Applied GeoSystems, Inc.
A RESNA Company

RESNA
Working To Restore Nature

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INITIAL SUBSURFACE INVESTIGATION
at
ARCO Station 2185
9800 East 14th Street
Oakland, California

62026.01

Report prepared for

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

by
RESNA Industries Inc.

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September 28, 1992

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INITIAL SUBSURFACE INVESTIGATION
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Oakland, California

For ARCO Products Company

INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA Industries Inc. (RESNA) performed an initial subsurface investigation at ARCO Station 2185, located at 9800 East 14th Street, Oakland, California. The objectives of this investigation were to evaluate the presence of gasoline hydrocarbons in the soil; evaluate impact to first encountered groundwater; and evaluate the gradient and flow direction of first encountered groundwater beneath the site. Hydrocarbon impacted soil was encountered beneath the site during a preliminary subsurface investigation performed by Roux Associates (Roux) of San Mateo, California, in May of 1991, in conjunction with replacement of underground gasoline-storage tanks (USTs) and product lines (Roux, June 1992).

Work performed for this investigation included drilling four onsite soil borings (B-9 through B-12); constructing four 4-inch diameter groundwater monitoring wells (MW-1 through MW-4) in borings B-9 through B-12, respectively; developing the wells; measuring groundwater levels; sampling the soil and groundwater; surveying the monitoring wells; and submitting selected soil and groundwater samples collected from the borings/monitoring wells for laboratory analyses. This report includes summaries of previous work performed at the site, field procedures used during this investigation, the results of laboratory analyses, interpretation of data, and conclusions.

The work was performed in accordance with the Work Plan written by Roux (Roux, December 1991). Work was initiated after completion of UST and product line replacement at the site.

SITE DESCRIPTION AND BACKGROUND

General

ARCO Station 2185 is located in a commercial and residential area on the southeastern corner of East 14th Street and 98th Avenue in Oakland, California. The location of the site is shown on the Site Vicinity Map, Plate 1. The site is on a relatively flat, asphalt and concrete covered lot at an elevation of approximately 25 feet above mean sea level (msl). The site is currently occupied by an operating AM/PM mini-market and self-serve gasoline station with regular unleaded and supreme unleaded gasoline pumps. Pertinent site features include two service islands (located in the northern section of the site), a station building, four newly installed USTs in the northeastern portion of the site, four groundwater monitoring wells, and two vapor extraction wells. These site features are shown on Plate 2, Generalized Site Plan.

Geology and Hydrogeology

The site is located in the East Bay Plain, an area of generally low relief lying between San Francisco Bay to the west and the foothills of the Diablo Range to the east. The East Bay Plain in underlain by about 1,000 ft. of unconsolidated Quaternary sediments, consisting mostly of sand and silt deposited by alluvial systems, and clay and silt deposited in shoreline and estuarine environments (Hickenbottom and Muir, 1988). The soils in the vicinity of the site have been mapped as medium-grained alluvium consisting of moderately sorted fine sand, silt and clayey silt, with localized layers of coarse sand (Helley et al., 1979).

The direction of groundwater flow in the vicinity of the site appears to be to the west-southwest based on regional and local topography and drainage patterns.

PREVIOUS WORK

In May 1991, Roux conducted a preliminary tank replacement assessment at the site (Roux, August 1991). The purpose of the assessment was to evaluate the presence of gasoline hydrocarbons in the soil in the area of the existing USTs prior to the planned tank removal activities. The investigation consisted of drilling and sampling four soil borings (B1 through B4) in the area of the existing USTs, submitting selected soil samples for laboratory analyses (total petroleum hydrocarbons (TPHg) and benzene, toluene, ethylbenzene and total xylenes (BTEX) by EPA Method 8015/8020) and drilling two soil borings and installing two vapor-extraction wells (VW-1 and VW-2) to be used for a vapor extraction test (VET). Locations of the soil borings and vapor extraction wells are shown on Plate 2.

Based on laboratory analytical results, petroleum hydrocarbons were detected in soil samples collected from the borings B1 through B4 at depths of 5 and 10 feet below ground surface, adjacent to the former USTs. Concentrations of TPHg in the soil ranged from nondetectable (less than 1.0 part per million [ppm]) to 350 ppm, concentrations of BTEX ranged from nondetectable (less than 0.005 ppm) to 19 ppm. Results of laboratory analyses are shown on Table 1, Cumulative Results of Laboratory Analyses of Soil Samples.

On June 6, 1991, Roux conducted a one day VET to evaluate whether subsurface soil conditions at the site were favorable for soil venting remediation techniques (Roux, July 1991). A vacuum was applied to vapor well VW-2 while vapor well VW-1 was monitored for an air pressure change, to determine the radius of influence. No air pressure change was detected in vapor well VW-1, indicating subsurface conditions at the site will not allow a capture radius of 21 feet, the distance between the two wells. From these results Roux concluded that the subsurface conditions at this site would not be suitable for soil venting remediation techniques.

On September 10, 1991, Roux performed a limited subsurface investigation to evaluate the impact of gasoline hydrocarbons on the soil in the area of the proposed new underground storage tank pit (Roux, November 1991). The investigation included drilling four soil borings (B5 through B8), collecting samples for laboratory analyses.

The results of laboratory analyses indicated that the soil in borings B5 and B6, located on the eastern edge of the proposed tank pit, had not been impacted by gasoline hydrocarbons. However, results of laboratory analyses of soil samples from borings B7 and B8, indicated the presence of relatively minor concentrations of TPHg and BTEX at depths of 11 and 13 feet. Concentrations of TPHg in these borings at 11 and 13 feet ranged from 1.3 to 1.7 ppm, and concentrations of BTEX ranged from 0.0053 to 0.27 ppm. Results of laboratory analyses are summarized in Table 1.

On October 30, 1991, three USTs were excavated and removed from the site by ARCO's tank replacement contractor, Paradiso Construction Co. (Paradiso) of Oakland, California (Roux, June 17, 1992). The former tank excavation for these USTs is shown on Plate 2. Because visibly impacted soil was observed in the former tank pit excavation, the pit was over-excavated prior to sampling. Paradiso over-excavated the former tank pit to a depth of approximately 16 feet, which was approximately one foot below the static water level, and widened the excavation in all directions between 3 and 6 feet. Following sampling on November 6, 1991, the bottom five feet of the former tank cavity were filled with pea gravel, and the remainder of the cavity was filled with clean, imported fill material.

On November 6, 1991, twelve soil samples (SW-1 through SW-12) were collected by Roux from the sidewalls of the former UST excavation (Roux, June 17, 1992). The samples were analyzed for TPHg and BTEX by Sequoia Analytical of Concord, California. On November 5, 1991, former product and vent lines were excavated and removed by Paradiso. Because visibly impacted soil was observed beneath the product dispensers, selected areas were over-excavated prior to sampling. Fourteen soil samples (L-1 through L-14) were collected from below the removed lines and dispensers. These samples were also analyzed for TPHg and BTEX by Sequoia Analytical. Results of laboratory analyses are presented in Table 1.

Roux concluded that although most of the impacted soil was removed from below the former tanks and dispensers during over-excavation, analytical results of the soil samples indicate that residual gasoline hydrocarbons may still be present in the vicinity of the former product dispensers and the former tank excavation (Roux, June 17, 1992).

FIELD WORK

Drilling

Field work at the site was conducted in accordance with the Work Plan written by Roux (Roux, December 18, 1991), and RESNA's Site Safety Plan (RESNA, June 16, 1992). A description of the field methods used is included in Appendix A, Field Protocol. A permit for monitoring well construction was obtained from the Alameda County Flood Control and Water Conservation District, Zone 7 (ACFCWCD) prior to drilling. A copy of the permit is included in Appendix B. Four soil borings (B-9 through B-12) were drilled at the site on July 7 and 8, 1992, under the direction of a RESNA geologist.

Boring B-9 was drilled in the northeastern portion of the site and completed as groundwater monitoring well MW-1 to investigate the presence of gasoline hydrocarbons in the inferred upgradient direction of the former USTs. Boring B-10 was drilled between the southwestern edge of the site and the former USTs, and completed as groundwater monitoring well MW-2 to investigate the presence of gasoline hydrocarbons in the inferred downgradient direction of the former USTs. Boring B-11 was drilled in the northwestern portion of the site, near the gasoline dispenser islands, and completed as groundwater monitoring well MW-3 to evaluate the presence of gasoline hydrocarbons in the vicinity of the dispenser islands. Boring B-12 was drilled near the southwestern corner of the site, and completed as groundwater monitoring well MW-4 to investigate the presence of gasoline hydrocarbons in the groundwater.

Borings B-9 through B-12 were drilled to depths of approximately 24 and 29 feet.

Soil Sampling and Description

Soil samples were described in accordance with the Unified Soil Classification System (Plate 3), and collected at the depths as indicated on the Logs of Borings B-9 through B-12 (Plates 4 through 11). Forty four samples were collected for description and possible laboratory analyses at intervals of 5 feet or less from the ground surface to the total depth of the borings. A summary of the sampling methods used is presented in Appendix A. Field

monitoring of organic vapor concentrations in soil samples was performed using an organic vapor meter (OVM).

The earth materials encountered during this investigation consisted primarily of clayey silt with sand interbedded with clayey and silty sands. Graphic interpretations of the soil stratigraphy encountered in the borings are shown on Geologic Cross Sections A-A' and B-B' (Plates 12 and 13). The locations of these cross sections are shown on Plate 2.

Four lithologic units were encountered at the site. Probable fill material underlies the asphalt section, and consists of about 7 feet of silty clay beneath the northern-central portion and about 2 feet of sandy silt beneath the remainder of the site. The fill contains brick, porcelain, and bark fragments. Underlying the fill is a silty clay to clayey silt unit, approximately 4 feet in thickness. This clay to silt is underlain by a clayey silt to silty sand water-bearing unit that is between about 13 and 17 feet thick. This water-bearing unit is underlain by a silty clay perching layer of unknown thickness. Rootholes and rootfibers were observed within some of the clayey and silty layers of the water-bearing unit, which was encountered at depths between 12 to 14 feet. The water table appears to be unconfined due to the absence of a confining layer and the apparent drop of initial water levels measured in most of the completed wells.

Soil cuttings generated from the borings were temporarily stored behind the station building, (along the southeastern edge) and placed on and covered with plastic sheeting pending proper disposal. After completion of drilling on July 8, 1992, four soil samples were collected from the stockpile and submitted for compositing and laboratory analyses. The field methods used to collect these samples are described in Appendix A.

Monitoring Well Construction and Development

Four groundwater monitoring wells (MW-1 through MW-4) were constructed in borings B-9 through B-12, respectively. The monitoring wells were constructed as summarized in Appendix A. The wells were completed with four-inch diameter, schedule 40 polyvinyl chloride (PVC) casing and the screened interval consisted of four-inch-diameter, 0.020-inch machine slotted PVC. The screened portions of wells MW-1, MW-3 and MW-4 were set

from depths of approximately 9 to 24 feet. The screened portion of well MW-2 was set from depths of approximately 8 to 24 feet.

The wells were developed on July 20 and 21, 1992, to remove fine-grained sediments and to allow better communication between the water-bearing zone and the groundwater monitoring well. Development was performed by a RESNA Technician. A description of the methods used to develop the wells is included in Appendix A.

