aqua resources inc.

2030 Addison Street, Suite 500 • Berkeley, California 94704 • 415 540-6954

TRANSMITTAL MEMORANDUM

TO: Regional Water Quality Control Board
San Francisco Bay Region
1800 Harrison Street, Suite 700
Oakland, CA 94612

DATE: January 17, 1991

ATTENTION: Mr. Lester Feldman

FILE: 90239.1

SUBJECT: Remedial Investigation and Closure Plan for Former Corporation Yard Site at 4030 Hollis Street, Emeryville, CA

WE ARE SENDING: __X__ Herewith _____ Under Separate Cover

__X__ Via Mail _____ Via __________

THE FOLLOWING: 1 copy of subject report

_____ At your request __X__ For your files _____ For your review

_____ For your approval _____ For correction _____ For payment

REMARKS:

Copies to:

By: Mark Milani
Project Manager

Ransome Co.

Consulting engineers and managers specializing in • water resources • hazardous and industrial waste projects.

aqua resources inc.

2030 Addison Street, Suite 500 • Berkeley, California 94704 • 415 540-6954

January 15, 1991

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

90239.1
File: report

Attention: Mr. Dennis Byrne, Hazardous Material Specialist

Subject: Transmittal of Remedial Investigation Report and Proposed Closure Plan
Corporation Yard, 4030 Hollis Street, Emeryville, California

Gentlemen:

Transmitted herewith is our final Remedial Investigation and Proposed Closure Plan for the subject property. This Remedial Investigation was performed in conformance with the workplan approved by your agency on July 25, 1990. (Please refer to your letter of September 14, 1990.)

The proposed Closure Plan conforms with the prevailing standard engineering practices and with the criteria and procedures contained in the Leaking Underground Fuel Manual (LUFT - October 1989).

We would appreciate your agency's comments and approval of the Closure Plan at the earliest possible date due to our client's desire to undertake the property cleanup and its final closure.

Please call the undersigned, or Mr. Janus Bajsarowicz, if you have any questions.

Very truly yours,
AQUA RESOURCES INCORPORATED

Mark Milani

Mark Milani, P.E.
Project Manager

90239.1/disk 1/ransme1.frt

Copies: Mr. Ed Webster, Ransome Company
Mr. Lester Feldman, Regional Water Quality Control Board, San Francisco Bay Region
Ms. Amanda Spencer, Levine-Fricke
Mr. Ric Notini, Catellus Development Corporation

Remedial Investigation and Closure Plan

for

Former Corporation Yard Site
4030 Hollis Street
Emeryville, California

Submitted to

Alameda County Health Care Services Agency
Department of Environmental Health
Division of Hazardous Materials

for

Ransome Company Inc.

January 16, 1991

Aqua Resources, Inc.
2030 Addison Street, Suite 500
Berkeley, California

Project No. 90239.1

EXECUTIVE SUMMARY

REGULATORY AGENCY INVOLVEMENT

This report presents Aqua Resources Incorporated's (ARI) Remedial Investigation (RI) and Closure Plan for the corporation yard formerly operated by the Ransome Company. The purpose of this RI is to identify the potential sources of contamination, the horizontal and vertical extent of contamination at identified release points and to characterize the types and levels of contamination so that various alternatives for remediating the contamination can be analyzed.

The Closure Plan presents detailed analysis of remedial treatment alternatives including technical and economic assessments. Conclusions and recommendations regarding remediation of the contaminated areas for site closure purposes are presented. The RI was performed in conformance with a July 25, 1990 Workplan, as amended in an addendum dated August 23, 1990. The Workplan, as amended, was approved by the Alameda County Health Care Services Agency, Environmental Health Department, Hazardous Materials Division in correspondence dated September 14, 1990.

SITE DESCRIPTION

The site is located at 4030 Hollis Street in the City of Emeryville. It is part of a larger parcel (the Yerba Buena Project Site) owned by the Catellus Development Company (Catellus). This property, including the subject site, will undergo eventual redevelopment that will include both residential and commercial facilities.

The site is triangular in shape, and is almost level. Currently, there are no buildings or other above ground structures or known underground improvements on the site. However, previously there were buildings and other above and below grade structures on the site during the time Ransome Company occupied it between 1938 and May, 1990. The structures and improvements were removed in July, 1990, pursuant to the requirements of the lease agreement between the Ransome Company and Catellus Development Corporation (formerly Santa Fe Pacific Realty).

In the northeast corner of the site there is an open excavation left from the removal of four underground tanks and related fuel lines, performed in March, 1990. This excavation is currently surrounded by a temporary 6 foot high chain link fence.

GENERAL SITE USAGE, WASTE MANAGEMENT AND SPILL HISTORY

The Ransome Company occupied the site from about 1938 to 1990. Between 1924 and 1938, the property was used by other companies and contractors. The Ransome Company used the site primarily for storage of equipment and materials used in manufacture, transport and placement of asphaltic concrete. Asphaltic concrete is specifically excluded as being a hazardous material or hazardous waste under the State of California hazardous waster regulations. Asphaltic concrete was manufactured in two batch plants that had a combined capacity of about 5,000 pounds per hour. The batch plant operation was discontinued and dismantled in 1983. One above ground asphalt emulsion storage tank was removed from the site in July, 1990.

Diesel and gasoline fuel for paving and transport equipment were stored in underground storage tanks (USTs). Diesel was stored in one 4,000 gallon steel tank, while regular gasoline was stored in one 10,000 gallon steel tank and unleaded in one 1,000 gallon steel tank. A fourth tank was discovered when the other USTs were removed. The fourth tank is believed to have been abandoned, and to have been used to store diesel fuel. The USTs were removed in March, 1990 by the Peregren Environmental Group.

Equipment maintenance was performed in the garage located on the southwest side of the site. Waste oils and solvents generated from the equipment maintenance were stored in a partially below grade waste oil tank. The practice instituted by Ransome Company in recent times has been to use Safety-Kleen units for parts washing so that waste solvents are not mixed with waste oil. The waste oil tank was removed from the site concurrently with the underground fuel tanks.

The area surrounding the site has primarily been used for industrial use, including manufacturing steel products, food products and paint. The site is bordered on the north by the existing Besler Building and the United Stamping facility. Metal fabrication is reportedly being performed at United Stamping. The Besler Building is currently occupied by art studiosy, but was used previously for manufacturing. Activities performed elsewhere in the vicinity of the site include light manufacturing, warehousing and drayage operations.

PREVIOUS INVESTIGATIONS

Levine-Fricke (L-F), consulting engineers to Catellus Development Company, has performed a Phase I and II Environmental Investigation of the Yerba Buena project site, and presented their results in a report dated August 15, 1990. In addition, Kennedy/Jenks/Chilton (K/J/C) prepared a Baseline Environmental Site Assessment of the former corporation yard site, and presented their results in a report dated October,

1989. The Ransome Company submitted a report documenting the removal of the USTs in a report dated April 9, 1990. Subsequently, ARI performed a field reconnaissance of the site in June, 1990 in order to develop the workplan for site assessment, remediation and closure.

SITE SOIL STRATIGRAPHY AND HYDROGEOLOGY

The area lies in the California Coast Ranges section of the Pacific Border physiographic province. The near surface soils at the site and vicinity have been mapped by various investigators as Holocene interfluvial basin deposits, surficial deposits and as alluvial fan deposits. The interfluvial basin deposits consist of plastic, poorly sorted, organic-rich clay and silty clays; the alluvial fan deposits are described as interfingering lenses of clayey gravel, sandy silty clay and mixtures of sands, silts and clays.

