK	2057	OK	23.89	23.89	ND	ND	38.6	well cap under pressure water in box waited 10 min to get level
5	MW-3	OK	Yes	OK	3259	OK	21.88	21.88	ND	ND	37.6	water in box
6	MW-6	OK	Yes	OK	3259	OK	23.70	23.70	ND	ND	43.2	—
7	MW-4	OK	Yes	OK	NONE	SLIP CAP	22.30	22.30	ND	ND	41.1	only 1 bolt in lid
8	MW-7	OK	NO	OK	NONE	SLIP CAP	21.76	21.76	ND	ND	39.7	No bolts in lid
9	RW-1	OK	Yes	OK	NONE	SLIP CAP	22.89	22.89	ND	ND	39.7	no bolt in lid need T-ham
10	MW-5	OK	Yes	OK	NONE	SLIP CAP	23.25	23.25	ND	ND	40.6	only 1 bolt in lid casing has bolts in it
11	MW-2	OK	NO Key	OK	NONE	SLIP CAP	20.12	20.12	ND	ND	38.8	No bolts in lid
12	MW-1	OK	Yes	OK	NONE	SLIP CAP	23.49	23.49	ND	ND	40.5	only 1 bolt in lid

Summary of Groundwater Monitoring Data
First Quarter 1993
ARCO Service Station 771
899 Rincon Avenue, Livermore, California
micrograms per liter (µg/l) and milligrams per liter (mg/l)

Well ID and Sample Depth	Sampling Date	Depth To Water (feet)	Floating Product Thickness (feet)	TPH[1] as Gasoline (µg/l)	Benzene (µg/l)	Toluene (µg/l)	Ethyl-benzene (µg/l)	Total Xylenes (µg/l)	TPH as Diesel (ug/l)	Total Oil and Grease, 5520C/F (mg/l)
MW-1(40)	01/29/93	23.49	ND.[2]	360,000.	2,500.	9,300.	5,100.	41,000.	NR.[3]	NR.
MW-2(38)	01/29/93	20.12	ND.	89,000.	4,600.	5,700.	1,800.	15,000.	NR.	NR.
MW-3(39)	01/29/93	21.88	ND.	380.	0.8	0.6	2.1	2.0	NR.	NR.
MW-4(41)	01/29/93	22.30	ND.	23,000.	2,000.	580.	770.	2,500.	NR.	NR.
MW-5	01/29/93	23.25	ND.	IW.[4]	IW.	IW.	IW.	IW.	IW.	IW.
MW-6(43)	01/29/93	23.70	ND.	20,000.	1,800.	1,700.	490.	2,600.	2,300.	4.0 /3.6
MW-7(39)	01/29/93	21.76	ND.	38,000.	3,200.	1,100.	740.	4,300.	NR.	NR.
MW-8(41)	01/29/93	23.23	ND.	<50.	<0.5	<0.5	<0.5	<0.5	NR.	NR.
MW-9(39)	01/29/93	18.91	ND.	<50.	<0.5	<0.5	<0.5	<0.5	NR.	NR.
MW-10(36)	01/29/93	19.27	ND.	<50.	<0.5	<0.5	<0.5	<0.5	NR.	NR.
MW-11(38)	01/29/93	23.88	ND.	<50	<0.5	<0.5	<0.5	<0.5	NR.	NR.
RW-1(39)	01/29/93	22.89	ND.	43,000.	3,100.	2,500.	990.	7,400.	NR.	NR.
FB-1.[5]	01/29/93	NA.[6]	NA.	<50	<0.5	<0.5	<0.5	<0.5	NR.	NR.

1. TPH. = Total petroleum hydrocarbons
2. ND. = Not detected
3. NR. = Not reported; sample was not scheduled for analysis of the selected parameter
4. IW. = Well inaccessable, newly installed elbow at well head prevents well from being sampled
5. FB. = Field blank
6. NA. = Not applicable

Columbia Analytical Services, Inc.

February 8, 1993

Service Request No. SJ93-0130

Jim Butera
EMCON Associates
1921 Ringwood Avenue
San Jose, CA 95131

Re: **EMCON Project No. 0G70-012.01**
ARCO Facility No. 771

Dear Mr. Butera:

Attached are the results of the water samples submitted to our lab on February 1, 1993. For your reference, these analyses have been assigned our service request number SJ93-0130.

All analyses were performed consistent with our laboratory's quality assurance program. All results are intended to be considered in their entirety, and CAS is not responsible for use of less than the complete report. Results apply only to the samples analyzed.

Please call if you have any questions.

Respectfully submitted:

COLUMBIA ANALYTICAL SERVICES, INC.

Keoni A. Murphy
Laboratory Manager

Annelise J. Bazar
Regional QA Coordinator

KAM/kt

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

Inorganic Parameters[1]
mg/L (ppm)

Sample Name:	MW-6 (43)	Method Blank
Date Sampled:	01/29/93	

Analyte	Method	MRL		
Total Oil and Grease	SM 5520C	0.5	4.0	ND
Hydrocarbons, IR	SM 5520F	0.5	3.6	ND

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
SM *Standard Methods for the Examination of Water and Wastewater*, 17th Ed., 1989
[1] Unless otherwise noted, all analyses were performed within EPA recommended maximum holding times specified in *Test Methods for Evaluating Solid Waste*, (SW-846, 3rd Edition) and *Methods for Chemical Analysis of Water and Waste* (EPA-600/4-79-020, Revised March 1983).

Approved by: _____ Date: February 5, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Date Extracted:**	02/01/93
	ARCO Facility No. 771	**Date Analyzed:**	02/02/93
Sample Matrix:	Water	**Service Request No.:**	SJ93-0130

Total Petroleum Hydrocarbons as Diesel
EPA Method 3510/California DHS LUFT Method
µg/L (ppb)

Sample Name	MRL	TPH as Diesel
MW-6 (43)	50	2,300. *
Method Blank	50	ND

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
* The sample contains a lower boiling point hydrocarbon mixture quantitated as diesel. The chromatogram does not match the typical diesel fingerprint.

Approved by: _____ Date: February 8, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
µg/L (ppb)

Sample Name:		MW-1 (40)	MW-2 (38)	MW-3 (39)
Date Analyzed:		02/04/93 *	02/04/93 *	02/04/93
Analyte	**MRL**			
Benzene	0.5	2,500.	4,600.	0.8
Toluene	0.5	9,300.	5,700.	0.6
Ethylbenzene	0.5	5,100.	1,800.	2.1
Total Xylenes	0.5	41,000.	15,000.	2.0
TPH as Gasoline	50	360,000.	89,000.	380. **

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
* This sample was part of the analytical batch started on February 4, 1993. However, it was analyzed after midnight so the actual date analyzed is February 5, 1993.
** The sample contains components eluting in the gasoline range that were quantitated as gasoline. The chromatogram does not match the typical gasoline fingerprint.

Approved by: _____ Date: 2/5/93

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
µg/L (ppb)

Sample Name:		MW-4 (41)	MW-6 (43)	MW-7 (39)
Date Analyzed:		02/04/93 *	02/05/93	02/04/93 *
Analyte	**MRL**			
Benzene	0.5	2,000.	1,800.	3,200.
Toluene	0.5	580.	1,700.	1,100.
Ethylbenzene	0.5	770.	490.	740.
Total Xylenes	0.5	2,500.	2,600.	4,300.
TPH as Gasoline	50	23,000.	20,000.	38,000.

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
* This sample was part of the analytical batch started on February 4, 1993. However, it was analyzed after midnight so the actual date analyzed is February 5, 1993.