Groundwater Level Measurement and Sampling

Groundwater monitoring wells (MW-1 through MW-4) were monitored on July 24, 1992 by RESNA. Depths-to-water (DTW) were measured, the wells were purged (approximately five wells volumes were removed), and water samples were collected for analysis. The water samples were visually inspected for the presence of floating product. No evidence of floating hydrocarbon product was observed in wells MW-1, MW-2, and MW-4. However, a hydrocarbon sheen was observed in well MW-3, and therefore MW-3 was not sampled. On August 26, 1992, DTW were measured by Emcon Associates (EMCON) of San Jose, California. Data is presented in Table 2.

EVALUATION OF GROUNDWATER GRADIENT

On July 23, 1992, the wellheads of the new groundwater monitoring wells MW-1 through MW-4, and existing vapor-extraction wells VW-1 and VW-2, were surveyed for top-of-casing (TOC) elevations to a local City of Oakland Datum benchmark by John E. Koch, Registered Land Surveyor, of Oakland, California. The results of this wellhead survey are included in Appendix C, Wellhead Survey. Groundwater elevations for each well were calculated by subtracting DTW measurements from the TOC elevation. The groundwater gradients as interpreted from the July 24, and August 26, 1992, DTW measurements were approximately 0.002 with a flow directions to the southwest as depicted on Plates 14 and 15, Groundwater Gradient Maps. The DTW measurements, TOC elevations, and calculated groundwater elevations are presented in Table 2, Cumulative Groundwater Monitoring Data.

LABORATORY METHODS

Soil Samples

Eleven soil samples collected from borings B-9 through B-12 were analyzed by Sequoia Analytical, of Redwood City, California (Hazardous Waste Testing Laboratory Certification # 1210), in accordance with the Roux Work Plan as approved by ACFCWCD, for TPHg and BTEX using Environmental Protection Agency (EPA) methods 5030/8015/8020. In addition, selected representative soil samples were analyzed by Soil Foundation Systems, Inc., of Fremont, California, a geotechnical laboratory, for grain size distribution, to obtain information for use in future recovery well construction. At the request of ARCO's contractor, Dillard Trucking, Inc. of Byron, California, the samples collected from the soil stockpile were composited and analyzed by Sequoia Analytical for TPHg and BTEX using EPA Methods 5030/8015/8020.

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.

Groundwater Samples

Groundwater samples obtained on July 24, 1992, from monitoring wells MW-1 through MW-4, were analyzed for TPHg and BTEX using EPA Methods 5030/8020/ DHS LUFT Method. The analyses were performed by Columbia Analytical Services of San Jose, California (Hazardous Waste Testing Laboratory Certification #1426).

RESULTS OF LABORATORY ANALYSES

Soil Samples

Results of laboratory analyses of the eleven soil samples from borings B-9 through B-12 are summarized in Table 1, Cumulative Results of Laboratory Analyses of Soil Samples. Chain

of Custody Records and Laboratory Analytical Reports of Soil Samples are included in Appendix D of this report.

Laboratory results of soil samples collected from boring B-12, located crossgradient of the former USTs, in the southwestern corner of the site, and B-9 located upgradient, in the east-central portion of the site, indicated nondetectable concentrations of TPHg (less than 1 ppm) and BTEX (less than 0.0050 ppm).

Laboratory results of soil samples collected from boring B-10, located directly downgradient of the former USTs, in the west-central portion of the site, indicated a concentration of 9.3 ppm TPHg at a depth of 9-1/2 feet, and 220 ppm at a depth of 12 feet in the capillary fringe zone; concentrations of BTEX ranging from 0.014 ppm to 6.3 ppm, at 9-1/2 and 12 feet, respectively; and nondetectable concentrations of TPHg and BTEX in the sample collected at a depth of 23 feet, below the water-bearing unit in the silty clay perching layer.

Laboratory results of soil samples collected from boring B-11, located cross gradient of the former USTs and downgradient of the dispenser islands, in the northwestern portion of the site, indicated nondetectable concentrations of TPHg at depths of 10-1/2 and 29 feet; concentrations of BTEX in the soil sample from a depth of 10-1/2 feet were nondetectable, with the exception of 0.0060 ppm benzene; and the soil sample from a depth of 29 feet contained relatively minor amounts of toluene, ethylbenzene, and total xylenes (less than 0.078 ppm) and benzene was nondetectable.

Sieve analysis results of the selected soil samples collected from boring B-10 indicated that the soil at a depth of 10 feet was a silt with fine sand; the soil at 14 feet was a silty clay; the soil at 18.5 feet was a clayey silt; and the soil at 20.5 feet was a slightly sandy, clayey silt. Laboratory Analytical Reports of the sieve analyses are included in Appendix E.

Groundwater Samples

Results of laboratory analyses of water samples from MW-1 through MW-4 are presented in Table 3, Results of Laboratory Analysis of Groundwater Samples. Chain of Custody Records and Laboratory Analytical Reports of Groundwater Samples are included in Appendix F.

Laboratory analyses of samples collected from upgradient groundwater monitoring well MW-1 and cross gradient well MW-4, indicated nondetectable concentrations of TPHg (less than 50 parts per billion [ppb]) and BTEX (less than 0.5 ppb) in the groundwater.

Laboratory analyses of the groundwater sample collected from downgradient well MW-2, located on the western edge of the former tank pit, indicated concentrations of 5,900 ppb TPHg, 510 ppb benzene, 370 ppb ethylbenzene, and 430 ppb total xylenes. Toluene was nondetectable (less than 10 ppb; the Method Reporting Limit was raised by the laboratory due to high analyte concentration requiring sample dilution).

The groundwater in monitoring well MW-3, located crossgradient of the USTs and downgradient of the product dispensers, was not sampled due to the presence of a product sheen.

Graphic representations of the detected concentrations of TPHg and benzene in the ground water are shown on Plate 16, TPHg Concentrations in Groundwater, and Plate 17, Benzene Concentrations in Groundwater.

Stockpiled Soil Cuttings

Results of laboratory analyses of the composited soil samples indicated nondetectable concentrations of TPHg (less than 1.0 ppm) and concentrations of BTEX ranging from nondetectable (less than 0.005 ppm) to 0.012 ppm. The results of composite soil sample analyses are included in Table 1, Cumulative Results of Laboratory Analyses of Soil Samples. The soil stockpile was disposed of by ARCO's contractor, Dillard Trucking Inc., of Byron, California, on July 17, 1992.

CONCLUSIONS

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

- Gasoline hydrocarbons in the soil at the site appear to be located in the area of the former USTs and former product lines, at depths of less than 13 feet as indicated by the presence of TPHg in downgradient boring B-10, in the previous borings B1 through B4 (drilled in the area of the former USTs), in borings B7 and B8 (drilled in the area of the new USTs), and in product line samples L-3 through L-5, L-7 through L-11, and product line sample L-13.

- Gasoline hydrocarbons in the soil beneath the site appears to have been delineated vertically in the area of the former USTs at a depth of 23 feet based on analytical data from samples collected in the silty clay perching layer. The lateral extent of gasoline hydrocarbons has not been delineated at the site.

- First groundwater was encountered beneath the site at a depth of approximately 13 feet in wells MW-1 through MW-4. The groundwater gradient was estimated to be approximately 0.002 with a flow direction to the southwest.

- Groundwater impacted by gasoline hydrocarbons at the site appears to be limited to the area of the former USTs and the existing product dispenser islands, as indicated by the presence of TPHg and BTEX in MW-2 and a product sheen in MW-3. Groundwater beneath the upgradient eastern and crossgradient southern portions of the site does not appear to have been impacted by gasoline hydrocarbons as indicated by nondetectable TPHg and BTEX in the groundwater samples collected from MW-1 and MW-4.

- The presence of gasoline hydrocarbons in the soil beneath the site appears to be related to the migration of hydrocarbons upward from the local water table because the greatest TPHg concentrations in the soil appears to be limited to the capillary fringe zone.

DISTRIBUTION

It is recommended that copies of this report be forwarded to:

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

Mr. Barney Chan
Alameda County Health Care Services Agency
Department of Environmental Health
Division of Hazardous Materials
80 Swan Way, Room 200
Oakland, California 94621

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 groundwater with respect to hydrocarbon-product at the subject site in the immediate areas of and related to the former gasoline-storage tanks. No soil engineering or geotechnical implications are stated or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this investigation is made from a limited number of observation points. Subsurface conditions may vary away from the data points available. Additional work, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of investigation.

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Helley, E. S., K. R. Lajoie, W. E. Spangle, and M. L. Blair. 1979. Flatland Deposits of the San Francisco Bay Region, California, U.S. Geological Survey Professional Paper 943.

Hickenbottom, K. and Muir, K. 1988. Geohydrology and Ground water - Quality Overview, East Bay Plain Area, Alameda County, California. Alameda County Flood Control and Water Conservation District 205 (j) Report.

RESNA, June 16, 1992. Site Safety Plan for ARCO Station 2185, 9800 E. 14th Street, Oakland California. 62026.01.

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Roux, August 8, 1991. Preliminary Tank Replacement Assessment, ARCO Facility No. 2185, 9800 East 14th Street, Oakland, California. Doc #A102W01.1.8

Roux, November 22, 1991. Limited Subsurface Soil Investigation, ARCO Facility No. 2185, 9800 East 14th Street, Oakland, California. Doc #A102W03.1.1

Roux, December 18, 1991. Site Investigation Work Plan, ARCO Facility No. 2185, 9800 East 14th Street, Oakland California. Doc #A119W02.1.1

Roux, June 17, 1992. Underground Storage Tank Removal and Soil Sampling, ARCO Facility No. 2185, East 14th Street, Oakland California. Doc #A119W01.1.2