A layer of artificial fill covers the site to a depth of approximately one foot. The fill generally consists of clayey gravelly silt, with sections of the site containing more gravel. Underlying the fill in several areas are pieces of concrete, or layers of asphalt, silt or sand. The fill is underlain by clay units containing varying amounts of silt, sand and/or gravel to the depths explored. The clay units are generally medium stiff to stiff, slightly plastic and have very low permeability.

Groundwater was encountered at depths ranging from 8½ feet to 11 feet below the surface. The direction of groundwater flow is estimated to the southwest; the average hydraulic gradient is estimated to be about .001 ft/ft.

The soils encountered below the free groundwater were observed to be comprised of clays and silts having low to moderate plasticity. Field observations indicate that the soils have very low permeability.

REMEDIAL INVESTIGATION

Contamination Source Identification: ARI identified the following areas where possible releases of contaminants had occurred and where subsurface investigation was performed as part of the Remedial Investigation (RI). These locations included:

- the previously removed gasoline and diesel fuel tanks (including the abandoned diesel tank), associated transfer piping and fuel island;
- area south of the former blacksmith shop and storeroom where at one time there was an outlet of the pipe which collected oil drippings from drums of lubricating and hydraulic oils stored inside the building;

- area where the partially below grade waste oil tank was located;

- diesel racks where a layer of diesel was sprayed in the back of delivery trucks so that asphaltic concrete would not stick to the track beds;

- excess material/scrap pile area where scrap asphaltic concrete, cement concrete, soil and other solid materials were collected before offsite disposal. SS-1, an oil-water emulsion used during asphalt pavement construction, was reportedly sprayed on this pile. In addition, solids from the trap below the steam cleaning area were collected at the excess material/scrap pile before offsite disposal;

- area where above-ground tank with SS-1 emulsion was located.

- the former spray painting canopy, garage and shop areas.

Soil Sampling: Soil sampling at the site was mainly concentrated in the areas described above which were considered to be potential sources of contamination. The soil sampling program was conducted in two phases. In the first phase, soil sampling was targeted to verify if contamination in these areas exists and to identify, if possible, the hot spots in these areas. The Phase II sampling program provided additional data required to estimate the horizontal and vertical extent of contaminated areas identified in the initial phase of sampling, and these data were used to determine the locations of monitoring wells.

Groundwater Sampling: As part of the Phase II sampling, "grab" groundwater samples were collected. The "grab" groundwater samples were obtained by driving a steel galvanized pipe to the free groundwater level. The pipe was equipped with a perforated section near the tip to enable groundwater to flow into the pipe.

To assess if groundwater underlying the site had been impacted from contaminant releases identified during the soil sampling, three monitoring wells were installed to enable collection of groundwater samples, to monitor fluctuations in the free groundwater level and to determine the direction and gradient of groundwater flow. Monitoring wells were installed downgradient of contaminant sources established by previous soil and "grab" water sampling to check if groundwater had been impacted.

Chemical Analyses: Soil samples collected during the Phase I soil sampling and from the monitoring well installation were transported under chain of custody control to Curtis & Tompkins, a State-certified laboratory in Berkeley, California, for chemical analyses. Soil and "grab" groundwater samples from the Phase II sampling were analyzed onsite in a State-certified mobile lab.

The soil and groundwater samples were analyzed for the compounds that, based on historical activities, were suspected to exist at the sample location. Soil samples were analyzed for one or more of the following compounds:

- Total Petroleum Hydrocarbons (EPA Method 8015, modified - sonication extraction),
- Total Volatile Hydrocarbons (EPA Method 8015, modified - purge and trap),
- Purgeable Aromatics (EPA Method 8020),
- Purgeable Halocarbons (EPA Method 8010),
- Hydrocarbon Oil and Grease (SMWW 5520);
- Semi Volatile Organics (EPA Method 8270);
- CCR Title 26 Metals in soils and wastes (Total Threshold Limit Concentrations).

Groundwater samples were analyzed for the same compounds except for heavy metals. The pH and Total Dissolved Solids concentration of the groundwater were also analyzed.

Remedial Action Objectives: Soil contamination has occurred primarily from releases associated with the former underground fuel storage tanks, partially below grade waste oil tank and from the above ground SS-1 emulsion storage tank and from surface spills that occurred during operation of the asphalt-batching plant and from equipment maintenance operations. At some locations, it is possible that the contamination extends to the saturated zone, and has impacted groundwater underlying the site. The results of this RI indicate that the major portion of the contamination was caused by releases of petroleum hydrocarbons.

In order to prevent further degradation of groundwater and to assist in the remediation of groundwater underlying the site, it is proposed that contaminated soils be remediated in the immediate vicinity of areas impacted by previous releases. Based upon data in hand, the total volume of soil which will require excavation and treatment is estimated to be about 6,400 cubic yards. An approximate breakdown by contaminant type is given in the following table.

Principal Contaminant	Estimated Soil Volume (cubic yards)
Diesel Contaminated Soil	60
Waste Oil Contaminated Soil	160
Diesel and Waste Oil Contaminated Soil	200
Gasoline, BTXE and Waste Oil Contaminated Soil	1,080
Gasoline and BTXE Contaminated Soil	4,900
Total Estimated Volume (combined all types)	6,400

However, for cost estimating purposes, the above soil volumes were categorized by the contaminant that would control the remediation alternative selected. For example, the waste oil in the mixed waste oil/diesel oil contaminated soil would be the controlling contaminant that would likely set the remedial action selected. The controlling contaminant was defined as the principal contaminant. The soil volume breakdown by principal contaminant is given in the following table.

Principal Contaminant	Estimated Soil Volume (cubic yards)
Diesel Contaminated Soil	60
Waste Oil Contaminated Soil	1,440
Gasoline and BTXE Contaminated Soil	4,900
Total Estimated Volume (combined all types)	6,400

Groundwater at the site was found only to contain only diesel at concentrations ranging from 85 ppb up to 100 ppb. Groundwater is considered to be impacted by the Regional Water Quality Control Board (RWQCB) if the petroleum hydrocarbon concentrations exceed the Practical Quantification Reporting Limits presented in the Tri-Regional guidelines. The Practical Quantification Reporting Limit for diesel is 50 ppb. The observed diesel concentrations in the groundwater are only slightly above the 50 ppb reporting limit.

Since 1) there are no known continuous permeable zones underlying the site that could readily conduct or transmit groundwater and contribute to wide-spread contamination, 2) the soil permeability below the free groundwater level (to the depth explored) is low, and 3) there are no known wells in the vicinity of the site drawing water from this zone, remediation of the groundwater does not appear to be necessary. However, groundwater monitoring should be performed for a period of one to two years to evaluate the effects of the proposed soil remediation on groundwater quality.

Screening of Technologies: Numerous technologies were initially screened as general response actions that could be undertaken at the former corporation yard site. Two basic groups of soil treatment technologies, in-situ and excavation, were considered. Two in-situ processes and five processes involving excavation, were analyzed. In-situ methods analyzed were:

- soil vapor extraction
- in-situ biodegradation

Five soil excavation and treatment or disposal technologies were analyzed. These methods were:

- aeration
- disposal without treatment
- onsite bioremediation
- offsite bioremediation
- offsite thermal treatment

The technologies that were considered to be potentially feasible during the initial screening process were evaluated against several criteria, including technical feasibility and relative cost of designing and implementing each technology during the final screening.

CONCLUSIONS AND RECOMMENDATIONS

The results of this Remedial Investigation (RI) indicate that soils have been impacted from the release of various kinds of petroleum hydrocarbons. The principal compounds include diesel, waste oils and gasoline (with BTXE compounds). Soil contamination with other compounds such as semi-volatile organics (EPA Method 8270 compounds), purgeable halocarbons (EPA Method 8010 compounds) and heavy metals were found to be insignificant. Results of chemical analyses are presented in Section 3.4.