Approved by: Kevin A. Murphy Date: February 5, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
µg/L (ppb)

Sample Name:		MW-8 (41)	MW-9 (39)	MW-10 (36)
Date Analyzed:		02/04/93	02/04/93	02/04/93
Analyte	**MRL**			
Benzene	0.5	ND	ND	ND
Toluene	0.5	ND	ND	ND
Ethylbenzene	0.5	ND	ND	ND
Total Xylenes	0.5	ND	ND	ND
TPH as Gasoline	50	ND	ND	ND

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by: Kevin Murphy Date: February 8, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
µg/L (ppb)

Sample Name:		MW-11 (38)	RW-1 (39)	FB-1
Date Analyzed:		02/04/93	02/04/93 *	02/04/93 *
Analyte	**MRL**			
Benzene	0.5	ND	3,100.	ND
Toluene	0.5	ND	2,500.	ND
Ethylbenzene	0.5	ND	990.	ND
Total Xylenes	0.5	ND	7,400.	ND
TPH as Gasoline	50	ND	43,000.	ND

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
* This sample was part of the analytical batch started on February 4, 1993. However, it was analyzed after midnight so the actual date analyzed is February 5, 1993.

Approved by: _____ Date: February 5, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
µg/L (ppb)

Sample Name:		Method Blank	Method Blank
Date Analyzed:		02/04/93	02/05/93
Analyte	**MRL**		
Benzene	0.5	ND	ND
Toluene	0.5	ND	ND
Ethylbenzene	0.5	ND	ND
Total Xylenes	0.5	ND	ND
TPH as Gasoline	50	ND	ND

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by: _____ Date: February 5, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

Initial Calibration Verification
Total Petroleum Hydrocarbons as Diesel
EPA Methods 3510/DHS LUFT Method
mg/L (ppm)

Date Analyzed: 02/02/93

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria
TPH as Diesel	500.	473.	95.	90-110

TPH Total Petroleum Hydrocarbons

Approved by: Kathy Murray Date: February 5, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON Associates
Project: EMCON Project No. 0G70-012.01
ARCO Facility No. 771

Date Received: 02/01/93
Service Request No.: SJ93-0130
Sample Matrix: Water

Surrogate Recovery Summary
Total Petroleum Hydrocarbons as Diesel
EPA Method 3510/DHS LUFT Method

Sample Name	Date Analyzed	Percent Recovery P-Terphenyl
MW-6 (43)	02/02/93	88.
MS	02/02/93	90.
DMS	02/02/93	90.
Method Blank	02/02/93	93.
	CAS Acceptance Criteria	46-133

Approved by: Kevin Murphy Date: February 5, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON Associates
Project: EMCON Project No. 0G70-012.01
ARCO Facility No. 771

Date Received: 02/01/93
Service Request No.: SJ93-0130
Sample Matrix: Water

Matrix Spike/Duplicate Matrix Spike Summary
Total Petroleum Hydrocarbons as Diesel
EPA Method 3510/DHS LUFT Method
µg/L (ppb)

Date Analyzed: 02/02/93

Parameter	Spike Level	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	Acceptance Criteria
Diesel	4,000.	ND	3,250.	3,290.	81.	82.	61-121

ND None Detected at or above the method reporting limit

Approved by: Tom Murphy Date: February 5, 93

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON Associates
Project: EMCON Project No. 0G70-012.01
ARCO Facility No. 771

Date Received: 02/01/93
Service Request No.: SJ93-0130

Initial Calibration Verification
BTEX and TPH as Gasoline
EPA Methods 5030/8020/DHS LUFT Method
Nanograms

Date Analyzed: 02/04/93

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria
Benzene	250.	223.	89.	85-115
Toluene	250.	231.	92.	85-115
Ethylbenzene	250.	219.	88.	85-115
Total Xylenes	750.	652.	87.	85-115
TPH as Gasoline	2,500.	2,526.	101.	90-110

Date Analyzed: 02/05/93

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria
Benzene	250.	255.	102.	85-115
Toluene	250.	260.	104.	85-115
Ethylbenzene	250.	258.	103.	85-115
Total Xylenes	750.	750.	100.	85-115
TPH as Gasoline	2,500.	2,452.	98.	90-110

TPH Total Petroleum Hydrocarbons

Approved by: _____ Date: February 5, 1993

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

Surrogate Recovery Summary
BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method

Sample Name	Date Analyzed	Percent Recovery α,α,α-Trifluorotoluene
MW-1 (40)	02/04/93	105.
MW-2 (38)	02/04/93	98.
MW-3 (39)	02/04/93	113.
MW-4 (41)	02/04/93	95.
MW-6 (43)	02/05/93	93.
MW-7 (39)	02/04/93	92.
MW-8 (41)	02/04/93	85.
MW-9 (39)	02/04/93	97.
MW-10 (36)	02/04/93	94.
MW-11 (38)	02/04/93	95.
RW-1 (39)	02/04/93	87.
FB-1	02/04/93	87.
MS	02/05/93	104.
DMS	02/05/93	106.
Method Blank	02/04/93	91.
Method Blank	02/05/93	89.
CAS Acceptance Criteria		70-130

TPH Total Petroleum Hydrocarbons

Approved by: _____ Date: 2/10/93

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON Associates	**Date Received:**	02/01/93
Project:	EMCON Project No. 0G70-012.01	**Service Request No.:**	SJ93-0130
	ARCO Facility No. 771	**Sample Matrix:**	Water

Matrix Spike/Duplicate Matrix Spike Summary
Total Petroleum Hydrocarbons as Gasoline
EPA Methods 5030/California DHS LUFT Method
µg/L (ppb)

Date Analyzed: 02/05/93

			Spike Result		Percent Recovery		CAS Acceptance
Analyte	Spike Level	Sample Result	MS	DMS	MS	DMS	Criteria
TPH as Gasoline	25,000.	19,900.	45,000.	45,600.	100.	103.	70-130

TPH Total Petroleum Hydrocarbons

Approved by: _____ Date: February 8, 1993

RCO Products Company [redacted] of AtlanticRichfieldCompany [redacted] **Task Order No.** EMC GC-92-1 [redacted] **Chain of Custody**

CO Facility no. 771	City (Facility) LIVERMORE		Project manager (Consultant) JIM BUTERA			Laboratory name CAS
CO engineer Kyle Christie		Telephone no. (ARCO)	Telephone no. (Consultant) 453-0719		Fax no. (Consultant) 453-0452	Contract number
nsultant name EMCON Associates		Address (Consultant) 1938 Junction Avenue San Jose				

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 ☐ (5520 C&F)	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 ☐		
-(40)	1-2	2		X		X	HCl	1-29-93	1740		X											
-2(38)	3-4	2		↓		↓	↓	↓	1659		X											
-3(37)	5-6	2							1241		X											
-4(41)	7-8	2							1442		X											
-5( )	—	2	—	—	—	—	—	—			X			No Sample — Casing Problem								
-6(43)	9-14	6							1335		X		X									
-7(39)	15-16	2							1535		X											
-8(41)	17-18	2							1042		X											
-9(39)	19-20	2							1108		X											
-10(36)	21-22	2							1133		X											
-11(38)	23-24	2							1155		X											
-12(39)	25-26	2							1618		X											
B-1	27-28	2		↓		↓	↓		1345		X											
-6(43)	29-32	2		X		X	NP	↓	1335			X										

Method of shipment: sampler will deliver

Special detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: 2-40ml HCl VOA's; 2-liter NP GLASS; 4-liter HCl GLASS; (R) 0670-01201

Lab number: SJ93-0130

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

ndition of sample:		Temperature received: cool	
linquished by sampler: [signature]	Date 2-1-93 Time 1030	Received by	
linquished by	Date Time	Received by [signature]	
linquished by	Date Time	Received by laboratory	Date 2-1-93 Time 1030

ribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
PC 3292 (2-91)

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 3670-012.01 SAMPLE ID: MW-1 (40)

PURGED BY: MAdler CLIENT NAME: Arco 771

SAMPLED BY: MAdler LOCATION: 899 Kincon Livermore, CA.