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

LEGEND

⊙ = Site Location

N

Approximate Scale

2000 1000 0 2000 4000

feet

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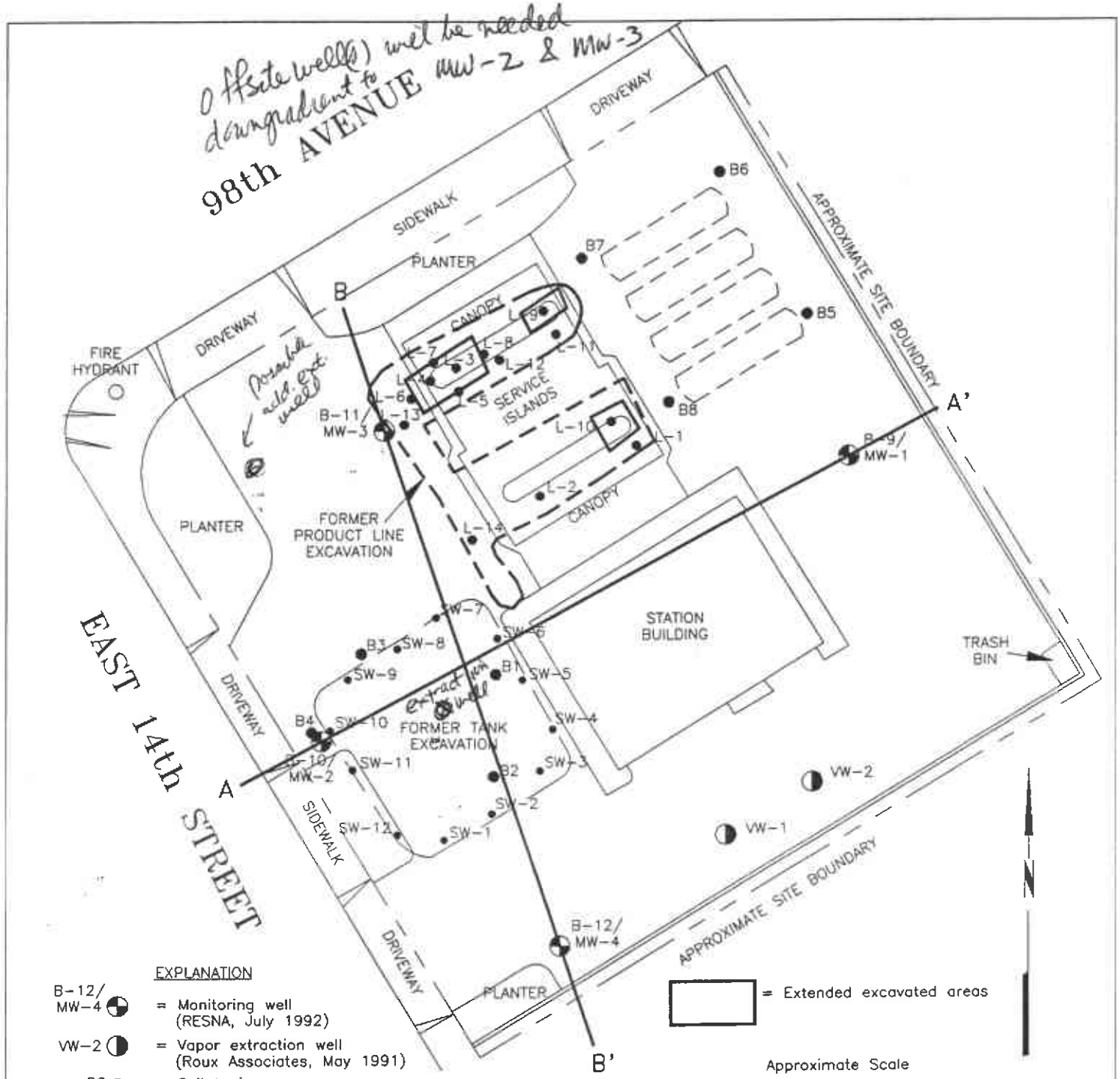
SITE VICINITY MAP
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
1



Source: Modified from a site plan provided by Roux Associates dated December 1991. Also surveyed by John Koch, Licensed Land Surveyor, July 1992.

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GENERALIZED SITE PLAN
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 2

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, grave-sand-silt mixtures.			OL	Organic silts and organic silt-clays of low plasticity.
		GC	Clayey gravel, gravel-sand-clay mixtures.		SILTS AND CLAYS LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	SAND AND SANDY SOILS	SW	Well-graded sand or gravelly sands, little or no fines.			CH	Inorganic clays of high plasticity, fat clays.
		SP	Poorly-graded sands or gravelly sands, little or no fines.			OH	Organic clays of medium to high plasticity, organic silts.
		SM	Silty sands, sand-silt mixtures.				
		SC	Clayey sands, sand-clay mixtures.	HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.

Depth through which sampler is driven

Relatively undisturbed sample

No sample recovered

Static water level observed in well/boring

Initial water level observed in boring

S-10 Sample number

Sand pack

Bentonite

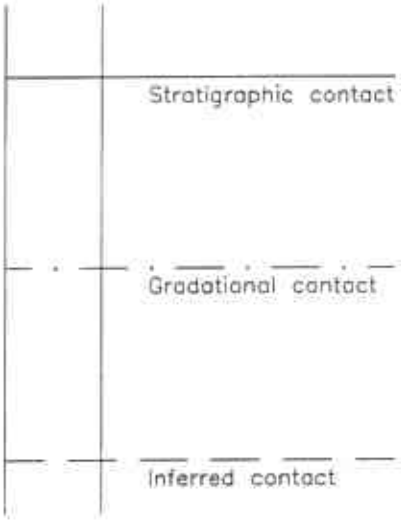
Neat cement

Caved native soil

Blank PVC

Machine-slotted PVC

P.I.D. Photoionization detector



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

GRADATIONAL AND INFERRED CONTACT 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.

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UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 3

Depth of boring: 24 feet Diameter of boring: 10.25 inches Date drilled: 07/08/92

Well depth: 24 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 9 to 24 feet Slot size: 0.020-inch

Drilling Company: Exploration Geoservices Driller: John and Dennis

Method Used: Hollow-Stem Auger Field Geologist: Erin McLucas

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 (5 inches).	
				GW	Gravel with sand, angular gravel, brown, dry, dense; baserock (7 inches).	
2				ML	Sandy silt, brown, damp, medium plasticity, very stiff; brick fragments: fill.	
				ML	Clayey silt with gravel, black, damp, medium plasticity, very stiff.	
4						
6	S-5.5	5 13 13	0			
				SM	Silty sand with gravel, fine-grained sand, brown with black mottling, damp, medium dense; rootholes.	
8						
10	S-10.5	7 17 13	0	SP	Sand with gravel, medium-grained sand, brown, moist, dense.	
				ML	Clayey silt with sand, olive to brown, moist to wet, medium plasticity, stiff; rootholes.	
12	S-13	3 4 6	0	▽ ▼		
14						
	S-15.5	3 3 6	0			
16						
18						
20	S-20.5	6 6 8	0			
				SM	Silty sand, medium-grained, olive to brown, wet, medium dense.	

(Section continues downward)

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LOG OF BORING B-9/MW-1

ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 4

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
				ML	Clayey silt with sand, olive to brown, moist to wet, medium plasticity, stiff; rootholes.	
				SM	Silty sand, medium-grained sand, olive to brown, wet, medium dense.	
22				ML	Clayey silt with sand, olive to brown, damp, medium plasticity, stiff.	
24					Total depth = 24 feet.	
26						
28						
30						
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						

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LOG OF BORING B-9/MW-1

ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 5

Depth of boring: 24 feet Diameter of boring: 10.25 inches Date drilled: 07/07/92

Well depth: 24 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 8 to 24 feet Slot size: 0.020-inch

Drilling Company: Exploration Geoservices Driller: John and Dennis

Method Used: Hollow-Stem Auger Field Geologist: Erin McLucas and Rob Campbell

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				GW	Asphalt (2 inches).	
				MH	Sandy gravel, angular gravel, brown, damp, medium dense: baserock (4 inches).	
2					Sandy silt, damp, black, high plasticity, stiff; fragments of bark and porcelain: probable fill.	
				CH	Silty clay with gravel, black, damp, high plasticity, very stiff.	
4	S-5	7 15 16	0			
6				SP	Sand with silt, fine-grained, brown, damp, medium dense; root fibers and rootholes.	
8					Color change to olive with brown mottling at 8-1/2 feet; noticeable hydrocarbon odor.	
10	S-9.5 S-10	3 7 6	18.5		Becoming moist at 11 feet.	
12	S-11.5 S-12	4 7 8	344			
	S-13.5	3 7 9	148.8	MH	Clayey silt with sand, olive with brown mottling, very moist, high plasticity, stiff; encountered apparent free product at 14 feet.	
14	S-15 S-15.5	5 5 7	92			
16				SM	Silty sand, medium-grained, olive with brown mottling, wet, medium dense; rootholes.	
18	S-18.5 S-19	4 7 10	8			
20	S-20 S-20.5	4 7 9	9.7	ML	Clayey silt with coarse-grained sand lenses, brown, damp to moist, medium plasticity, stiff to very stiff.	

(Section continues downward)

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PROJECT: 62026.01

LOG OF BORING B-10/MW-2

ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 6

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22	S-22 S-22.5 S-23	4 7 10 4 5 8	0 0	ML	Clayey silt with coarse-grained sand lenses, brown, damp to moist, medium plasticity, stiff to very stiff.	
24					Total depth = 24 feet.	
26						
28						
30						
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						

RESNA
Working to Restore Nature

PROJECT 62026.01

LOG OF BORING B-10/MW-2
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
7

Depth of boring: 29 feet Diameter of boring: 10.25 inches Date drilled: 07/07/92

Well depth: 24 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 9 to 24 feet Slot size: 0.020-inch

Drilling Company: Exploration Geoservices Driller: John and Dennis

Method Used: Hollow-Stem Auger Field Geologist: Erin McLucas and Rob Campbell

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 (5 inches).	
				CL	Silty clay, black, damp, medium plasticity, very stiff; brick fragments: fill.	
2						
4					Increasing gravel.	
	S-5.5	4 7 12	0			
6						
8				SC	Clayey sand, fine-grained, light green, damp, medium dense; rootholes, slight hydrocarbon odor.	
10	S-10.5	6 7 9	0.2			
12			288		▽ ▼	
14						
	S-15	6 8	40			
	S-15.5	10		CH	Silty clay, gray with brown mottling, moist to wet, high plasticity, very stiff.	
16	S-16.5	6 7	49	SP	Sand, medium-grained, brown, wet, medium dense; noticeable hydrocarbon odor.	
		10		CH	Silty clay, gray with brown mottling, moist, high plasticity, very stiff.	
18						
20	S-20	20/12"	0	MH	Silt with clay and coarse-grained sand, brown, wet, high plasticity, stiff.	
	S-21 S-21.5	4 6 7	0			

(Section continues downward)

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PROJECT: 62026.01

LOG OF BORING B-11/MW-3

ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 8

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22	S-21	4	0	MH	Silt with clay and coarse-grained sand, brown, wet, high plasticity, stiff.	
	S-21.5	6 7				
	S-22.5	4	0			
	S-23	7 8		SM	Silty sand, fine-grained, brown, wet, medium dense.	
24	S-24.5	11	10			
	S-25	12	13			
	S-25.5	15				
26	S-26.5	7	0			
	S-27	11 14				
28		8		SP	Sand, medium-grained, gray, wet, medium dense.	
	S-28.5	13 16	0			
30					Total depth = 29 feet.	
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						

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PROJECT 62026.01

LOG OF BORING B-11/MW-3
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
9

Depth of boring: 24 feet Diameter of boring: 10.25 inches Date drilled: 07/08/92

Well depth: 24 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 9 to 24 feet Slot size: 0.020-inch

Drilling Company: Exploration Geoservices Driller: John and Dennis

Method Used: Hollow-Stem Auger Field Geologist: Erin McLucas

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				GW	Asphalt (3 inches).	
				ML	Sandy gravel, angular gravel, brown, dry, dense: baserock (6 inches).	
2					Sandy silt, brown, damp, medium plasticity, very stiff; brick fragments: fill.	
				CL	Silty clay with gravel, black, damp, medium plasticity, very stiff.	
4	S-5	5 12 13				
6						
				SM	Silty sand, fine-grained, brown, moist, medium dense.	
8						
10	S-10	5 7 7				
				SP-SM	Sand with silt and gravel, medium-grained sand, olive mottled brown, moist, medium dense; rootholes.	
12				ML	Clayey silt with sand, olive mottled brown, moist to wet, medium plasticity, stiff; rootholes, strong hydrocarbon odor.	
	S-13	4 5 7			Becoming wet.	
14						
	S-15.5	4 5 7	0			
16						
18						
20	S-20	5 6 6	0	SM	Silty sand, fine-grained, brown with black mottling, wet, medium dense.	