The soils that have been impacted will require some remediation. The total volume of soil may require removal and/or treatment is about 6,400 cubic yards. Of this total, approximately 75 percent consists of soils contaminated principally with gasoline and BTXE compounds. The remaining contaminants, diesel and waste oil, comprise about 2 percent and 23 percent of soil volumes, respectively.

Groundwater was found to contain diesel above the 50 ppb reporting RWQB limit in all three monitoring wells installed at the site during this investigation. Gasoline and BTXE compounds were detected in several of the "grab" groundwater samples; but not in any of the monitoring wells. The presence of gasoline and BTXE compounds in several of the "grab" groundwater samples is thought to have occurred from contaminated soil carried down with the "grab" sample probe. Hence, the "grab" groundwater sample data were concluded to provide only qualitative information regarding the impact that previous releases at the site have had on groundwater quality.

The diesel concentration detected in the groundwater was found to range from 85 ppb up to 100 ppb. Because the diesel concentration is not significantly above the reporting limit, and no free product was observed, groundwater remediation is not considered to be necessary at this time.

However, we recommend that a groundwater monitoring program be designed and implemented to monitor the effectiveness of soil remediation on groundwater quality at the site as part of the site closure. The groundwater monitoring program is recommended to last from one to two years, with groundwater sampling to be performed quarterly. As part of this program, we recommend that one additional monitoring well be installed by the former fuel island location. The monitoring well by the former fuel island should be installed after soils in this area have been excavated, and any backfill placed to prevent damage to the monitoring well. In addition, the existing monitoring wells should be protected from damage during remediation and site redevelopment activities.

RECOMMENDED REMEDIATION PROGRAM AND PROGRAM IMPLEMENTATION COSTS

Based on the data obtained during the Remedial Investigation and estimated quantities of soils that have been impacted, there are two remediation programs that are considered feasible. Under the first alternative remediation program, we recommend that soils contaminated with diesel and waste oil be remediated using onsite bioremediation. Where practical, the waste oil contaminated soils should be separated from the diesel contaminated soil, and these soils placed in separate units in the biotreatment cell. Under the second alternative, the diesel and waste oil contaminated soil would be treated at an offsite landfarming operation.

The volume of waste oil and diesel contaminated soil estimated to require bioremediation is approximately 1500 cubic yards. This will require between one and two acres of open space for setup and operation of the biotreatment cell.

The treatability study showed that onsite bioremediation was determined to be feasible for diesel contaminated soil; however, most of the diesel contaminated soil areas were also found to contain waste oils. The treatability study indicated that bioremediation may not be as effective on waste oil contaminated soils. It was concluded that a target concentration for lighter fractions of waste oil to under 100 ppm may be achievable; however, no estimate of how long this would require could be estimated from the treatability study. This would still leave some heavier fractions in the soil.

Under both alternatives, the gasoline contaminated soils would be remediated by aeration and reused onsite as fill. The gasoline and BTXE contaminated soils should be treated with conventional aeration. It is estimated that about 4900 cubic yards of soil containing these compounds will have to be aerated. The aeration should be performed in conformance with the requirements established under Regulation 8, Rule 40 administered by the Bay Area Air Quality Management District.

After the excavated soils have been remediated, they can be reused as backfill or as general fill on the site, provided the contamination level is reduced to levels to be established in discussions with the RWQCB.

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LIST OF ACRONYMS AND ABBREVIATIONS

ARI	Aqua Resources Incorporated
BAAQMD	Bay Area Air Quality Management District
CCR	California Code of Regulations
HM	Hazardous Material
HW	Hazardous Waste
ID	Inside Diameter
OD	Outside Diameter
RI	Remedial Investigation
RWQCB	Regional Water Quality Control Board
UST	Underground Storage Tank
VOC	Volatile Organic Compound

REMEDIAL INVESTIGATION REPORT AND PROPOSED CLOSURE PLAN
FORMER RANSOME CORPORATION YARD
4030 HOLLIS STREET, EMERYVILLE, CALIFORNIA

1.0 INTRODUCTION

1.1 Statement of Purpose

This report presents the results of ARI's Remedial Investigation (RI) and Closure Plan for the former corporation yard operated by the Ransome Company. The site is located at 4030 Hollis Street in Emeryville, California. The site is shown in relation to the City of Emeryville on the Vicinity Map, Figure 1.1. The purpose of this RI was to identify the potential sources of contamination, the horizontal and vertical extent of contamination at identified release points and to characterize the types and levels of contamination so that various alternatives for remediating the contamination could be analyzed.

The Closure Plan presents detailed analysis of remedial alternatives including technical and economic assessments. Conclusions and recommendations regarding remediation of the contaminated areas for site closure purposes are presented. The RI was performed in conformance with a July 25, 1990 Workplan, as amended in an addendum dated August 23, 1990. The Workplan, as amended, was approved by the Alameda County Health Care Services Agency, Environmental Health Department, Hazardous Materials Division in correspondence dated September 14, 1990.