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 ___ 3 ___ 4 X 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 11.11

DEPTH TO WATER (feet): 23.49 CALCULATED PURGE (gal.): 33.33

DEPTH OF WELL (feet): 40.5 ACTUAL PURGE VOL. (gal.): 33.5

DATE PURGED: 1-29-93 Start (2400 Hr) 1713 End (2400 Hr) 1736

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1740 End (2400 Hr) 1741

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1716	11.5	6.93	1251	65.5	grey	heavy
1726	22.5	6.96	1279	66.6	grey	heavy
1736	33.5	7.05	1207	65.1	grey	heavy

D. O. (ppm): NR ODOR: Very Strong / NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ QDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: Slip cap

REMARKS: Sheen of product seen on purge water

Meter Calibration: Date: 1-29-93 Time: 1500 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-7 (39)

OK

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 06-70-012.01 | SAMPLE ID: MW-2 (35)

PURGED BY: Madia | CLIENT NAME: Arco 771

SAMPLED BY: M Adler | LOCATION: 899 Rincon Livermore, CA

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 ___ 3 ___ 4 X 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR | VOLUME IN CASING (gal.): 12.18

DEPTH TO WATER (feet): 20.15 | CALCULATED PURGE (gal.): 36.55

DEPTH OF WELL (feet): 38.8 | ACTUAL PURGE VOL. (gal.): 37.0

DATE PURGED: 1-29-93 | Start (2400 Hr) 1627 | End (2400 Hr) 1658

DATE SAMPLED: 1-29-93 | Start (2400 Hr) 1655 | End (2400 Hr) 1659

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1635	12.5	6.89	1135	69.0	green	moderate
1647	25.0	6.90	1136	69.0	grey	moderate
1658	37.0	6.90	1174	69.1	grey	moderate

D. O. (ppm): NR | ODOR: Very Strong | NR (COBALT 0 - 100) | NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK | LOCK #: SLIP CAP

REMARKS: sheen of product seen on Purge water

Meter Calibration: Date: 1-29-93 Time: 1500 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-7

AR

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 0670-012.01 SAMPLE ID: MW-3 (39)

PURGED BY: MAdler CLIENT NAME: Arco 771

SAMPLED BY: MAdler LOCATION: 889 Rincon Livermore, CA.

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 ___ 3 ___ 4 X 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 11.57

DEPTH TO WATER (feet): 21.88 CALCULATED PURGE (gal.): 34.

DEPTH OF WELL (feet): 38.6 ACTUAL PURGE VOL (gal.): 35.0

DATE PURGED: 1-29-93 Start (2400 Hr) 1217 End (2400 Hr) 1238

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1241 End (2400 Hr) 1242

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1222	12.0	7.20	1055	67.9	TAN	moderate
1230	24.0	7.20	1110	68.6	TAN	moderate
1238	35.0	7.30	1115	67.9	TAN	moderate

D. O. (ppm): NR ODOR: NONE NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: 3259

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1022 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-9 (L)

AB 3 10

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: CG70-012.01 SAMPLE ID: MW-4 (41)

PURGED BY: MAHler CLIENT NAME: ARCO 771

SAMPLED BY: MAHler LOCATION: 899 Rincon Livermore, CA.

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 ___ 3 ___ 4 X 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 12.28

DEPTH TO WATER (feet): 22.30 CALCULATED PURGE (gal.): 36.84

DEPTH OF WELL (feet): 41.1 ACTUAL PURGE VOL. (gal.): 37.0

DATE PURGED: 1-29-93 Start (2400 Hr) 1413 End (2400 Hr) 1440

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1442 End (2400 Hr) 1443

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1423	12.5	6.93	1364	70.8	TAN	moderate
1432	25.0	6.90	1369	71.2	TAN	moderate
1440	37.0	6.92	1349	70.8	TAN	moderate

D. O. (ppm): NR ODOR: Strong / NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ ODL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: 3 SLIP CAP

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1022 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-5 (41)

AB

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 0G70-C12.01 SAMPLE ID: MW-5

PURGED BY: Madler CLIENT NAME: Arco 771

SAMPLED BY: NA LOCATION: 899 Rincon, Livermore, CA.

TYPE: Ground Water x Surface Water ____ Treatment Effluent ____ Other ____

CASING DIAMETER (inches): 2 ____ 3 ____ 4 x 4.5 ____ 6 ____ Other ____

CASING ELEVATION (feet/MSL):	NR	VOLUME IN CASING (gal.):	NA /
DEPTH TO WATER (feet):	≅ 23.25	CALCULATED PURGE (gal.):	/
DEPTH OF WELL (feet):	≅ 40.6	ACTUAL PURGE VOL. (gal.):	/

DATE PURGED: 1-29-93 Start (2400 Hr) NA / End (2400 Hr) NA /

DATE SAMPLED: NA Start (2400 Hr) / End (2400 Hr) /

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
	No	sample	- Casing	has	elbows	in it

D. O. (ppm): NR ODOR: NA NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT NA

____ 2" Bladder Pump	____ Bailer (Teflon®)
____ Centrifugal Pump	____ Bailer (PVC)
____ Submersible Pump	____ Bailer (Stainless Steel)
____ Well Wizard™	____ Dedicated

Other: ____

SAMPLING EQUIPMENT NA

____ 2" Bladder Pump	____ Bailer (Teflon®)
____ DDL Sampler	____ Bailer (Stainless Steel)
____ Dipper	____ Submersible Pump
____ Well Wizard™	____ Dedicated

Other: ____

WELL INTEGRITY: OK LOCK #: Slip cap

REMARKS: The casing has 2 45° ells in it. I could get my sounder down for a water level but it shouldn't be used! No way a bailer will go down. An MMC and Grundfos won't fit either! No samples - well inaccessible -

Meter Calibration: Date: 1-29-93 Time: ____ Meter Serial #: 9112 Temperature °F: ____

(EC 1000 ____ / ____) (DI ____) (pH 7 ____ / ____) (pH 10 ____ / ____) (pH 4 ____ / ____)

Location of previous calibration: ____

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 06-70-012.01 | SAMPLE ID: MW-6 (43)

PURGED BY: MAdler | CLIENT NAME: Arco 771

SAMPLED BY: MAdler | LOCATION: 899 Rincon Livermore, CA.