(Section continues downward)

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LOG OF BORING B-12/MW-4

ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 10

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				SM	Silty sand, fine–grained, brown with black mottling, wet, medium dense.	
	S–23.5	4 4 5	0	CL	Silty clay with sand, brown, damp to moist, medium plasticity, stiff.	
24					Total depth = 24 feet.	
26						
28						
30						
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						

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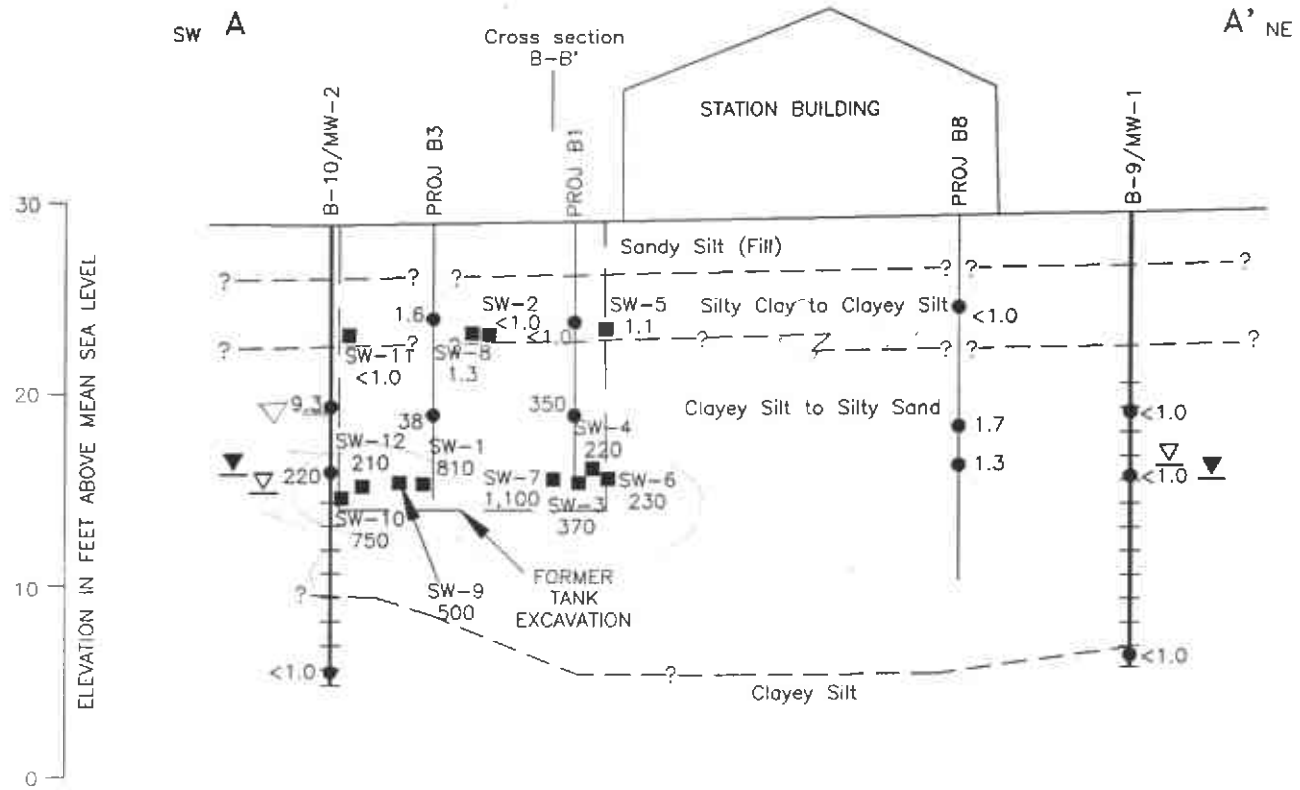
PROJECT 62026.01

LOG OF BORING B–12/MW–4

ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 11



EXPLANATION

SW-10
1,100 ■ = Laboratory analyzed tank pit soil sample (projected) showing concentration of TPHg in ppm

220 ● = Laboratory analyzed soil sample showing concentration of TPHg in ppm

= Well casing

= Well screen

= Boring

▽ = Initial water level in boring

▼ = Static water level in well (08/26/92)

Approximate Horizontal Scale

30 15 0 30 60

feet

Approximate Vertical Scale

10 5 0 10 20

feet

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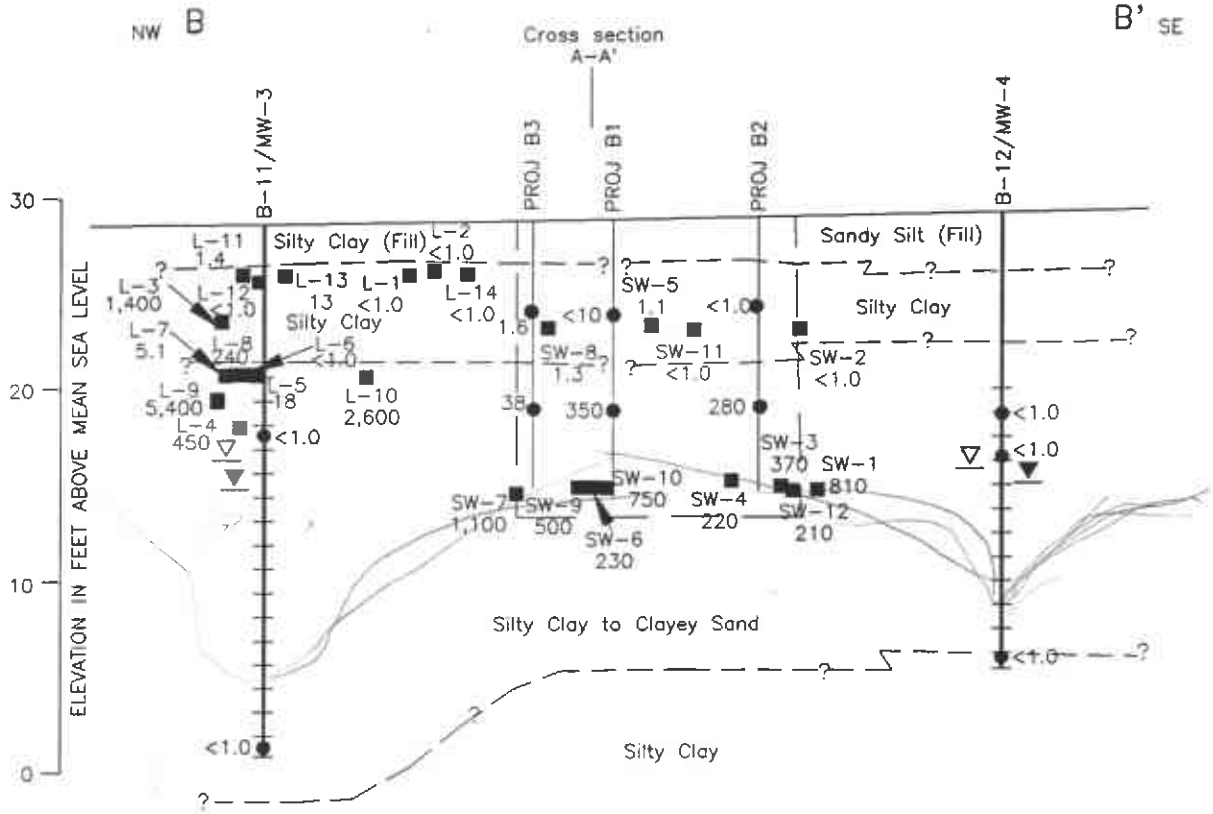
PROJECT 62026.01

GEOLOGIC CROSS SECTION A-A'
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
12



EXPLANATION

SW-7
1100 ■ = Laboratory analyzed tank pit soil sample (projected) showing concentration of TPHg & product line in ppm

350 ● = Laboratory analyzed soil sample showing concentration of TPHg in ppm

= Well casing

= Well screen

= Boring

▽ = Initial water level in boring

▼ = Static water level in well (08/26/92)

Approximate Horizontal Scale

30 15 0 30 60

feet

Approximate Vertical Scale

10 5 0 10 20

feet

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GEOLOGIC CROSS SECTION B-B'
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
13

SOURCE: Modified from a site plan provided by ROUX Associates dated December 1991. Also surveyed by John Koch, Licensed Land Surveyor, July 1992.

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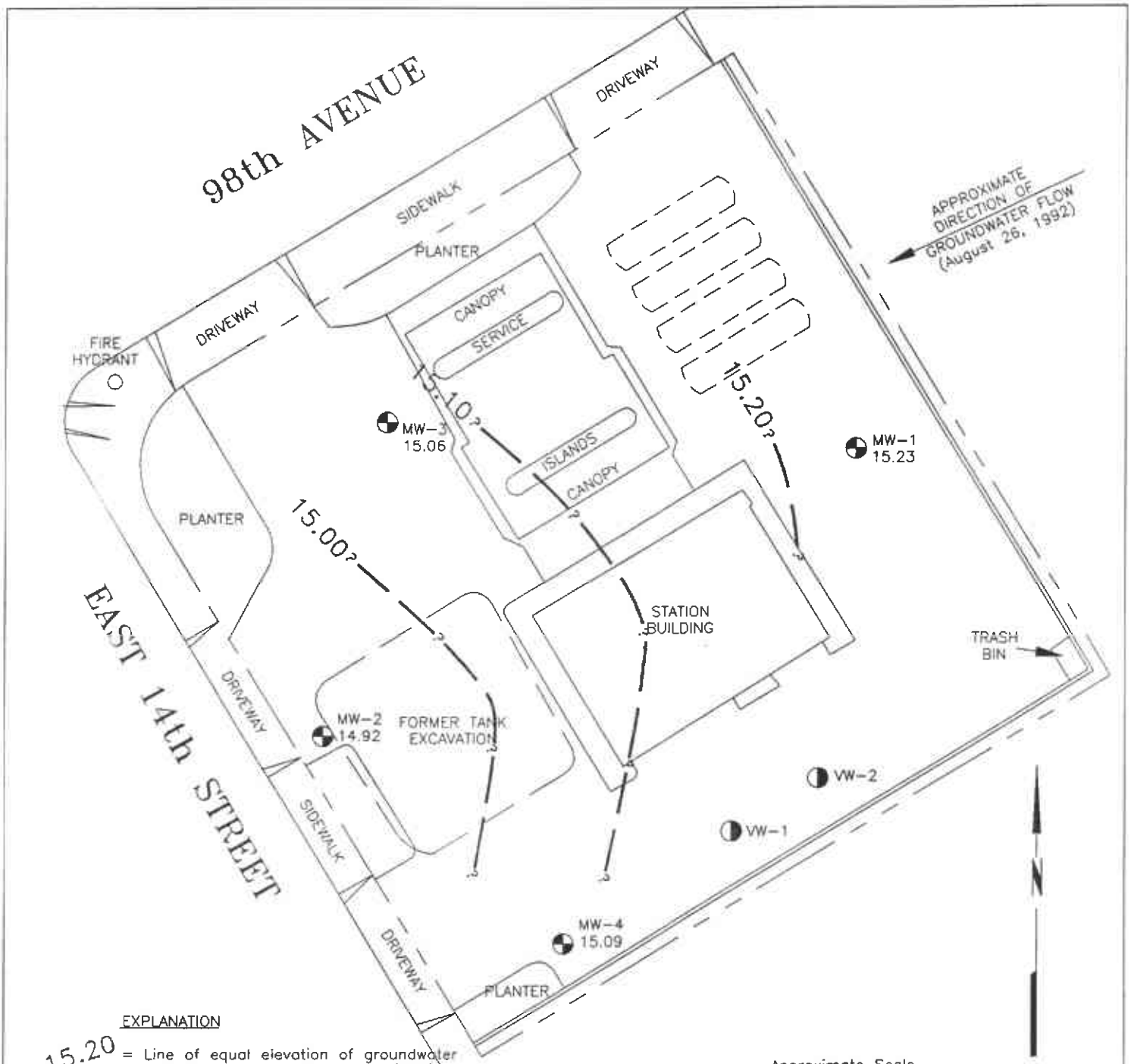
GROUNDWATER GRADIENT MAP
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
14



EXPLANATION

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

15.23 = Elevation of groundwater in feet above MSL, August 26, 1992

MW-4 = Monitoring well (RESNA, July 1992)

VW-2 = Vapor extraction well (Roux Associates, May 1991)

= Existing underground storage tanks

Approximate Scale

30 15 0 30 60

feet

SOURCE: Modified from a site plan provided by ROUX Associates dated December 1991. Also surveyed by John Koch, Licensed Land Surveyor, July 1992.