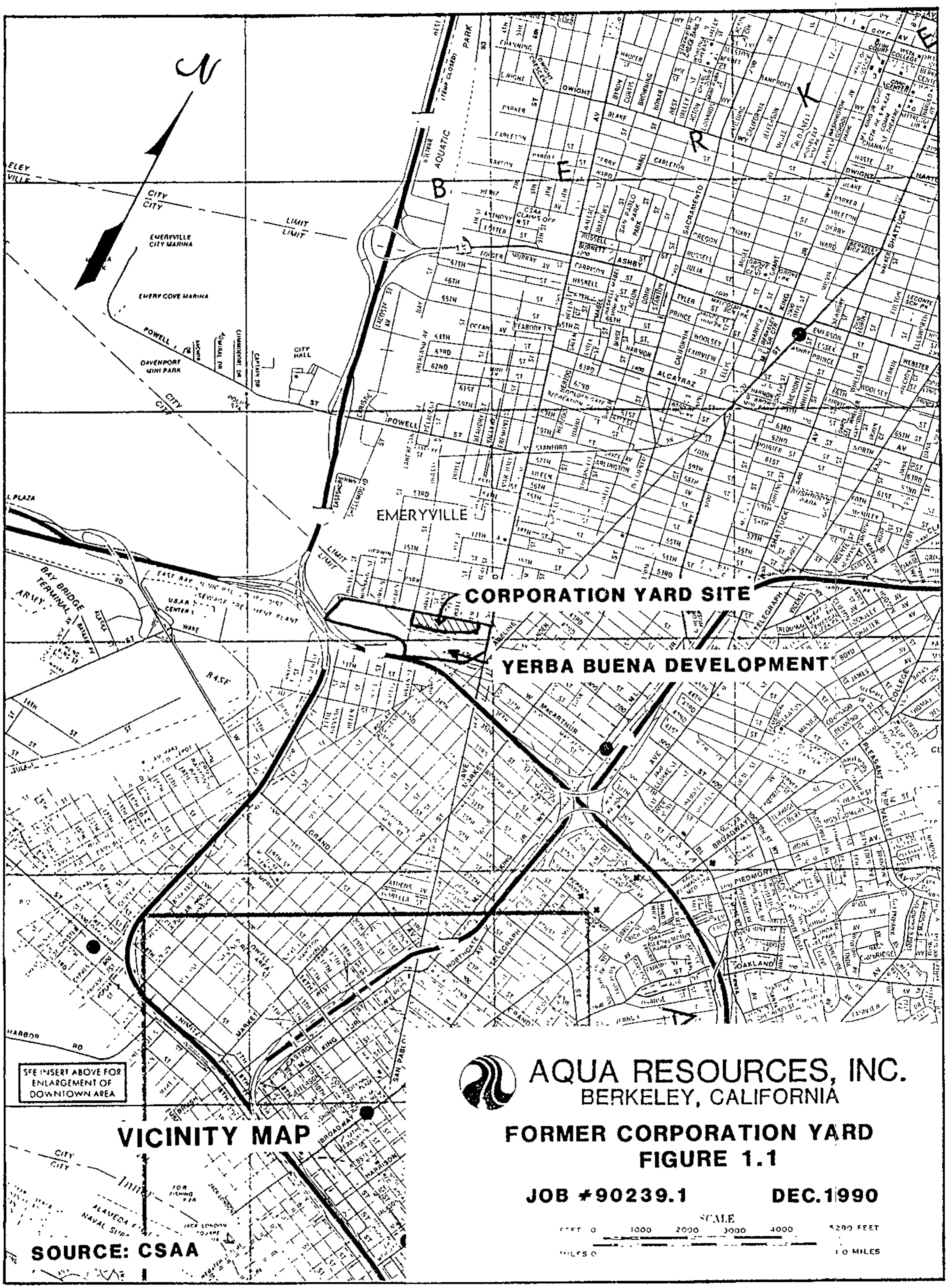
1.2 Organization of Report

The RI and Closure Plan report consists of the following elements:

- Site Background
- Site Investigation
- Site Geology and Hydrology
- Initial Screening of Soil Remediation Alternatives
- Remediation Alternatives
- Conclusions and Site Closure Recommendations

The soil boring logs, monitoring well logs, chain of custody forms, certified chemical analyses reports and other pertinent documentation are presented as appendices to the report.

1.3 Summary of Previous Site Investigations


N
CORPORATION YARD SITE
YERBA BUENA DEVELOPMENT
EMERYVILLE
SEE INSERT ABOVE FOR ENLARGEMENT OF DOWNTOWN AREA
VICINITY MAP
SOURCE: CSAA
AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA
FORMER CORPORATION YARD
FIGURE 1.1
JOB #90239.1
DEC.1990
SCALE

The former Ransome Company corporation yard site is part of a larger parcel (the Yerba Buena Project Site) owned by the Catellus Development Company (Catellus). This property, including the site, will be subject to eventual redevelopment that is anticipated to include both residential and commercial developments.

Sections of this report reference investigations performed by others. Levine-Fricke (L-F) has performed a Phase I and II Environmental Investigation of the Yerba Buena project site, and presented the results in a report dated August 15, 1990 to Catellus. Kennedy/Jenks/Chilton (K/J/C) prepared a Baseline Environmental Site Assessment of the former Ransome Company Corporation yard site, and presented their results in a report dated October, 1989 to the Ransome Company. In addition, ARI performed a field reconnaissance of the site in June, 1990 in order to develop the workplan. The reconnaissance included a survey of the existing buildings and discussions with Ransome personnel.

Four underground storage tanks (USTs) and one partially below grade waste oil tank were removed in March 1990, from the site, and one above ground SS-1 asphalt emulsion tank was removed in July 1990. The four USTs included two diesel oil tanks and two gasoline tanks. One of the diesel tanks was apparently abandoned and had not been used for some time. The size, orientation and location of the four USTs and the partially below grade waste oil tank, including the results of soil and groundwater samples taken during the tank removal, were presented in a letter report dated April 9, 1990 to the Alameda County Health Care Services Agency. The sampling and chemical analyses presented in the report were performed by Kennedy/Jenks/Chilton. The removal of the above ground SS-1 emulsion tank was documented in an ARI report to Ransome Company dated August, 1990.

2.0 SITE BACKGROUND

2.1 Site Description

The site is located at 4030 Hollis Street, and is shown in relation to the City of Emeryville on Figure 1.1. The site is approximately triangular in shape, and is almost level. Ground surface elevations, based on a spot elevation survey at soil boring and monitoring well locations, range from about +27 feet (Mean Sea Level datum) at the northeast side of the site to about +20 feet at the south west side of the site. Currently, there are no buildings or other above ground structures or known underground improvements on the site. However, there were previous buildings and other above and below grade structures on the site during the time Ransome Company occupied it between 1938 and May, 1990. The structures and improvements were removed in July, 1990, pursuant to the requirements of the lease agreement between the Ransome Company and Catellus Development Corporation (formerly Santa Fe Pacific Realty). The location of buildings and other site features referenced in the report are shown on the Site Features Plan, Figure 1.2.

In the northeast corner of the site there is an open excavation left from the removal of the four underground tanks and related fuel lines performed in March, 1990. This excavation is currently protected by a 6 foot high chain link fence.