TYPE: Ground Water X | Surface Water ___ | Treatment Effluent ___ | Other ___

CASING DIAMETER (inches): 2 ___ 3 ___ 4 X 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): N/A | VOLUME IN CASING (gal.): 12.74

DEPTH TO WATER (feet): 23.70 | CALCULATED PURGE (gal.): 38.22

DEPTH OF WELL (feet): 43.2 | ACTUAL PURGE VOL. (gal.): 38.5

DATE PURGED: 1-29-92 | Start (2400 Hr) 1301 | End (2400 Hr) 1330

DATE SAMPLED: 1-29-92 | Start (2400 Hr) 1335 | End (2400 Hr) 1342

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1310	13.0	6.95	1240	67.2	TAN	light
1320	26.0	7.06	1264	66.1	TAN	moderate
1330	38.5	7.15	1271	66.7	green/TAN	heavy

D. O. (ppm): NR | ODOR: Strong | NR (COBALT 0 - 100) | NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): FB-1

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK | LOCK #: 3259

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1022 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___/___) (DI ___) (pH 7 ___/___) (pH 10 ___/___) (pH 4 ___/___)

Location of previous calibration: MW-8 (41)

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 06-70-012.01 SAMPLE ID: MW-7(39)

PURGED BY: M Adler CLIENT NAME: Arco 771

SAMPLED BY: M Adler LOCATION: 899 Rincon

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 ___ 3 ___ 4 X 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 11.72

DEPTH TO WATER (feet): 21.26 CALCULATED PURGE (gal.): 35.16

DEPTH OF WELL (feet): 39.7 ACTUAL PURGE VOL (gal.): 36.0

DATE PURGED: 1-29-93 Start (2400 Hr) 1503 End (2400 Hr) 1534

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1535 End (2400 Hr) 1536

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1513	12.0	7.05	1298	71.0	Grey	moderate
1524	24.0	6.94	1269	72.0	grey	heavy
1534	36.0	7.03	1163	71.0	Grey	heavy

D. O. (ppm): NIL ODOR: Strong / NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: SLIP CAP

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1500 Meter Serial #: 9112 Temperature °F: 71.2

(EC 1000 1615/1000) (DI ___) (pH 7 7.04 / 7.00) (pH 10 10.02 / 10.00) (pH 4 3.96 / ___)

Location of previous calibration: MW-7 (39)

MW-1 DI NR

Rev. 2, 5/

WATER SAMPLE FIELD DATA SHEET

EMCON ASSOCIATES

PROJECT NO: 0670-012.01 SAMPLE ID: MW-8 (41)

PURGED BY: MAdler CLIENT NAME: Arco 771

SAMPLED BY: MAdler LOCATION: 899 Rincon Ave Livermore, CA.

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 X 3 ___ 4 ___ 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 3.04

DEPTH TO WATER (feet): 23.23 CALCULATED PURGE (gal.): 9.14

DEPTH OF WELL (feet): 41.9 ACTUAL PURGE VOL. (gal.): 9.5

DATE PURGED: 1-29-93 Start (2400 Hr) 1029 End (2400 Hr) 1040

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1042 End (2400 Hr) 1043

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1032	3.5	7.21	954	63.1	brown	heavy
1036	6.5	7.29	1116	67.4	brown	heavy
1040	9.5	7.34	1049	68.0	brown	heavy

D. O. (ppm): NR ODOR: NONE NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: Dolphin

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1022 Meter Serial #: 9112 Temperature °F: 60.0

(EC 1000 1019 / 1000) (DI 17.2) (pH 7 7.04 / 7.00) (pH 10 9.93 / 10.00) (pH 4 3.94 / ___)

Location of previous calibration: MW-8 (41)

AA

WATER SAMPLE FIELD DATA SHEET

Rev. 2.5

EMCON ASSOCIATES

PROJECT NO: 0670-012-01 SAMPLE ID: MW-9 (39)

PURGED BY: MAdler CLIENT NAME: Arco 771

SAMPLED BY: MAdler LOCATION: 899 Rincon Livermore, CA.

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 T 3 ___ 4 ___ 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 3.31

DEPTH TO WATER (feet): 18.91 CALCULATED PURGE (gal.): 9.94

DEPTH OF WELL (feet): 39.2 ACTUAL PURGE VOL (gal.): 10.0

DATE PURGED: 1-29-93 Start (2400 Hr) 1055 End (2400 Hr) 1106

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1108 End (2400 Hr) 1109

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1059	3.5	7.36	1082	66.1	brown	heavy
1102	7.0	7.29	1121	67.3	brown	heavy
1106	10.0	7.33	1133	67.6	brown	heavy

D. O. (ppm): NR ODOR: NONE NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	T Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: Dolphin

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1022 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-8 (41)

WATER SAMPLE FIELD DATA SHEET

Rev. 2.5

EMCON ASSOCIATES

PROJECT NO: 6470-012.01 SAMPLE ID: MW-10 (36)

PURGED BY: MAdler CLIENT NAME: Arco 771

SAMPLED BY: MAdler LOCATION: 899 Rincon Livermore, CA.

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 X 3 ___ 4 ___ 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 2.78

DEPTH TO WATER (feet): 19.27 CALCULATED PURGE (gal.): 8.34

DEPTH OF WELL (feet): 36.3 ACTUAL PURGE VOL. (gal.): 9.0

DATE PURGED: 1-29-93 Start (2400 Hr) 1122 End (2400 Hr) 1131

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1133 End (2400 Hr) 1134

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmnos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1124	3.0	7.33	1419	66.0	brown	heavy
1128	6.0	7.38	1428	65.7	brown	heavy
1131	9.0	7.39	1455	65.9	brown	heavy

D. O. (ppm): NR ODOR: none NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ QDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: Dolphin

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1022 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-8 (41)

WATER SAMPLE FIELD DATA SHEET

Rev. 2.5

EMCON ASSOCIATES

PROJECT NO: 0670-012.01 SAMPLE ID: MW-11 (38)

PURGED BY: MAdler CLIENT NAME: Arco 771

SAMPLED BY: MAdler LOCATION: 589 Rincon Livermore, CA.

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 X 3 ___ 4 ___ 4.5 ___ 6 ___ Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 2.40

DEPTH TO WATER (feet): 23.89 CALCULATED PURGE (gal.): 7.20

DEPTH OF WELL (feet): 38.6 ACTUAL PURGE VOL. (gal.): 7.5

DATE PURGED: 1-29-93 Start (2400 Hr) 1144 End (2400 Hr) 1153

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1155 End (2400 Hr) 1156

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1147	2.5	7.35	1050	67.2	brown	moderate
1150	5.0	7.25	1043	68.4	brown	heavy
1153	7.5	7.21	1050	68.1	brown	heavy

D. O. (ppm): NR ODOR: NONE NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NA

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	X Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
___ Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: 2357

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1022 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-8 (41)

WATER SAMPLE FIELD DATA SHEET

Rev. 2. 5

EMCON ASSOCIATES

PROJECT NO: 0[illegible]-012.01 SAMPLE ID: MW-1 (39)

PURGED BY: MAJ CLIENT NAME: Arco 771

SAMPLED BY: MAJ LOCATION: 899 Rincon

TYPE: Ground Water X Surface Water ___ Treatment Effluent ___ Other ___

CASING DIAMETER (inches): 2 ___ 3 ___ 4 ___ 4.5 ___ 6 X Other ___

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 24.71

DEPTH TO WATER (feet): 22.89 CALCULATED PURGE (gal.): 74.13

DEPTH OF WELL (feet): 39.7 ACTUAL PURGE VOL. (gal.): 75.0

DATE PURGED: 1-29-93 Start (2400 Hr) 1550 End (2400 Hr) 1616

DATE SAMPLED: 1-29-93 Start (2400 Hr) 1618 End (2400 Hr) 1618

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmnos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1558	25.0	6.90	1189	72.3	TAN	light
1607	50.0	6.79	1220	71.3	TAN	light
1616	75.0	6.83	1188	70.3	TAN	moderate