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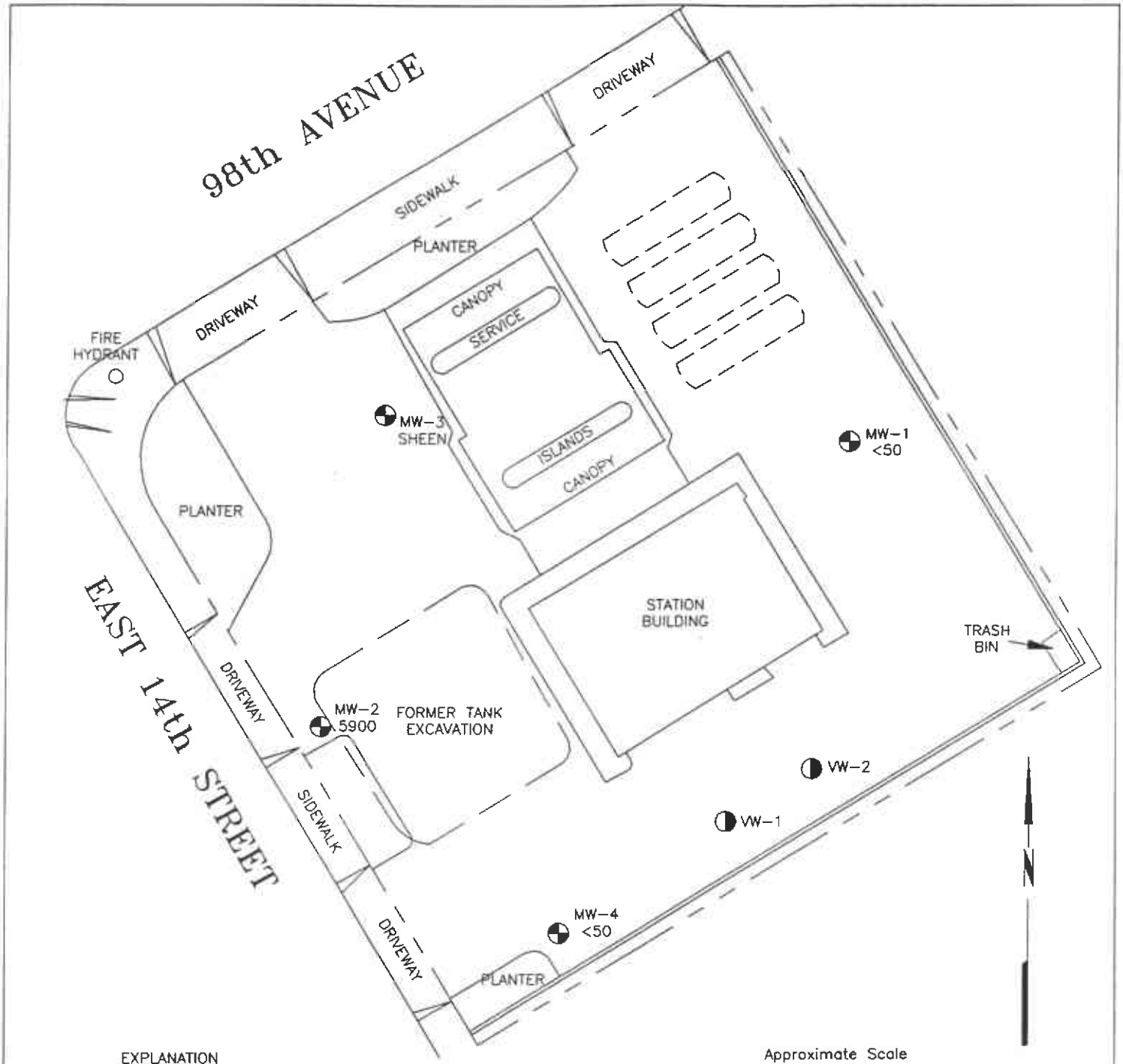
PROJECT 62026.01

GROUNDWATER GRADIENT MAP
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE 15



EXPLANATION

5900 = Concentration of TPHg in groundwater in parts per billion, July 24, 1992

MW-4 = Monitoring well (RESNA, July 1992)

VW-2 = Vapor extraction well (Roux Associates, May 1991)

= Existing underground storage tanks

Approximate Scale

30 15 0 30 60

feet

SOURCE: Modified from a site plan provided by ROUX Associates dated December 1991. Also surveyed by John Koch, Licensed Land Surveyor, July 1992.

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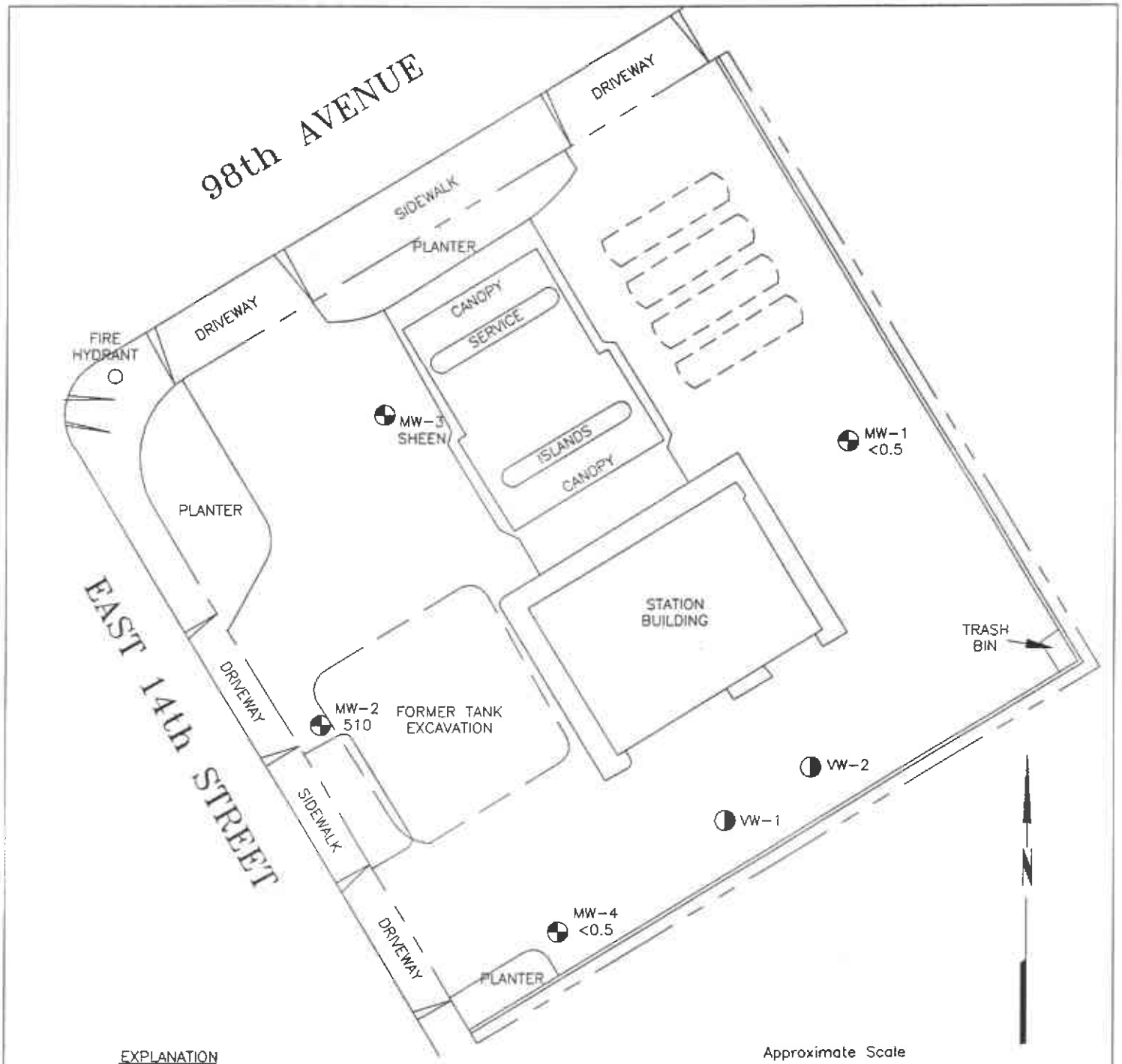
Working to Restore Nature

PROJECT 62026.01

TPHg CONCENTRATIONS IN GROUNDWATER
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
16



EXPLANATION

510 = Concentration of benzene in groundwater in parts per billion, July 24, 1992

MW-4 = Monitoring well (RESNA, July 1992)

VW-2 = Vapor extraction well (Roux Associates, May 1991)

= Existing underground storage tanks

Approximate Scale

30 15 0 30 60

feet

SOURCE: Modified from a site plan provided by ROUX Associates dated December 1991. Also surveyed by John Koch, Licensed Land Surveyor, July 1992.