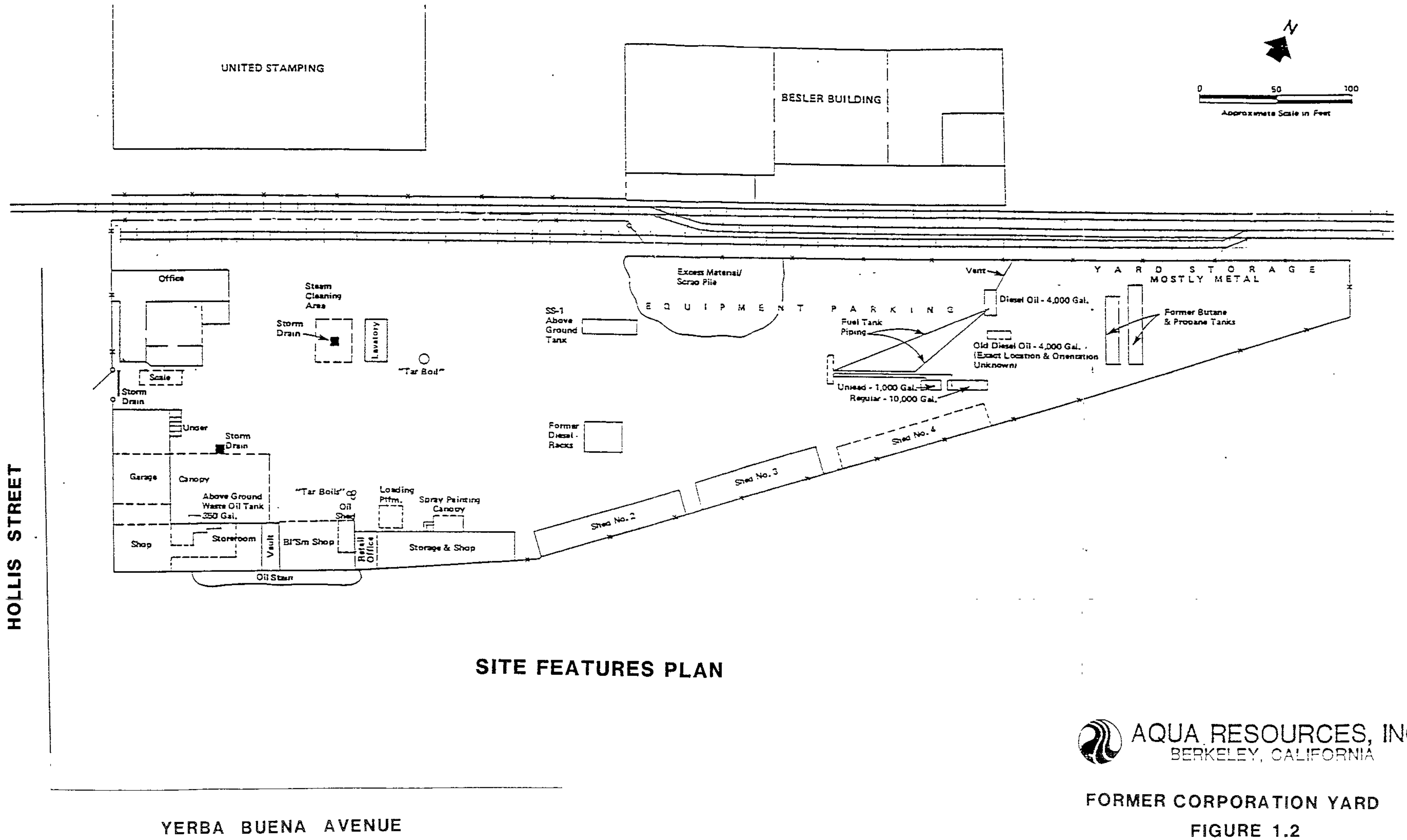
2.2 Site History

The Ransome Company occupied the site from about 1938 to 1990. Between 1924 and 1938, the property was used by other companies and contractors. During all of these years, the site has been primarily used for storage of equipment and materials used in manufacture, transport and placement of asphaltic concrete. These materials included storage of aggregates and various types of asphalts. The raw materials were transported to the site both by rail and by trucks. The aggregates were stored in receiving pits; the liquid asphalt was stored in above ground tanks. For a period of years, asphaltic concrete was manufactured in two batch plants that had a combined capacity of about 5,000 pounds per hour. The batch plant operation was discontinued and dismantled in 1983. One above ground asphalt emulsion storage tank was removed from the site in July, 1990.

The asphalt in the batch plants was heated using natural gas provided by PG&E. Backup supplies of butane and propane were stored in above ground tanks located at the east end of the site. The above ground butane and propane tanks were removed at the time the asphalt batch plant equipment was removed in 1983.

Diesel and gasoline fuel for paving and transport equipment were stored in underground storage tanks (USTs). Diesel was stored in one 4,000 gallon steel tank, while regular gasoline was stored in one 10,000 gallon steel tank and unleaded in a 1,000 gallon steel tank. The USTs were removed in March, 1990 by Peregren Environmental Group. Engineering oversight was provided by Kennedy/Jenks/Chilton during the removal of the tanks. *At the time the tanks were removed, a fourth tank was discovered and removed.* The fourth tank was apparently used for storage of diesel fuel; but had been abandoned for some time.

Equipment maintenance was performed in the garage located on the southwest side of the site. Waste oils and solvents generated from the equipment maintenance were stored in a partially below grade waste oil tank. Ransome's practice in recent times has been



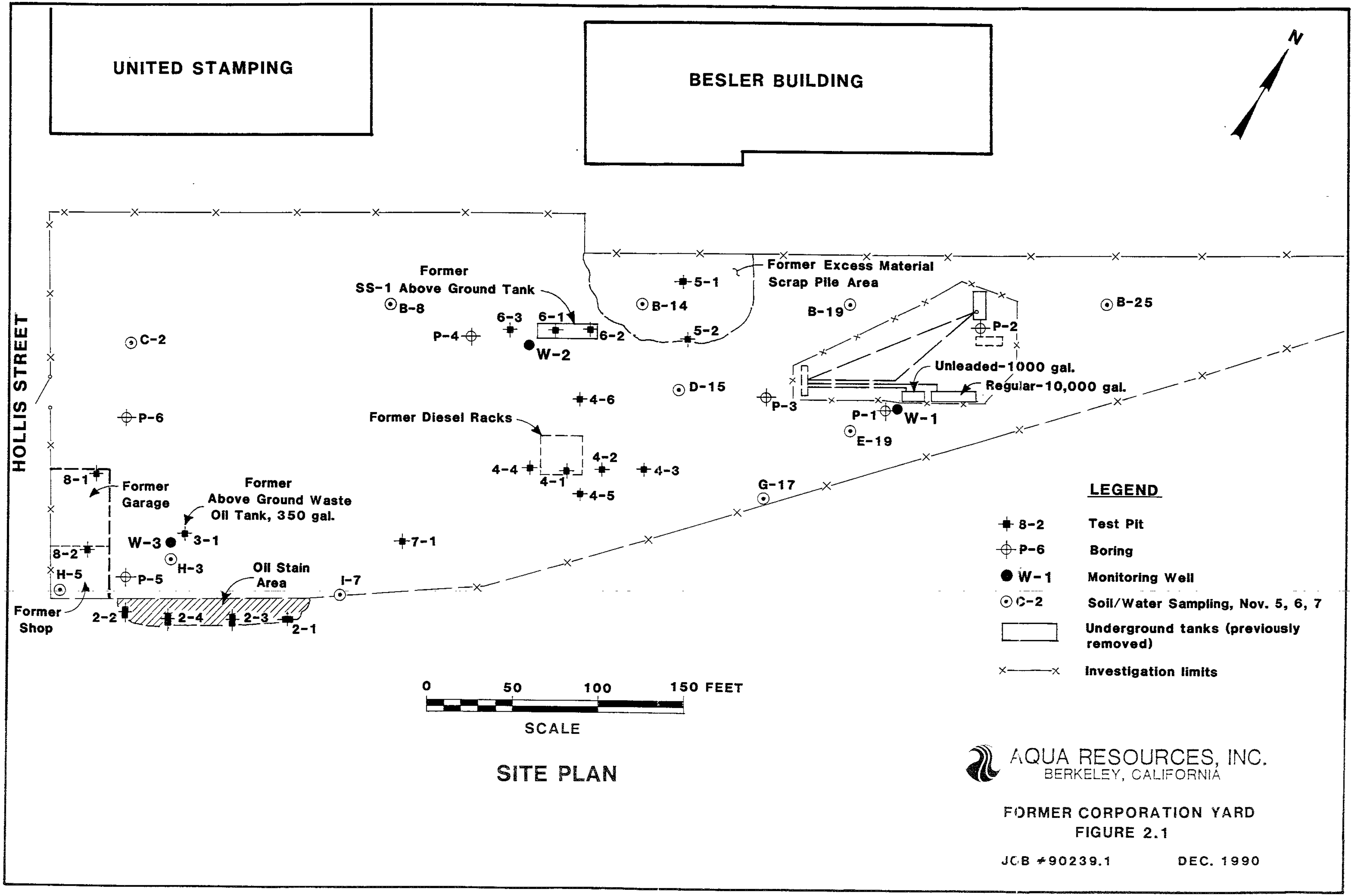
SITE FEATURES PLAN

AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA

FORMER CORPORATION YARD

FIGURE 1.2

JOB #90239.1 DEC. 1990


UNITED STAMPING
BESLER BUILDING
N
HOLLIS STREET
Former Excess Material Scrap Pile Area
Former SS-1 Above Ground Tank
Former Diesel Racks
Unleaded-1000 gal.
Regular-10,000 gal.
Former Garage
Former Above Ground Waste Oil Tank, 350 gal.
Oil Stain Area
Former Shop
8-1
8-2
H-5
C-2
P-6
P-5
W-3
3-1
H-3
2-2
2-4
2-3
2-1
I-7
7-1
B-8
P-4
6-3
6-1
6-2
W-2
5-1
B-14
5-2
B-19
B-25
P-2
D-15
P-3
P-1
W-1
E-19
4-6
4-4
4-1
4-2
4-3
4-5
G-17
LEGEND
8-2 Test Pit
P-6 Boring
W-1 Monitoring Well
C-2 Soil/Water Sampling, Nov. 5, 6, 7
Underground tanks (previously removed)
Investigation limits
0
50
100
150 FEET
SCALE
SITE PLAN
AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA
FORMER CORPORATION YARD
FIGURE 2.1
JOB #90239.1
DEC. 1990

to use Safety-Kleen units for parts washing so that solvents are not mixed with waste oil. The tank was removed from the site recently.