D. O. (ppm): NR ODOR: Strong NR (COBALT 0 - 100) NR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
___ 2" Bladder Pump	___ Bailer (Teflon®)	___ 2" Bladder Pump	X Bailer (Teflon®)
___ Centrifugal Pump	___ Bailer (PVC)	___ DDL Sampler	___ Bailer (Stainless Steel)
X Submersible Pump	___ Bailer (Stainless Steel)	___ Dipper	___ Submersible Pump
___ Well Wizard™	___ Dedicated	___ Well Wizard™	___ Dedicated
Other: ___		Other: ___	

WELL INTEGRITY: OK LOCK #: SLIP CAP

REMARKS: ___

Meter Calibration: Date: 1-29-93 Time: 1500 Meter Serial #: 9112 Temperature °F: ___

(EC 1000 ___ / ___) (DI ___) (pH 7 ___ / ___) (pH 10 ___ / ___) (pH 4 ___ / ___)

Location of previous calibration: MW-7 (39)

APPENDIX F

LABORATORY ANALYSES REPORTS AND CHAIN-OF-CUSTODY RECORDS FOR SOIL SAMPLES

SEQUOIA ANALYTICAL

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

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

Project: ARCO 771, Livermore

Enclosed are the results from 11 soil samples received at Sequoia Analytical on April 10,1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2041877	Soil, S-10.5-B15	4/9/92	EPA 5030/8015/8020
2041878	Soil, S-20.5-B15	4/9/92	EPA 5030/8015/8020
2041879	Soil, S-28.5-B15	4/9/92	EPA 5030/8015/8020
2041880	Soil, S-41-B15	4/9/92	EPA 5030/8015/8020
2041881	Soil, S-11-B16	4/8/92	EPA 5030/8015/8020
2041882	Soil, S-21-B16	4/8/92	EPA 5030/8015/8020
2041884	Soil, S-11-B17	4/8/92	EPA 5030/8015/8020
2041885	Soil, S-21-B17	4/8/92	EPA 5030/8015/8020
2041886	Soil, S-30.5-B17	4/8/92	EPA 5030/8015/8020
2041887	Soil, S-33-B17	4/8/92	EPA 5030/8015/8020
2041888	Soil, S-43-B17	4/8/92	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

Maria Lee

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	4/8-9/92
3315 Almaden Expwy., Suite 34	Matrix Descript:	Soil	Received:	Apr 10, 1992
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Apr 13, 1992
Attention: Joel Coffman	First Sample #:	204-1877	Reported:	Apr 18, 1992

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)
204-1877	S-10.5-B15	N.D.	N.D.	N.D.	N.D.	N.D.
204-1878	S-20.5-B15	N.D.	N.D.	N.D.	N.D.	N.D.
204-1879	S-28.5-B15	N.D.	N.D.	N.D.	N.D.	N.D.
204-1880	S-41-B15	N.D.	N.D.	N.D.	N.D.	N.D.
204-1881	S-11-B16	N.D.	N.D.	N.D.	N.D.	N.D.
204-1882	S-21-B16	N.D.	0.0080	N.D.	N.D.	N.D.
204-1884	S-11-B17	N.D.	N.D.	N.D.	N.D.	N.D.
204-1885	S-21-B17	N.D.	0.021	N.D.	0.017	0.0080
204-1886	S-30.5-B17	N.D.	N.D.	N.D.	N.D.	N.D.
204-1887	S-33-B17	N.D.	N.D.	N.D.	N.D.	N.D.
204-1888	S-43-B17	7.0	0.30	0.77	0.15	1.1
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

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 2041877-88

Reported: Apr 18, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	E. Cunanan	E. Cunanan	E. Cunanan	E. Cunanan
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 13, 1992	Apr 13, 1992	Apr 13, 1992	Apr 13, 1992
QC Sample #:	GBLK041392	GBLK041392	GBLK041392	GBLK041392
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.20	0.20	0.20	0.59
Matrix Spike % Recovery:	100	100	100	98
Conc. Matrix Spike Dup.:	0.20	0.20	0.20	0.60
Matrix Spike Duplicate % Recovery:	100	100	100	100
Relative % Difference:	0.0	0.0	0.0	1.7

SEQUOIA ANALYTICAL

Maria Lee
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

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 2041877-88

Reported: Apr 18, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	B. Ali	B. Ali	B. Ali	B. Ali
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 13, 1992	Apr 13, 1992	Apr 13, 1992	Apr 13, 1992
QC Sample #:	GBLK041392	GBLK041392	GBLK041392	GBLK041392
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.23	0.23	0.24	0.69
Matrix Spike % Recovery:	115	115	120	115
Conc. Matrix Spike Dup.:	0.24	0.23	0.25	0.70
Matrix Spike Duplicate % Recovery:	120	115	125	117
Relative % Difference:	4.2	0.0	4.1	1.4

SEQUOIA ANALYTICAL

Maria Lee
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. 771-92-2

Chain of Custody

ARCO Facility no. 771 | City (Facility) Livermore | Project manager (Consultant) Joel Coffman | Laboratory name Sequoia

ARCO engineer Michael Whelan | Telephone no. (ARCO) (415) 571-2434 | Telephone no. (Consultant) (408) 264-7723 | Fax no. (Consultant) (408) 264-2435 | Contract number 07-073

Consultant name RESNA | Address (Consultant) 3315 Almaden Exp. Suite 34, San Jose CA 95118

Method of shipment: Sequoia 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 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 ☐		
S-10.5-	B15	1	✓			✓		2041877	4/9		✓											
S-20.5-	B15	1	✓			✓	↓	1878	↓		✓											
S-28.5-	B15	1	✓			✓		1879			✓											
S-40-	B15	1	✓			✓		1880	↓		✓											
S-11-	B16	1	✓			✓		1881	4/8		✓											
S-21-	B16	1	✓			✓		1882			✓											
S-32.5-	B16	1	✓			✓		~~1883~~			✓							cancelled Barbara			4/12	
S-11-	B17	1	✓			✓		1884			✓											
S-21-	B17	1	✓			✓		1885			✓											
S-30.5-	B17	1	✓			✓		1886			✓											
S-33-	B17	1	✓			✓		1887			✓											
S-43-	B17	1	✓			✓	↓	1888	↓		✓											

Special detection Limit/reporting: cancelled

Special QA/QC

Remarks

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	Date	Time	Received by
Relinquished by sampler: Barbara Sieminski	04/10/92	2:20	Stephen Butler
Relinquished by: Stephen Butler	4-10-92	425p	
Relinquished by:			Received by laboratory: A. Nugro. Date 4/10 Time 1625

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
APPC-3292 (2-91)

SEQUOIA ANALYTICAL

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

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

Project: ARCO 771, Livermore

Enclosed are the results from 1 soil sample received at Sequoia Analytical on April 13,1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2041883	Soil, S-31-B16	4/8/92	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

Maria Lee

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Apr 8, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript:	Soil	Received:	Apr 13, 1992
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Apr 14, 1992
Attention: Joel Coffman	First Sample #:	204-1883	Reported:	Apr 20, 1992

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)
204-1883	S-31-B16	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

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 204-1883

Reported: Apr 20, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. Maralit	A. Maralit	A. Maralit	A. Maralit
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 14, 1992	Apr 14, 1992	Apr 14, 1992	Apr 14, 1992
QC Sample #:	GBLK041492	GBLK041492	GBLK041492	GBLK041492
Sample Conc.:	0.0070	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.20	0.20	0.21	0.61
Matrix Spike % Recovery:	95	100	105	102
Conc. Matrix Spike Dup.:	0.20	0.20	0.22	0.60
Matrix Spike Duplicate % Recovery:	95	100	110	100
Relative % Difference:	0.0	0.0	4.7	1.7