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PROJECT 62026.01

BENZENE CONCENTRATIONS IN GROUNDWATER
ARCO Station 2185
9800 East 14th Street
Oakland, California

PLATE
17

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 2185
Oakland, California
(Page 1 of 2)

Sample ID	Depth	TPHg	B	T	E	X
May 1991						
B1-5	5	<1.0	0.021	<0.0050	<0.0050	<0.0050
B1-10	10	350	1.1	0.65	4.9	19
B2-5	5	<1.0	0.034	<0.0050	<0.0050	<0.0050
B2-10	10	280	1.3	0.34	3.4	10
B3-5	5	1.6	0.015	<0.0050	0.021	0.048
B3-10	10	38	<0.050	0.24	.031	2.0
B4-5	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B4-10	10	110	0.40	0.20	0.72	0.24
September 1991						
B5-5	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B5-11	11	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B5-13	13	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B6-5	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B6-10	10	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B7-5	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B7-11	11	1.7	0.04	0.013	0.0079	0.078
B7-13	13	1.7	0.27	0.0083	0.04	0.028
B8-5	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
B8-11	11	1.7	0.054	0.0094	0.012	0.019
B8-13	13	1.3	0.013	0.0073	0.0053	0.0069
Tank Excavation November 1991						
SW-1	14	810	3.4	1.0	13	50
SW-2	6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
SW-3	14	370	1.6	17	8.8	53
SW-4	14	220	0.73	1.2	2.8	15
SW-5	6	1.1	0.014	0.0069	0.012	0.034
SW-6	14	230	0.84	2.3	2.4	15
SW-7	14	1100	5.9	28	15	90
SW-8	6	1.3	0.11	0.0054	<0.0050	0.016
SW-9	14	500	3.7	0.92	7.1	32
SW-10	14	750	5.9	5.3	10	61
SW-11	6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
SW-12	14	210	1.6	0.26	3.2	5.0
Product Lines						
L-1	3	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
L-2	3	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
L-3	5	1,400	0.51	87	55	350
L-4	11	450	2.6	24	8.7	56
L-5	8	18	<0.0050	0.029	0.042	0.38
L-6	8	<1.0	<0.0050	<0.0050	<0.0050	<0.0050

See notes on page 2 of 2.

TABLE 1
CUMULATIVE RESULTS OF LABORATORY
ANALYSES OF SOIL SAMPLES
ARCO Station 2185
Oakland, California
(Page 2 of 2)

Sample ID	Depth	TPHg	B	T	E	X	
Product Lines (cont.)							
L-7	8	5.1	0.032	0.047	0.058		0.13
L-8	8	240	0.17	2.8	2.8	15	
L-9	9.5	5,400	22	330	120	640	
L-10	8	2,600	5	130	53	29	
L-11	3	1.4	<0.0050	0.014	0.012	0.1	
L-12	3	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	
L-13	3	13	<0.0050	0.026	0.05	0.7	
L-14	3	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	
July 1992							
S-10.5-B9 MW1	10.5	<1.0	<0.0050	<0.0050	<0.0050		<0.0050
S-13-B9	13	<1.0	<0.0050	<0.0050	<0.0050		<0.0050
S-23.5-B9	23.5	<1.0	<0.0050	<0.0050	<0.0050		<0.0050
S-9.5-B10	9.5	9.3	0.034	0.023	0.014		0.059
S-12-B10 MW2	12	220	1.1	0.75	5.1		6.3
S-23-B10	23	<1.0	<0.0050	<0.0050	<0.0050		<0.0050
S-10.5-B11	10.5	<1.0	0.0060	<0.0050	<0.0050		<0.0050
S-29-B11 MW3	29	<1.0	<0.0050	0.015	0.015		0.078
S-10-B12	10	<1.0	<0.0050	<0.0050	<0.0050		<0.0050
S-13-B12	13	<1.0	<0.0050	<0.0050	<0.0050		<0.0050
S-23.5-B12 MW4	23.5	<1.0	<0.0050	<0.0050	<0.0050		<0.0050
Composited Stockpile Sample							
SPA-SPD	NA	<1.0	<0.0050	<0.0050	0.010		0.012

Results in parts per million (ppm).
Depth in feet below ground surface.
TPHg = Total petroleum hydrocarbons as gasoline using EPA Method 5030/8020/8015
B = benzene, T = toluene, E = ethylbenzene, X = total xylenes (EPA Method 8020/8015)
< = Below indicated laboratory reporting limits.
NA = Not applicable
Sample Identification:

S-10-B12
- Boring number
- Sample depth in feet below ground surface
- Soil sample

SW-1
- Sample number
- Former tank cavity sample

B1-5
- Sample depth in feet below ground surface
- Boring number

SPA-SPD
- Composite sample
- Soil pile

Line-1
- Sample number
- Product line sample

TABLE 2
GROUNDWATER MONITORING DATA
ARCO Station 2185
Oakland, California
(Page 1 of 1)

Date Well Measured	Well Elevation	Depth to Water	Water Elevation	Floating Product
MW-1				
7-24-92	29.15	13.38	15.77	None
8-26-92		13.92	15.23	None
MW-2				
7-24-92	28.47	12.95	15.52	None
8-26-92		13.55	14.92	None
MW-3				
7-24-92	28.57	12.90	15.67	Sheen
8-26-92		13.51	15.06	None
MW-4				
7-24-92	29.21	13.68	15.53	None
8-26-92		14.12	15.09	None

Measurements in feet. Elevations in feet above mean sea level. Wells surveyed on July 23, 1992 (Benchmark #24/D, near the corner of 98th Avenue [5' feet west of west curb] and East 14th Street [7' feet east of the south curb] in Oakland).

TABLE 3
RESULTS OF LABORATORY ANALYSES OF
GROUNDWATER SAMPLES-TPHg AND BTEX
ARCO Station 2185
Oakland, California
(Page 1 of 1)

Well	TPHg	B	T	E	X
MW-1					
7-24-92	<50	<0.5	<0.5	<0.5	<0.5
MW-2					
7-24-92	5,900	510	<10*	370	430
MW-3					
7-24-92		Not sampled – sheen			
MW-4					
7-24-92	<50	<0.5	<0.5	<0.5	<0.5
MCL	—	1.0	—	680	1,750
DWAL	—	—	100	—	—

Results in parts per billion (ppb).
TPHg = Total petroleum hydrocarbons as gasoline by EPA Method 5030/8020 DHS LUFT.
B = benzene, T = toluene, E = ethylbenzene, X = total xylenes
< = Below indicated laboratory detection limits.
* = Laboratory raised Method Reporting Limit (MRL) due to high analyte concentration requiring sample dilution.
MCL = State Maximum Contaminant Level (California Department of Health Services, October 1990).
DWAL = State Recommended Drinking Water Action Level (California Department of Health Services, October 1990).

APPENDIX A

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 to 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 12-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 foil, 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 analyses 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 analyses, and the soil in the sampler shoe, are extruded in the field for inspection. Logs include texture, color, moisture, plasticity, consistency, blow counts, and any other characteristics noted. Logs also include subjective evidence for the presence of hydrocarbons, such as soil staining, noticeable or obvious product odor, and OVM readings.

Monitoring Well Construction

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

The annular space of each well is backfilled with No. 2 by 12 sand, or similar sorted sand, to approximately two feet above the top of the screened casing for initial site wells. The sand pack grain size for subsequent wells may be based on sieve 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.

Groundwater Monitoring Well Development

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

Groundwater Sampling

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

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

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

Sample Labeling and Handling

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

APPENDIX B

WELL PERMITS

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94588 • (510) 484-2600

4 June 1992

Resna
3315 Almaden Expressway, Ste. 34
San Jose, CA 95118

Gentlemen:

Enclosed is drilling permit 92291 for a monitoring well construction project at 9800 East 14th Street in Oakland for Arco Products Company.

Please note that permit condition A-2 requires that a well construction report be submitted after completion of the work. The report should include drilling and completion logs, location sketch, and permit number.

If you have any questions, please contact Wyman Hong or me at 484-2600.

Very truly yours,

Craig A. Mayfield

Craig A. Mayfield
Water Resources Engineer

WH:mm
Enc.

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

FOR OFFICE USE

LOCATION OF PROJECT ARCO STATION [redacted] 2185
9800E 14th STREET
OAKLAND, CA

PERMIT NUMBER 92291
LOCATION NUMBER

CLIENT
Name ARCO PRODUCTS CO.
Address P.O. BOX 5811 Phone (415) 571-2434
City SAN MATEO, CA Zip 94402

APPLICANT
Name RESNA
Address 3315 ALMADEN Expy. Suite 24 Phone (408) 264-7723
City SAN JOSE, CA Zip 95118

TYPE OF PROJECT

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

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

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger Mollow-STEM
Cable ___ Other ___

DRILLER'S LICENSE NO. 484288 (C-57)

WELL PROJECTS

Drill Hole Diameter	10	in.	Maximum		
Casing Diameter	4	in.	Depth	40	ft.
Surface Seal Depth	5	ft.	Number	4	

GEOTECHNICAL PROJECTS

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

ESTIMATED STARTING DATE 6-1-1992
ESTIMATED COMPLETION DATE 6-1-1992

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

APPLICANT'S SIGNATURE [signature] Date 5-28-92

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 [signature] Date 2 Jun 92
Wyman Hong

31992

APPENDIX C

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

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

07/30/92

Tabulation of Elevations as of
6:00 p.m. 07/23/92

Job #92061
RESNA Project 62026.01
Project Geologist:Erin McLucas/Joel Coffman
Site: Arco Station 2185
9800 East 14th Street
@ 98th Avenue
Oakland, CA

BENCHMARK: Bench Mark #24/D (El.=26.88') is the Standard Oakland disc under standard casting in the concrete walk 5' West of the West curb of 98th Avenue and 7' South curb of E 14th Street. Datum is City of Oakland.

MONITOR WELL DATA TABLE

Well Designation	Elevation	Description
MW-1	29.15	Top of PVC Casing
	29.39	Top of Box
MW-2	28.47	Top of PVC Casing
	28.81	Top of Box
MW-3	28.57	Top of PVC Casing
	28.81	Top of Box
MW-4	29.21	Top of PVC Casing
	29.42	Top of Box

JOHN E. KOCH, P.L.S. RESNA PROJ. #62026.01 JEKOB#92061

VW-A	29.85	Top of PVC Casing
	30.03	Top of Box
VW-B	29.85	Top of PVC Casing
	30.16	Top of Box

NOTES:

1. Datum is City of Oakland = (USGS) + 3.00'
2. Top of PVC Casing Elevation is at notch set on top of 4" PVC for MW's wells 1 through 4 and at top of 2" PVC for VW-A and VW-B. Notch bearing N for all wells.
3. Top of Box Elevation is at notch set on rim for all wells. Notch bearing N for all wells.