Other minor operations that were conducted on the site included torch and burner equipment assembly, material storage, painting, printing and equipment storage.

A detailed site usage history is presented in the previously referenced K/J/C Baseline Environmental Site Assessment report.

3.0 SITE INVESTIGATION

3.1 Contamination Source Identification

The former corporation yard site was mainly used by Ransome Company for the storage, production and distribution of asphaltic concrete. In order to identify potential sources of contamination and release points, ARI reviewed the previously referenced reports by L-F and K/J/C but also performed a field reconnaissance of the site and interviewed Ransome employees. Based on this, ARI identified the following areas where possible releases had occurred and where subsurface investigation should be performed. These locations included:

- the previously removed gasoline and diesel fuel tanks, transfer piping and fuel island (Area 1);
- area south of the former blacksmith shop and storeroom where at one time there was an outlet of the pipe which collected oil drippings from drums of lubricating and hydraulic oils stored inside the building (Area 2);
- area where a partially below grade waste oil tank was located (Area 3);
- diesel racks where a layer of diesel was sprayed in the back of delivery trucks so that asphaltic concrete would not stick to the track beds (Area 4);
- excess material/scrap pile area where scrap asphaltic concrete, cement concrete, soil and other solid materials were collected. SS-1, an oil-water emulsion, was sprayed on this pile. Additionally, solids collected in the steam cleaning sump have been deposited here (Area 5);
- area where above-ground tank with SS-1 emulsion was located (Area 6);

- the former spray painting canopy, garage and shop areas (Areas 7 and 8).

These areas were identified in the Workplan, as amended.

3.2 Soil Contamination Investigation

<u>3.2.1 Phase I Soil Sampling</u> - Soil sampling at the former corporation yard site was mainly concentrated in the areas described above which were considered to be potential sources of contamination. The soil sampling program was conducted in two phases. In the first phase, soil sampling was targeted to verify if contamination in these areas exists and to identify, if possible, the hot spots in these areas. Two methods were used to collect these Phase I soil samples:

- excavation of test pit using a backhoe and collection of sample(s) using hand-driven sampling equipment;

- hollow-stem auger drilling equipment and collection of soil samples using a split-spoon sampler.

The Phase I test pit (identified as 2-1 to 8-2) and soil boring (P-1 to P-6) locations are shown on the attached Site Plan, Figure 2.1. The test pit and boring locations were determined by tape measurements from existing fences. The logs of the test pits and soil borings are presented in Appendix A. Surface elevations, where shown on the logs, were determined using survey methods by a licensed civil engineer. The test pits extended to depths ranging from about 3 feet to 9 feet; soil borings extended to depths from about 9 feet to 15 feet. The soil borings were backfilled with a cement -bentonite grout; test pits were backfilled with excavated materials with little compactive effort. Drill cuttings were placed in 55-gallon DOT-approved drums.

Soil samples were collected at about five foot intervals beginning at a depth of 2 feet. Sample depths between borings were staggered in order to provide a cross section of the complete boring interval. All augers were steam cleaned prior to drilling of each boring. The location of soil samples from test pit locations was selected by an ARI field engineer using an Organic Vapor Meter. Borings and test pits were logged by or under the supervision of Registered Civil Engineer.

A California split sampler with 2-5/8-inch OD and 2-inch ID was used to collect soil samples from the soil borings. The sampler has the capacity to obtain an 18-inch long sample using three 6-inch long liners. The hand auger sampling equipment is similar to the split barrel sampler except it has the capacity to collect only one six inch sample. Soil samples were collected using 2-inch diameter brass tubes. The split sampler was driven using a 140-hammer with a fall of 30-inches. Blow counts were recorded for each 6-inch of penetration of the sampler.

Prior to obtaining each sample, including the initial one, the disassembled sampler and the brass liners were washed and rinsed or steam cleaned. The wash consisted of a solution of tri-sodium phosphate (TSP) in water. Each piece was triple rinsed with the final rinse being distilled water.

The lower-most sample liner (next to the shoe) was used for any required chemical analyses. The soil exposed in the ends of the tube was quickly noted, then sealed with teflon tape and new, snug-fitting plastic caps. The edges of the caps were sealed with plastic tape, and each sample was immediately labeled with the sample number, the depth, the project number, and the date. The samples were placed in a chilled (approximately 4° C) ice chest for storage and transported to the analytical laboratory. Samples were delivered under strict chain-of-custody procedures to Curtis & Tompkins, a state-certified laboratory located in Berkeley, for chemical analyses. Standard chain of custody forms were completed and kept with the samples. Copies of the chain of custody forms are presented in appendix D.

<u>3.2.2 Phase II Soil Sampling</u> - The results of chemical analyses performed on soil samples collected during the Phase I sample interval were utilized in determining the Phase II sample locations. The purpose of the Phase II sampling program was to provide additional data in order to estimate the horizontal and vertical extent of contaminated area identified in the initial phase of sampling. In addition, the data were used in siting the locations of monitoring wells.

The Phase II sampling program was conducted on November 5, 6 and 7, 1990. During this phase, additional soil samples and "grab" groundwater samples were collected. The sample collection was performed by National Environmental Testing, Inc., under the supervision of an ARI field engineer. As part of the Phase II sampling program, ten soil samples and six "grab" groundwater samples were collected at the site. Samples were analyzed by a state-certified NET field laboratory. Soil samples were collected by driving a steel galvanized pipe into the ground. The pipe was fitted with an internal mandrel (to prevent the pipe from buckling during hard driving and from soil entering the inside of the pipe) which was removed after the pipe was driven to the desired sample depth.

Once the desired sample depth was reached, the mandrel was removed and pipe was driven an additional six inches in order to collect the soil sample. After driving, the pipe was removed and the lower six inches of pipe was cutoff. Both ends of the removed pipe section were plugged with plastic caps and the sample was transferred to the field laboratory for analyses. The procedures for obtaining the "grab" groundwater samples are discussed in Section 3.3.1. The Phase II soil sample locations (B-8 to I-7) are shown on the Site Plan.

3.2.3 Chemical Analyses - Soil samples collected during the Phase I soil sampling were transported to Curtis & Tompkins, a State-certified laboratory, under chain of custody control for chemical analyses; soil samples from the Phase II sampling were analyzed onsite field laboratory. The soil samples were analyzed for the compounds that, based on historical activities at the site, were suspected to exist at the sample location. Soil samples were analyzed for one or more of the following compounds:

- Total Petroleum Hydrocarbons (EPA Method 8015, modified - sonication extraction),
- Total Volatile Hydrocarbons (EPA Method 8015, modified - purge and trap),
- Purgeable Aromatics (EPA Method 8020),
- Purgeable Halocarbons (EPA Method 8010),
- Hydrocarbon Oil and Grease (SMWW 5520);
- Semi Volatile Organics (EPA Method 8270);
- Title 26 Metals in soils and wastes (Total Threshold Limit Concentrations).

The results of laboratory analyses are presented in Section 3.4.

3.3 Groundwater Investigation

3.3.1 Collection of "Grab" Groundwater Samples - As part of the Phase II sampling, "grab" groundwater samples collection was performed. The "grab" groundwater samples were collected by driving a steel galvanized pipe to below the free groundwater level. The pipe was equipped with a perforated section near the tip to enable groundwater flow into the pipe once the internal mandrel was removed. "Grab" groundwater sampling was attempted at depths ranging from about 8 feet up to 24 feet.