SEQUOIA ANALYTICAL

Maria Lee
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. 771-92-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2434
Consultant name RESNA	Address (Consultant) 3315 Almaden Exp., Suite 34, San Jose, CA 95118		Contract number 07-073

Method of shipment: Sequoia 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 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-31-B16		1	V			V			04/08/92		V						204883					

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number

Turnaround time

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

Condition of sample: Cool		Temperature received: 4°C	
Relinquished by sampler: Barbara Sieminski	Date 4-13-92	Time 1:33	Received by: Stephen Sutton
Relinquished by: Stephen Sutton	Date 4-13-92	Time 4:55	Received by:
Relinquished by:	Date	Time	Received by laboratory: Sophia Ortiz	Date 4/13	Time 4:25

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
APPC-3292 (2-91)

SEQUOIA ANALYTICAL

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

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

Project: ARCO 771, Livermore

Enclosed are the results from 2 soil samples received at Sequoia Analytical on April 10,1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2041714	Soil, S-0409-SP1-A-D	4/10/92	EPA 5030/8015/8020
2041715	Soil, S-0409-SP2-A-D	4/10/92	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

Maria Lee

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Apr 10, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript:	Soil	Received:	Apr 10, 1992
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Analyzed:	4/11, 12/92
Attention: Joel Coffman	First Sample #:	204-1714	Reported:	Apr 14, 1992

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)
204-1714	S-0409-SP1-A-D	N.D.	N.D.	N.D.	N.D.	N.D.
204-1715	S-0409-SP2-A-D	6.4	0.0070	0.015	0.020	0.12
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

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 2041714-5

Reported: Apr 14, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. Miraftab	A. Miraftab	A. Miraftab	A. Miraftab
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 11, 1992	Apr 11, 1992	Apr 11, 1992	Apr 11, 1992
QC Sample #:	GBLK041192	GBLK041192	GBLK041192	GBLK041192
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.19	0.19	0.19	0.57
Matrix Spike % Recovery:	95	95	95	95
Conc. Matrix Spike Dup.:	0.18	0.19	0.18	0.56
Matrix Spike Duplicate % Recovery:	90	95	90	93
Relative % Difference:	5.4	0.0	5.4	1.8

SEQUOIA ANALYTICAL

Maria Lee
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

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 2041714-5

Reported: Apr 14, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. Miraftab	A. Miraftab	A. Miraftab	A. Miraftab
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Apr 12, 1992	Apr 12, 1992	Apr 12, 1992	Apr 12, 1992
QC Sample #:	GBLK041292	GBLK041292	GBLK041292	GBLK041292
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.17	0.17	0.18	0.53
Matrix Spike % Recovery:	85	85	90	88
Conc. Matrix Spike Dup.:	0.18	0.18	0.18	0.54
Matrix Spike Duplicate % Recovery:	90	90	90	90
Relative % Difference:	5.7	5.7	0.0	1.9

SEQUOIA ANALYTICAL

Maria Lee
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. 771-92-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA	Address (Consultant) 3315 Almaden Expy. Suite 34, San Jose, CA 95118		Contract number 07-073

Method of shipment: Sequoia 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 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-0409-SP1-A										X		X			2041714							
S-0409-SP1-B																						
S-0409-SP1-C																						
S-0409-SP1-D																						
S-0409-SP2-A										X		X						15				
S-0409-SP2-B																4						
S-0409-SP2-C																						
S-0409-SP2-D																						

Special detection Limit/reporting

Special QA/QC

Remarks: 48 hr turnaround time

Composite Samples

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: Barbara Sieminski	Date: 04/10/92	Time: 2:20	Received by: Stephen Butler
Relinquished by: Stephen Butler	Date: 4-10-92	Time: 4:25	Received by:
Relinquished by:	Date:	Time:	Received by laboratory: A. Naghavi
			Date: 4/10
			Time: 16:25

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

APPC-3292 (2-91)

SEQUOIA ANALYTICAL

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

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

FEB 1993

Project: Arco 771, Livermore

Enclosed are the results from 12 soil samples received at Sequoia Analytical on January 15,1993. The requested analyses are listed below:

3A19701	Soil, S-9.5-B13	1/14/93	EPA 5030/8015/8020
3A19702	Soil, S-14.5-B13	1/14/93	EPA 5030/8015/8020
3A19703	Soil, S-26-B13	1/14/93	EPA 5030/8015/8020
3A19704	Soil, S-40-B13	1/14/93	EPA 5030/8015/8020
3A19705	Soil, S-9.5-B14	1/14/93	EPA 5030/8015/8020
3A19706	Soil, S-17-B14	1/14/93	EPA 5030/8015/8020
3A19707	Soil, S-27.5-B14	1/14/93	EPA 5030/8015/8020
3A19708	Soil, S-38-B14	1/14/93	EPA 5030/8015/8020
3A19709	Soil, S-9-B12	1/14/93	EPA 5030/8015/8020
3A19710	Soil, S-17-B12	1/14/93	EPA 5030/8015/8020
3A19711	Soil, S-26-B12	1/14/93	EPA 5030/8015/8020
3A19712	Soil, S-43.5-B12	1/14/93	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

Maria Lee

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	Arco 771, Livermore	Sampled:	Jan 14, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jan 15, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jan 29, 1993
Attention: Joel Coffman	First Sample #:	3A19701		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3A19701 S-9.5-B13	Sample I.D. 3A19702 S-14.5-B13	Sample I.D. 3A19703 S-26-B13	Sample I.D. 3A19704 S-40-B13	Sample I.D. 3A19705 S-9.5-B14	Sample I.D. 3A19706 S-17-B14
Purgeable Hydrocarbons	1.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethyl Benzene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Total Xylenes	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chromatogram Pattern:		--	--	--	--	--	--

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	1.0	1.0	1.0
Date Analyzed:	1/22/93	1/22/93	1/22/93	1/22/93	1/22/93	1/22/93
Instrument Identification:	GCHP-6	GCHP-7	GCHP-7	GCHP-7	GCHP-7	GCHP-7
Surrogate Recovery, %: (QC Limits = 70-130%)	91	86	87	89	92	88

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	Arco 771, Livermore	Sampled:	Jan 15, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jan 15, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jan 29, 1993
Attention: Joel Coffman	First Sample #:	3A19707		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3A19707 S-27.5-B14	Sample I.D. 3A19708 S-38-B14	Sample I.D. 3A19709 S-9-B12	Sample I.D. 3A19710 S-17-B12	Sample I.D. 3A19711 S-26-B12	Sample I.D. 3A19712 S-43.5-B12
Purgeable Hydrocarbons	1.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethyl Benzene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Total Xylenes	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chromatogram Pattern:		--	--	--	--	--	--

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	1.0	1.0	1.0
Date Analyzed:	1/22/93	1/22/93	1/22/93	1/22/93	1/22/93	1/22/93
Instrument Identification:	GCHP-7	GCHP-7	GCHP-7	GCHP-7	GCHP-7	GCHP-7
Surrogate Recovery, %: (QC Limits = 70-130%)	96	97	93	96	99	98

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

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

Client Project ID: Arco 771, Livermore

QC Sample Group: 3A19701-12

Reported: Jan 29, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	E. Cunanan	E. Cunanan	E. Cunanan	E. Cunanan
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jan 23, 1993	Jan 23, 1993	Jan 23, 1993	Jan 23, 1993
QC Sample #:	G9301220-01A	G9301220-01A	G9301220-01A	G9301220-01A
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.15	0.15	0.16	0.45
Matrix Spike % Recovery:	75	75	80	75
Conc. Matrix Spike Dup.:	0.15	0.15	0.15	0.43
Matrix Spike Duplicate % Recovery:	75	75	75	72
Relative % Difference:	0.0	0.0	6.5	4.5