APPENDIX D

CHAIN OF CUSTODY RECORDS AND LABORATORY ANALYTICAL REPORTS OF SOIL SAMPLES

SEQUOIA ANALYTICAL

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

RECEIVED

JUL 1992

RESNA
SAN JOSE

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

Project: ARCO 2185, Oakland

Enclosed are the results from 1 soil samples received at Sequoia Analytical on July 9,1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2071172	Soil, SPA-SPD	7/8/92	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 2185, Oakland	Sampled:	Jul 8, 1992
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jul 9, 1992
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jul 13, 1992
Attention: Joel Coffman	First Sample #:	207-1172		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 207-1172 SPA-SPD
Purgeable Hydrocarbons	1.0	N.D.
Benzene	0.005	N.D.
Toluene	0.005	N.D.
Ethyl Benzene	0.005	0.010
Total Xylenes	0.005	0.012
Chromatogram Pattern:		Gas

Quality Control Data

Report Limit Multiplication Factor:	1.0
Date Analyzed:	7/9/92
Instrument Identification:	GCPE-2
Surrogate Recovery, %: (QC Limits = 70-130%)	90

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 2185, Oakland

QC Sample Group: 207-1172

Reported: Jul 13, 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:	Jul 9, 1992	Jul 9, 1992	Jul 9, 1992	Jul 9, 1992
QC Sample #:	GBLK070992	GBLK070992	GBLK070992	GBLK070992
	MS/MSD	MS/MSD	MS/MSD	MS/MSD
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.:	0.19	0.20	0.19	0.58
Matrix Spike Duplicate % Recovery:	95	100	95	97
Relative % Difference:	0.0	5.1	0.0	1.7

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

2071172.RES <2>

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 2185-92-2

Chain of Custody

ARCO Facility no. 2185	City (Facility) OAKLAND	Project manager (Consultant) JOEL COFFMAN	Laboratory name SEQUOIA
ARCO engineer MIKE LUTHECAW	Telephone no. (ARCO) 415 571-2149	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA INDUSTRIES	Address (Consultant) 3315 ALMADEN EXPRESSWAY SUITE #1 SAN JOSE CA 95118		Contract number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Water	Other	Preservation: Ice	Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH GAS EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
SPA	2071	172	✓			✓		7-8-92			X	Composite 4 to 1										
SPB	1		✓			✓		7-8-92			X											
SPC	1		✓			✓		7-8-92			X											
SPD	1		✓			✓		7-8-92			X											

Special detection Limit/reporting

Special QA/QC

Remarks
Composite Samples 4 to 1 for analysis

Lab number

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

Method of shipment

Condition of sample:		Temperature received:	
Relinquished by sampler: Erin D. McLean	Date 7-9-92 Time 2:40	Received by: Gail V. Ellery	7-9-92 2:20pm
Relinquished by: Gail V. Ellery	Date 7-9-92 Time 3:10	Received by:	
Relinquished by:	Date Time	Received by laboratory:	Date 7-9 Time 3:10

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

SEQUOIA ANALYTICAL

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

RECEIVED
JUL 23 1992
RESNA
SAN JOSE

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

Project: ARCO 2185, Oakland

Enclosed are the results from 11 soil samples received at Sequoia Analytical on July 9,1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2071418	Soil, S-10.5-B11	7/7/92	EPA 5030/8015/8020
2071419	Soil, S-29-B11	7/7/92	EPA 5030/8015/8020
2071420	Soil, S-9.5-B10	7/7/92	EPA 5030/8015/8020
2071421	Soil, S-12-B10	7/7/92	EPA 5030/8015/8020
2071422	Soil, S-23-B10	7/7/92	EPA 5030/8015/8020
2071423	Soil, S-10-B12	7/8/92	EPA 5030/8015/8020
2071424	Soil, S-13-B12	7/8/92	EPA 5030/8015/8020
2071425	Soil, S-23.5-B12	7/8/92	EPA 5030/8015/8020
2071426	Soil, S-10.5-B9	7/8/92	EPA 5030/8015/8020
2071427	Soil, S-13-B9	7/8/92	EPA 5030/8015/8020
2071428	Soil, S-23.5-B9	7/8/92	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 2185, Oakland	Sampled:	7/7-8/92
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jul 9, 1992
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jul 21, 1992
Attention: Joel Coffman	First Sample #:	207-1418		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 207-1418 S-10.5-B11	Sample I.D. 207-1419 S-29-B11	Sample I.D. 207-1420 S-9.5-B10	Sample I.D. 207-1421 S-12-B10	Sample I.D. 207-1422 S-23-B10	Sample I.D. 207-1423 S-10-B12
Purgeable Hydrocarbons	1.0	N.D.	N.D.	9.3	220	N.D.	N.D.
Benzene	0.0050	0.0060	N.D.	0.034	1.1	N.D.	N.D.
Toluene	0.0050	N.D.	0.015	0.023	0.75	N.D.	N.D.
Ethyl Benzene	0.0050	N.D.	0.015	0.014	5.1	N.D.	N.D.
Total Xylenes	0.0050	N.D.	0.078	0.059	6.3	N.D.	N.D.
Chromatogram Pattern:		Discrete Peak	Gas	Gas	Gas	--	--

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	50	1.0	1.0
Date Analyzed:	7/13/92	7/13/92	7/13/92	7/13/92	7/13/92	7/13/92
Instrument Identification:	GCHP-1	GCHP-1	GCHP-1	GCHP-1	GCHP-1	GCHP-1
Surrogate Recovery, %: (QC Limits = 70-130%)	106	111	113	126	99	97

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 2185, Oakland	Sampled:	7/7-8/92
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jul 9, 1992
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jul 21, 1992
Attention: Joel Coffman	First Sample #:	207-1424		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 207-1424 S-13-B12	Sample I.D. 207-1425 S-23.5-B12	Sample I.D. 207-1426 S-10.5-B9	Sample I.D. 207-1427 S-13-B9	Sample I.D. 207-1428 S-23.5-B9
Purgeable Hydrocarbons	1.0	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.
Ethyl Benzene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.
Total Xylenes	0.0050	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
Date Analyzed:	7/13/92	7/13/92	7/13/92	7/13/92	7/13/92
Instrument Identification:	GCHP-1	GCHP-1	GCHP-1	GCHP-1	GCHP-1
Surrogate Recovery, %: (QC Limits = 70-130%)	87	94	118	106	106

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 2185, Oakland

QC Sample Group: 2071418-28

Reported: Jul 21, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	C. Dononue	C. Donohue	C. Donohue	C. Donohue
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jul 13, 1992	Jul 13, 1992	Jul 13, 1992	Jul 13, 1992
QC Sample #:	GBLK071392 MS/MSD	GBLK071392 MS/MSD	GBLK071392 MS/MSD	GBLK071392 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.22	0.22	0.22	0.66
Matrix Spike % Recovery:	110	110	110	110
Conc. Matrix Spike Dup.:	0.21	0.21	0.22	0.64
Matrix Spike Duplicate % Recovery:	105	105	110	107
Relative % Difference:	4.7	4.7	0.0	3.1

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

SEQUOIA ANALYTICAL

Maria Lee

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 AtlantiRichfieldCompany

Chain of Custody

Task Order No. 2185-92-2

ARCO Facility no. 2185	City (Facility) Oakland	Project manager (Consultant) JOEL COFFMAN	Laboratory name SEQUOIA
ARCO engineer MIKE WHELAN	Telephone no. (ARCO) (415) 571-2449	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA	Address (Consultant) 3315 ALMADEN EXPRESSWAY, SUITE 34, SAN JOSE CA 95118		Contract number

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 G,A,S EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 8010/8010	EPA 8240/8240	EPA 625/8270	TCLP Semi Metals ☐ VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		HOLD
S-5.5-MW3			✓			✓		7-7-92														X
S-10.5-MW3	2071	418	✓			✓		7-7-92			X											
[illegible]			✓			✓		7-7-92			X											
S-15-MW3			✓			✓		7-7-92														X
S-16.5-MW3			✓			✓		7-7-92														
S-20-MW3			✓			✓		7-7-92														
S-21-MW3			✓			✓		7-7-92														
S-22-MW3			✓			✓		7-7-92														
S-22.5-MW3			✓			✓		7-7-92														
S-23-MW3			✓			✓		7-7-92														
S-24-MW3			✓			✓		7-7-92														
S-25-MW3			✓			✓		7-7-92														
S-25.5-MW3			✓			✓		7-7-92														
S-26-MW3			✓			✓		7-7-92														
S-27.5-MW3			✓			✓		7-7-92														
S-29-MW3	2071	419	✓			✓		7-7-92			X											

Special detection Limit/reporting

Special QA/QC

Remarks
PLEASE NAME THESE AS FOLLOWS
MW1 = B-9
MW2 = B-10
MW3 = B-11
MW4 = B-12

Lab number

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

Condition of sample:

Temperature received:

	Date	Time
Relinquished by sampler: Gina D. McLucas	7-9-92	2:20
Relinquished by: Mark A. Ellis	7-9-92	3:10
Relinquished by:		

	Date	Time
Received by: Mark V. Ellis	7-9-92	2:20
Received by:		
Received by laboratory: Stephen Potigan	7-9	3:10

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

Dillard Trucking, Inc.

ENVIRONMENTAL SERVICES
P.O. BOX 218 BYRON, CALIFORNIA 94514
(510) 634-6850 FAX (510) 634-0569

July 21, 1992

Resna
San Jose, CA

FAX #408-264-2435

Attn: Joel Coffman

RE: Arco #2185 - 9800 E. 14th St., Oakland, CA

Dear Joel:

Please be advised that the drill cuttings from the above referenced service station site have been removed.

The drill cuttings were transported to BFI Landfill, Livermore on 07-17-92.

If you have any questions please do not hesitate to contact me.

Sincerely,

DILLARD TRUCKING, INC.

Donna L. Pedersen

Donna L. Pedersen
Estimator

DLP/st

cc:file

APPENDIX E

SIEVE ANALYTICAL REPORTS OF SOIL SAMPLES

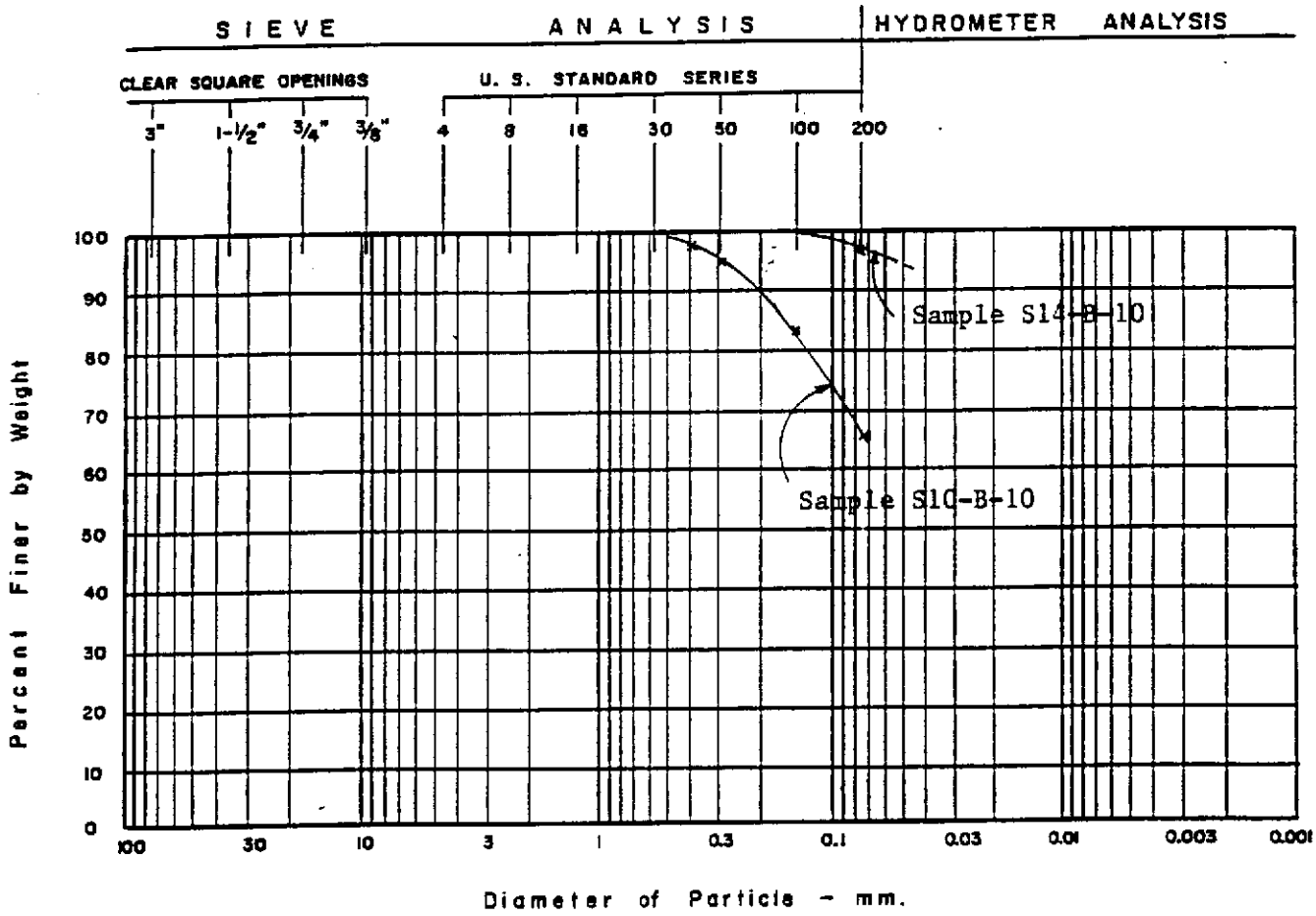
GRADATION TEST RESULTS

ASTM D422

Client: RESNA #62026-2	Project: ARCO #2185, Oakland

Sample No.	Depth	Physical Description	Date Sample Received	Date Test Completed
S-10-B-10		Med. gra-blue Silt w/fine sand	7/9/92	7/14/92
S-14-B-10		Dark gray to black silty Clay, very stiff	7/9/92	7/14/92

COMMENTS:



Gravel		Sand			Clay & Silt
Coarse	Fine	Coarse	Medium	Fine	

SOIL FOUNDATION SYSTEMS, INC.