After the pipe had been driven to the desired depth and the mandrel was removed, the groundwater was allowed to reach equilibrium. Groundwater samples were then collected using a 3/8-inch diameter stainless steel bailer. The groundwater sample was transferred to the field laboratory for analyses.

Because the soils encountered at the site were principally clayey and have low permeability, it was possible to collect groundwater samples from only six of the nine locations where "grab" groundwater sampling was attempted. The Phase II sample locations (B-8 to I-7) are shown on the Site Plan (Figure 2.1).

3.3.2 Monitoring Well Location and Construction - Three monitoring wells were installed to assess if groundwater underlying the site had been impacted. The purpose of the monitoring wells was to enable collection of groundwater samples, to monitor fluctuations in the free groundwater level and to evaluate the direction of groundwater flow. The soil and chemical analyses data obtained from the Phase I and II sampling intervals were utilized in establishing the monitoring well locations. The monitoring wells were installed on the site downgradient of probable sources of contamination established by previous soil and "grab" groundwater sampling. The locations of the monitoring wells (W-1 to W-3) are shown on the Site Plan (Figure 2.1). These locations were tape measured from the existing fences surrounding the site.

The monitoring wells were installed on November 13 and 14, 1990, by HEW Drilling Co. under the supervision of ARI field engineers. The monitoring wells were drilled using a 10-inch diameter hollow-stem auger. Soil samples were collected at 5 foot intervals using a California split sampler; soil samples were collected in 2-inch diameter brass tubes. Soil samples were collected for geological description, and selected samples were submitted for chemical analysis. Sampling and handling procedures conformed to those described in Section 3.2. Drill cuttings were placed in 55-gallon DOT-approved drums.

The boreholes, in which monitoring wells were installed, were drilled to depths of about 24 feet. After the borehole was advanced to the desired depth, the well was installed. The monitoring well consisted of 4-inch diameter PVC casing. The lower, about 18-feet, portion of the well casing consisted of slotted casing (0.002 inch opening); the remaining portion of the casing was solid. The sand pack consisted of Lone Star #3 sand, which was placed to a depth of about 1 foot above the top of the slotted casing. A one foot thick bentonite seal was constructed immediately above the sand pack. The remaining portion of the borehole, from the bentonite seal to the ground surface, was filled with cement grout. An expansion locking plug was placed over the top of the PVC casing, and a christy box with a screw type metal cover was installed. The christy box provides for a positive surface drainage away from the monitoring well. The monitoring well logs and well construction details are presented in Appendix C.

3.3.2 Monitoring Well Development and Sampling - After the monitoring wells were installed, the ground surface and well casing elevations were surveyed by a licensed Civil Engineer. The ground surface and casing elevations are shown on the monitoring well logs. The depth to groundwater was measured using an electric water level indicator and recorded for each well locations. Each well was then developed by purging about six casing volumes (about 50 gallons) of water. A centrifugal pump was used to develop the wells, and the purge water was pumped into 55 gallon drums. ARI completed development of the monitoring wells on November 17, 1990.

Groundwater samples were collected from the monitoring wells for chemical analyses on November 19, 1990. Water samples were collected into laboratory supplied containers. Polyethylene disposable bailers were used to collect water samples. Samples were placed in the cooler and delivered to Curtis & Tompkins Laboratory under chain of custody form for analyses. Each well was checked for the presence of free floating product (gasoline or oil); no free floating product was observed at the three monitoring wells installed at the site.

In addition to the three wells described above, ARI sampled three existing monitoring wells installed by Levine-Fricke located upgradient of the site. Wells sampled were LF-7, LF-8 and LF-20; sampling was performed by ARI personnel on December 3 and 4, 1990. Purging and sampling of the these three well conformed to procedures described previously.

<u>3.3.3 Chemical Analyses</u> - "Grab" groundwater samples from the Phase II sampling were analyzed by an onsite field lab. The groundwater samples were analyzed for the compounds that, based on historical activities, were suspected to exist at the sample location. Groundwater samples were analyzed for one or more of the following compounds:

- Total Petroleum Hydrocarbons (EPA Method 8015, modified - sonication extraction),
- Total Volatile Hydrocarbons (EPA Method 8015, modified - purge and trap),
- Purgeable Aromatics (EPA Method 8020),
- Purgeable Halocarbons (EPA Method 8010),
- Hydrocarbon Oil and Grease (SMWW 5520);

Groundwater samples obtained from monitoring wells W-1, W-2 and W-3 installed by ARI were analyzed for the following compounds:

- pH,
- Total Dissolved Solids (TDS),
- Total Petroleum Hydrocarbons (EPA Method 8015, modified - sonication extraction),
- Total Volatile Hydrocarbons (EPA Method 8015, modified - purge and trap),
- Purgeable Aromatics (EPA Method 8020, BTXE compounds only) and
- Semi Volatile Organics (EPA Method 625, well W-3 only) and

Results of analyses performed on the "grab" groundwater samples obtained during the Phase II sampling and groundwater samples from the three ARI monitoring wells are presented in Section 3.4. The groundwater samples obtained from the L-F monitoring wells were analyzed using the same methods, and the results are presented in Section 3.4.

3.4 Interpretation of Chemical Analyses

<u>3.4.1 Summary of Soil Analyses</u> - Soil samples were collected from 38 different locations at the site. Soil samples were chemically analyzed as described in Section 3.2.2. The chemical analyses were performed for total petroleum hydrocarbons (TPH - quantified as diesel and gasoline), Total oil and grease (O&G), semi-volatile organics, volatile organics and heavy metals. Certified chemical results are presented in Appendix D.

3.4.1.1 Heavy Metals: Six soil samples were analyzed for heavy metals according to Title 26 of the California Code of Regulations (CCR). Soil sample locations included were the former location of the SS-1 emulsion tank (sample 6-1 from a depth of 6 feet), the former location of the garage (sample 8-1 from a depth of 3 feet, sample 8-2 from a depth of 2.5 feet), downgradient from the former location of the waste oil tank (samples P-5 and 3-1), and from the hydraulic oil surface spill area (sample 2-1 at a depth of 3.5 feet). The results are presented in Table 3.1 All results were below Total Threshold Limit Concentration (TTLC) and Soluble Threshold Limit Concentration (STLC) as listed in Title 26 of the CCR.

Table 3.1
Summary of Laboratory Results — Metals Analyses

Metal	TTLC (ppm)	Concentration in ppm at Various Locations (Depths in Feet)					
		P-5 (10.5)	2-1 (3.5)	3-1 (4)	6-1 (6)	8-1 (3)	8-2 (2.5)
Antimony	500	ND	ND	ND	ND	ND	ND
Arsenic	500	ND	ND	ND	ND	ND	ND
Barium	10,000	65	160	90	93	76	180
Beryllium	75	ND	ND	ND	ND	ND	0.5
Cadmium	100	0.93	1.5	0.8	ND	0.7	1.4
Chromium (total)	2,500	12	18	10	10	13	19
Cobalt	8,000	4.5	9.5	6.5	8.6	6.4	11
Copper	2,500	10	20	11	12	15	40
Lead	1,000	ND	4.8	6.9	6.4	2.5	12
Mercury	20	ND	ND	ND	ND	ND	ND
Molyb-denum	3,500	ND	ND	ND	ND	ND	ND
Nickel	2,000	29	32	16	12	17	32
Selenium	100	ND	ND	ND	ND	ND	ND
Silver	500	ND	ND	ND	ND	ND	ND
Thallium	700	ND	ND	ND	ND	ND	ND
Vanadium	2,400	6	17	9	11	13	21
Zinc	5,000	23	34	14	11	18	46

3.4.1.2 Purgeable Halocarbons: Thirteen soil samples were analyzed for Purgeable Halocarbons by EPA Method 8010 from the following locations: B-25 (6'); H-5 (6'), H-3 (5)'; I-7 (4'); C-2 (5'); 7-1 (5'); 7-1 (2.5'); 8-1 (3'); 8-2 (2.67'); 2-1 (3.5'); 3-1 (4'); P-5 (5.5') and P-5 (10.5'). The sample depth is shown in parentheses next to the sample location designation. The only compound which was detected above the method detection limit by this method was 1,1 Dichloroethane in sample C-2 at a concentration of 2.4 ppb. Based on these results, it appears that contamination of soil by purgeable hydrocarbons is not evident.