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Maria Lee
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. 771-92-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA	Address (Consultant) 3315 Almaden Expy, Suite 34, San Jose, CA 94555		Contract number 07-773

Method of shipment: Sequoia Courier

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Water	Other	Preservation: Ice	Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH 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 ☐		Hold
S-4.5-B12	1	1	✓			✓		1/15/93														X
S-9-B12	1	1	✓			✓		1/15/93			X		09									X
S-14.5-B12	1	1	✓			✓		1/15/93														X
S-17-B12	1	1	✓			✓		1/15/93			X		10									
S-19.5-B12	1	1	✓			✓		1/15/93														X
S-24-B12	1	1	✓			✓		1/15/93														X
S-26-B12	1	1	✓			✓		1/15/93			X		11									
S-29-B12	1	1	✓			✓		1/15/93														X
S-43.5-B12	1	1	✓			✓		1/15/93			X		12									

Special detection Limit/reporting:

Special QA/QC:

Remarks: RESNA will call req. samples to be analyzed

Lab number: 9301197

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: B. Silvinski	1/15/93	15[illegible]	Received by: [signature]		
Relinquished by: [signature]	1/15/93	1630	Received by:		
Relinquished by:			Received by laboratory: A. Nagore	1/15	1630

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

APPC-3292 (2-91)

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 771-92-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415)-571-2434	Telephone no. (Consultant) (408)261-4928	Fax no. (Consultant) (408)264-2435
Consultant name RESNA	Address (Consultant) 3315 Almaden Expy., Suite 34, San Jose, CA 95118		Contract number 07-73

Method of shipment: Sequoia 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 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 ☐		Hold
S-4.5-B13	1	1	✓			✓		1/14/93														X
S-9.5-B13	1	1	✓			✓		1/14/93			X		01									
S-14.5-B13	1	1	✓			✓		1/14/93			X		02									
S-19-B13	1	1	✓			✓		1/14/93														X
S-26-B13	1	1	✓			✓		1/14/93			X		03									
S-28-B13	1	1	✓			✓		1/14/93														X
S-34-B13	1	1	✓			✓		1/14/93														X
S-40-B13	1	1	✓			✓		1/14/93			X		04									
S-4.5-B14	1	1	✓			✓		1/14/93														X
S-9.5-B14	1	1	✓			✓		1/14/93			X		05									
S-14.5-B14	1	1	✓			✓		1/14/93														X
S-17-B14	1	1	✓			✓		1/14/93			X		06									
S-19-B14	1	1	✓			✓		1/14/93														X
S-27.5-B14	1	1	✓			✓		1/15/93			X		07									
S-29.5-B14	1	1	✓			✓		1/15/93														X
S-38-B14	1	1	✓			✓		1/15/93			X		08									

Special detection Limit/reporting:

Special QA/QC:

Remarks: RESNA will call regarding samples to be analyzed

Lab number: 9301197

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	
Relinquished by sampler: Barbara Sieminski	1/15/93	1510	Received by:
Relinquished by:	1/15/93	1630	Received by:
Relinquished by:	Date	Time	Received by laboratory: Date: 1/15 Time: 1630

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

APPC-3292 (2-91)

SEQUOIA ANALYTICAL

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

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

Project: ARCO 771, Livermore

Enclosed are the results from 1 soil sample received at Sequoia Analytical on January 15,1993. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
3012033	Soil, S-0115-SPA-D	1/15/93	EPA 5030/8015/8020 EPA 5030/8015/8020 by TCLP Lead by STLC Corrosivity, Ignitability and Reactivity

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

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Jan 15, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil, Composite	Received:	Jan 15, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jan 21, 1993
Attention: Joel Coffman	First Sample #:	301-2033		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 301-2033 S-0115-SPA-D
Purgeable Hydrocarbons	1.0	N.D.
Benzene	0.0050	N.D.
Toluene	0.0050	N.D.
Ethyl Benzene	0.0050	N.D.
Total Xylenes	0.0050	N.D.
Chromatogram Pattern:		--

Quality Control Data

Report Limit Multiplication Factor:	1.0
Date Analyzed:	1/19/93
Instrument Identification:	GCHP-7
Surrogate Recovery, %: (QC Limits = 70-130%)	94

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Jan 15, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	TCLP Extract of Soil	Received:	Jan 15, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jan 21, 1993
Attention: Joel Coffman	First Sample #:	301-2033		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 301-2033 S-0115-SPA-D
Purgeable Hydrocarbons	50	N.D.
Benzene	0.50	N.D.
Toluene	0.50	N.D.
Ethyl Benzene	0.50	N.D.
Total Xylenes	0.50	N.D.
Chromatogram Pattern:		--

Quality Control Data

Report Limit Multiplication Factor:	20
Date Analyzed:	1/20/93
Instrument Identification:	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	104

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Jan 15, 1993
3315 Almaden Expwy., Suite 34	Sample Descript:	Soil, S-0115-SPA-D	Received:	Jan 15, 1993
San Jose, CA 95118			Analyzed:	see below
Attention: Joel Coffman	Lab Number:	301-2033	Reported:	Jan 21, 1993

LABORATORY ANALYSIS by STLC

Analyte	Date Analyzed	Detection Limit mg/L	Sample Result mg/L
Lead	1/21/93	0.10	N.D.

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

SEQUOIA ANALYTICAL

Maria Lee

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	ARCO 771, Livermore	Sampled:	Jan 15, 1993
3315 Almaden Expwy., Suite 34	Sample Descript:	Soil, S-0115-SPA-D	Received:	Jan 15, 1993
San Jose, CA 95118			Analyzed:	1/16-19/93
Attention: Joel Coffman	Lab Number:	301-2033	Reported:	Jan 21, 1993

CORROSIVITY, IGNITABILITY, AND REACTIVITY

Analyte	Detection Limit	Sample Results
Corrosivity:		
pH	N.A.	7.1
Ignitability:		
Flashpoint (Pensky-Martens), °C	N.A.	> 100 °C
Reactivity:		
Sulfide, mg/kg	10	N.D.
Cyanide, mg/kg	0.50	N.D.
Reaction with water	N.A.	Negative

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

SEQUOIA ANALYTICAL

Maria Lee
Project Manager

SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 301-2033

Reported: Jan 21, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	M. Nipp	M. Nipp	M. Nipp	M. Nipp
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jan 19, 1993	Jan 19, 1993	Jan 19, 1993	Jan 19, 1993
QC Sample #:	301-2035	301-2035	301-2035	301-2035
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.16	0.16	0.16	0.47
Matrix Spike % Recovery:	80	80	80	78
Conc. Matrix Spike Dup.:	0.16	0.15	0.16	0.46
Matrix Spike Duplicate % Recovery:	80	75	80	77
Relative % Difference:	0.0	6.5	0.0	2.2

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Maria Lee
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

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 301-2033

Reported: Jan 21, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	M. Nipp	M. Nipp	M. Nipp	M. Nipp
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Jan 20, 1993	Jan 20, 1993	Jan 20, 1993	Jan 20, 1993
QC Sample #:	301-1964	301-1964	301-1964	301-1964
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	9.8	9.7	10	30
Matrix Spike % Recovery:	98	97	100	100
Conc. Matrix Spike Dup.:	10	9.9	10	30
Matrix Spike Duplicate % Recovery:	100	99	100	100
Relative % Difference:	2.0	2.0	0.0	0.0

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Maria Lee
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