SOIL FOUNDATION SYSTEMS, INC.

Geotechnical Engineers • Engineering Geologists
Soil Mechanics Laboratories

326 E. WARREN AVENUE, FREMONT, CA 94539, (415) 226-9394, FAX: (415) 226-9396

File No. S22-663-RESNA-1
July 15, 1992

RESNA
3315 Almaden Expressway, Suite 34
San Jose, California 95118

Attention: Mr. Ken Mateik

Subject: RESNA #62026-2; ARCO #2185, Oakland
SIEVE ANALYSES (ASTM D422)

Gentlemen:

Transmitted herewith are the results of our sieve analyses on the soil samples received by our Soils Laboratories on July 9, 1992, for the subject project.

The sieve analyses were performed in accordance with the ASTM test procedure D422-90. A copy of the Chain of Custody pertaining to the soil samples is attached herewith.

If you have any questions, please give us a call.

Very truly yours,

SOIL FOUNDATION SYSTEMS, INC.

K. C. Sohn

KCS;ls

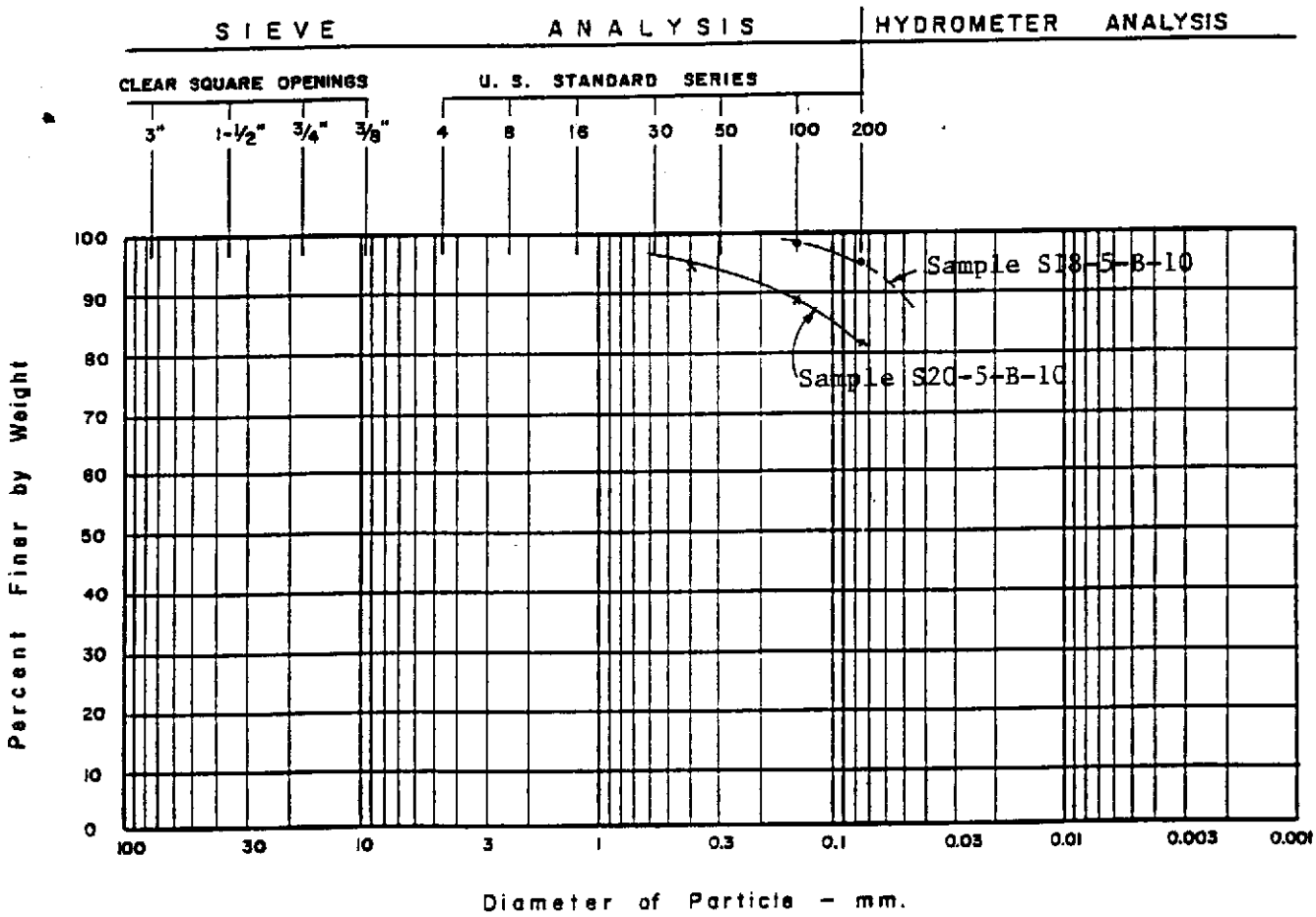
GRADATION TEST RESULTS

ASTM D422

Client: RESNA #62026-2	Project: ARCO #2185, Oakland

Sample No.	Depth	Physical Description	Date Sample Received	Date Test Completed
S18-5-B-10		Light to medium gray-brown clayey Silt stiff	7/9/92	7/15/92
S20-5-B-10		Light brown clayey Silt, slightly sandy, medium stiffness	7/9/92	7/15/92

COMMENTS:



Gravel		Sand			Clay & Silt
Coarse	Fine	Coarse	Medium	Fine	

SOIL FOUNDATION SYSTEMS, INC.

APPENDIX F

CHAIN OF CUSTODY REPORTS AND LABORATORY ANALYTICAL REPORTS OF GROUNDWATER SAMPLES

Columbia Analytical Services inc.

August 10, 1992

Joel Coffman
RESNA
3815 Almaden Expressway, #39
San Jose, CA 95118

Re: **Arco Facility No. 2185-62026.01**

Dear Mr. Coffman:

Enclosed are the results of the water samples submitted to our lab on July 27, 1992. For your reference, our service request number for this work is SJ92-0919.

All analyses were performed in accordance with the laboratory's quality assurance program.

Please call if you have any questions.

Respectfully submitted:

COLUMBIA ANALYTICAL SERVICES, INC.

Keoni A. Murphy
Laboratory Manager

Annelise J. Bazar
Regional QA Coordinator

le/KAM

1921 Ringwood Avenue • San Jose, California 95131 • Telephone 408/437-2400 • Fax 408/437-9356

Client: RESNA
Project: Arco Facility No. 2185-62026.01

Date Received: 07/27/92
Work Order #: SJ92-0919
Sample Matrix: Water

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

Sample Name:		W-13-MW 4	W-13-MW 1	W-13-MW 2
Date Analyzed:		07/30/92	07/30/92	07/30/92
Analyte	**MRL**			
Benzene	0.5	ND	ND	510.
Toluene	0.5	ND	ND	<10.*
Ethylbenzene	0.5	ND	ND	370.
Total Xylenes	0.5	ND	ND	430.
TPH as Gasoline	50	ND	ND	5,900.

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
* Raised MRL due to high analyte concentration requiring sample dilution.

Approved by Kevin Murphy Date August 10, 1992

1921 Ringwood Avenue • San Jose, California 95131 • Telephone 408/437-2400 • Fax 408/437-9356

Client: RESNA
Project: Arco Facility No. 2185-62026.01

Date Received: 07/27/92
Work Order #: SJ92-0919
Sample Matrix: Water

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

	Sample Name:	Method Blank
	Date Analyzed:	07/30/92
Analyte	**MRL**	
Benzene	0.5	ND
Toluene	0.5	ND
Ethylbenzene	0.5	ND
Total Xylenes	0.5	ND
TPH as Gasoline	50	ND

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

Approved by Kevin P. Murphy Date August 10, 1992

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APPENDIX A

LABORATORY QC RESULTS

Client: RESNA
Project: Arco Facility No. 2185-62026.01

Date Received: 07/27/92
Work Order #: SJ92-0919

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

Date Analyzed: 07/30/92

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria
Benzene	250.	276	111.	85-115
Toluene	250.	280.	112.	85-115
Ethylbenzene	250.	270.	108.	85-115
Total Xylenes	750.	813.	108.	85-115
TPH as Gasoline	2,500.	2,572.	103.	90-110

TPH Total Petroleum Hydrocarbons

Approved by Kevin Murphy Date August 10, 1992

Client: RESNA
Project: Arco Facility No. 2185-62026.01

Date Received: 07/27/92
Work Order #: SJ92-0919
Sample Matrix: Water

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

Sample Name	Date Analyzed	Percent Recovery α,α,α-Trifluorotoluene
W-13-MW 4	07/30/92	105.
W-13-MW 1	07/30/92	108.
W-13-MW 2	07/30/92	112.
MS	07/30/92	112.
DMS	07/30/92	109.
Method Blank	07/30/92	105.
	CAS Acceptance Criteria	70-130

TPH Total Petroleum Hydrocarbons

Approved by ____________________ Date August 10, 1992

... San Jose, California 95134 • Telephone 408/437-2400 • Fax 408/437-9356

Client: RESNA
Project: Arco Facility No. 2185-62026.01

Date Received: 07/27/92
Work Order #: SJ92-0919
Sample Matrix: Water

QA/QC Report
Matrix Spike/Duplicate Matrix Spike Summary
BTE
EPA Methods 5030/8020
µg/L (ppb)

Date Analyzed: 07/30/92

Analytes	Spike Level	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	Acceptance Criteria
Benzene	25.	ND	21.2	22.2	85.	89.	39-150
Toluene	25.	ND	25.6	26.6	102.	106.	46-148
Ethylbenzene	25.	ND	27.5	28.6	110.	114.	32-160

ND None Detected at or above the method reporting limit

Approved by Kevin Murphy Date August 10, 1992

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