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(415) 364-9600 • FAX (415) 364-9233

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

Client Project ID: ARCO 771, Livermore

QC Sample Group: 301-2033

Reported: Jan 21, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Lead STLC	Cyanide	pH	Reactive Sulfide	Flashpoint
Method:	EPA 7421	EPA 9010	EPA 9045	EPA 9030	EPA 1010
Analyst:	S. Chin	A. Savva	M. Fazzio	K. Follett	K. Follett
Reporting Units:	mg/L	mg/kg	N.A.	mg/kg	°C
Date Analyzed:	Jan 21, 1993	Jan 14, 1993	Jan 16, 1993	Jan 19, 1993	Jan 20, 1993
QC Sample #:	301-2033	301-0652	301-2033	301-1802	301-0017
Sample Conc.:	N.D.	N.D.	7.1	N.D.	>100
Spike Conc. Added:	0.50	10	N.A.	1300	N.A.
Conc. Matrix Spike:	0.50	10	N.A.	1300	N.A.
Matrix Spike % Recovery:	100	100	N.A.	100	N.A.
Conc. Matrix Spike Dup.:	0.47	10	7.0	1400	>100
Matrix Spike Duplicate % Recovery:	94	100	N.A.	108	N.A.
Relative % Difference:	6.2	0.0	1.4	7.4	0.0

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Maria Lee
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. 771-92-2

Chain of Custody

ARCO Facility no. 771	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA	Address (Consultant) 3315 Almaden Expy, Suite 34, San Jose, CA 94555		Contract number 07-73

Method of shipment: Sequoia 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 (TCLP extr. meth.)	BTEX/TPH 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 ☐	STLC Lead	RCI
S-0115-SPA		1	✓			✓		01/15/93		X		X									X	X
S-0115-SPB		1	✓			✓		01/15/93		X		X									X	X
S-0115-SPC		1	✓			✓		01/15/93		X		X									X	X
S-0115-SPD		1	✓			✓		01/15/93		X		X									X	X

Special detection Limit/reporting: 3012033

Special QA/QC:

Remarks: 48 hr turnaround time. Composite Sample

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

	Date	Time
Relinquished by sampler: Barbara Sieminski	1/15/93	1510
Relinquished by:	1/15/93	1630
Relinquished by:	Date	Time

Received by:

Received by:

Received by laboratory: | Date: 1/15/93 | Time: 1630

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

APPC-3292 (2-91)

APPENDIX G

SIEVE ANALYSES REPORT

DRILLER HEW DRILLING INC.

ENGINEER

ANALYSIS BY BILL SCHAFER
DATE May 22, 1992

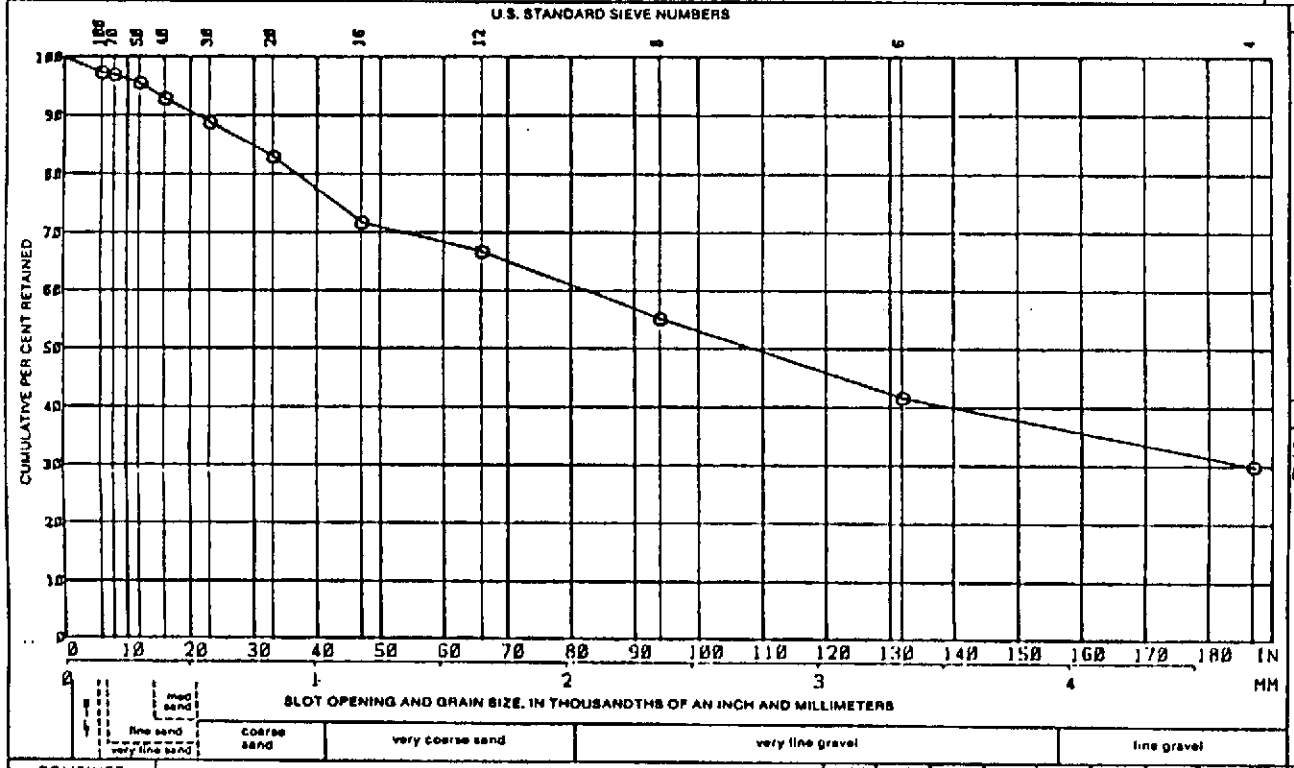
JOB NAME ARCO STATION 771

LOCATION 899 RINCON AVENUE

JOHNSON I.D. NUMBER 92135A
SAMPLE SENT IN BY RESNA

SAND ANALYSIS REPORT

Johnson Filtration Systems Inc.
World Leader through Talent & Technology™
P.O. Box 64118 • St. Paul, Minnesota 55164-0118
612-636-3900 • 1-800-VEE-WIRE • FAX 612-636-3171



TEST HOLE DATA

DIAMETER 12.000

DEPTH 45

DRILLING METHOD
AUGER

DRILLING FLUID

GEOPHYSICAL LOGS

STATIC WATER LEVEL
31

COMMENTS

SAMPLE S-35, 5-B1S
GRAVELY CLAY

WELL DATA

CASING DIAMETER 6.000

DESIRED YIELD

WELL APPLICATION
RECOVERY

DESIGN RECOMMENDATIONS

RECOMMEND:
40 SLOT SCREEN (0.040IN)
WITH 10-14 SILICA OR
EQUIVALENT.

SCREEN RECOMMENDATIONS

DIAMETER

SLOT	LENGTH	SETTING

COMBINED SAMPLE DEPTHS	PHYSICAL SAMPLE DESCRIPTION		4.76	3.36	2.38	1.68	1.19	.840	.590	.420	.297	.210	.149	.074	.053	TOTAL WT.
		mm														
		Inches	.187	.132	.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	
S-35-B1T	⊙ SILT TO FINE GRAVEL 2ØØ 3/8IN. OR GREATER.	CUMULATIVE % RETAINED	38.8	41.7	55.2	68.8	71.7	83.8	88.8	92.8	95.5	96.9	97.3			223.8

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