3.4.1.3 Semi-volatile Organics: Seven soil samples were analyzed for semi-volatile organic compounds using EPA Method 8270. The samples locations and depths (in parentheses) are as follows: 6-1 (6'); 7-1 (2.5'); 2-1 (3.5'); 3-1 (4'); 5-1 (2.75'); P-5 (5.5') and P-5 (10.5').

Compounds detected above the method detection limit were found in the following areas:

- former location of the waste oil tank (area 3): 2-methylnaphthaline at a concentration of 640 ppb

- former location of excess material scrap pile (area 5): fluorine at a concentration of 680 ppb and benzidine at a concentration of 47,000 ppb and

- at the former location of SS-1 above ground tank (area 6): naphthalene at a concentration of 2,900 ppb and 2-methylnaphthaline at 4,300 ppb.

The sources of these compounds were probably coal asphalts and diesel.

3.4.1.4 Total Petroleum Hydrocarbons: Forty soil samples were analyzed for Total Petroleum Hydrocarbons (TPH) as diesel — 4 from area 2 (oil stain), 8 from area 3 (former location of oil tank), 4 from area 4 (former location of diesel racks), 3 from area 5 (former location of excess material scrap pile), 5 from area 6 (former location of SS-1 tank), 2 from area 7, 1 sample from the former shop area and 1 sample from the former garage area (Area 8). These sample locations are referenced on Figure 2.1 by area and sample number (i.e., 2-1 is area 2, sample no. 1). Twelve soil samples were also collected from borings P-1 through P-6.

Twenty soil samples were analyzed for TPH as gasoline: one from area 2 (oil stain), one form area 4 (former diesel racks), two from area 5 (former excess material scrap pile), 6 from area 6 (former location of SS-1 tank). Ten soil samples were collected from borings P-1 through P-6. The highest concentrations were found in the soil samples taken from borings P-1 and P-3 located south of former underground tanks. The TPH-G was detected at concentrations of 530 mg/kg and 510 mg/kg, respectively.

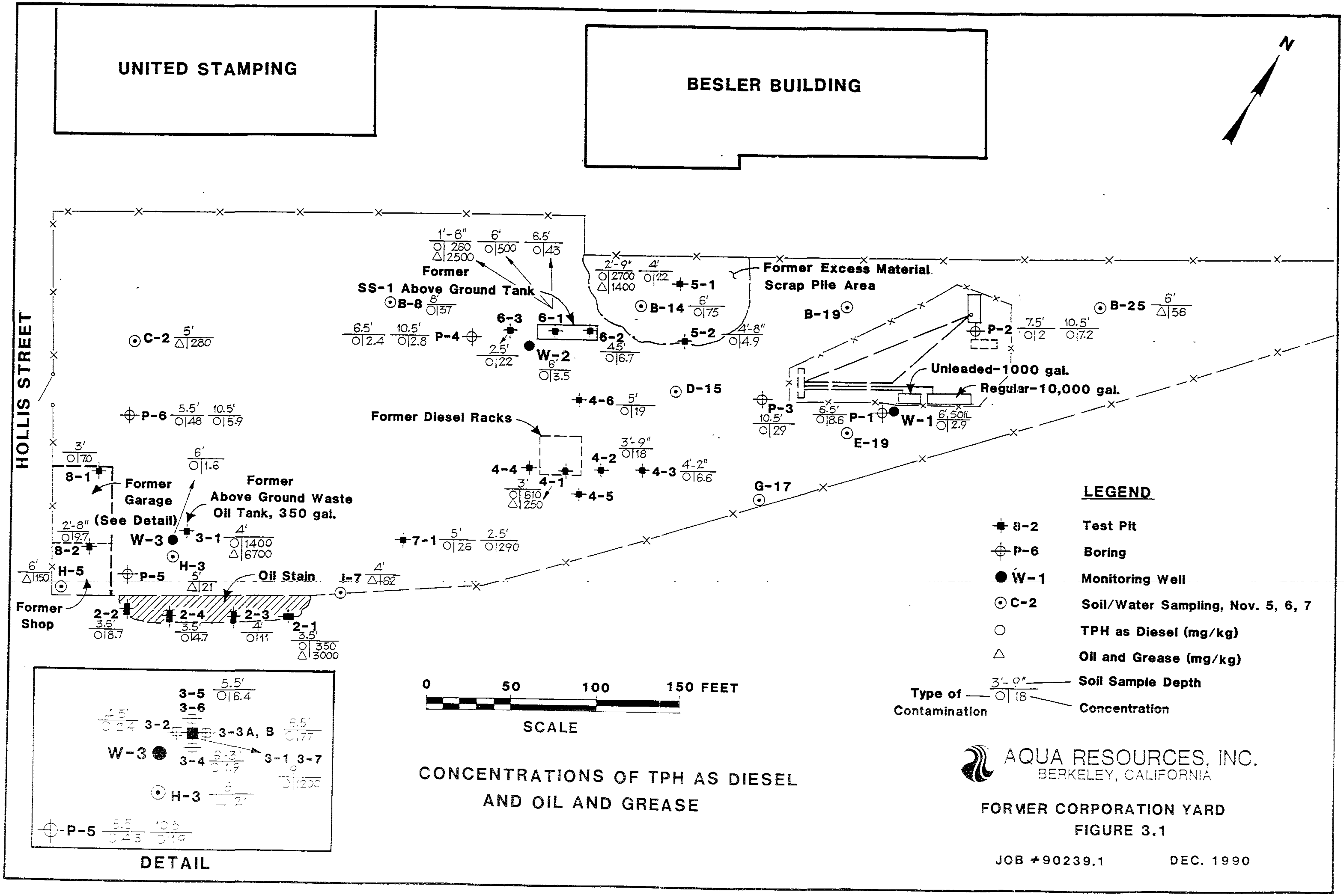
The average concentration of TPH as diesel at the site was 760 mg/kg (ppm), with the highest levels in area 5 (the former material scrap pile) at 2,700 mg/kg and in area 3 (the former location of the oil tank) at 1,400 mg/kg. In other areas, concentrations vary from 610 mg/kg to 260 mg/kg.

3.4.1.5 Total Oil and Grease: Eight soil samples were analyzed for oil and grease: one from area 2 (oil stain), one from area 3 (former location of oil tank), one from area 4 (former location of diesel racks), two from area 5 (former location of excess material scrap pile), and one from area 6 (former location of SS-1 tank). Generally higher concentrations of oil and grease were found in shallow soils. Area 3 at a depth of 4 feet had the highest concentration at 6,700 mg/kg.

3.4.1.6 Purgeable Aromatics: Twenty-one soil samples were analyzed for purgeable aromatics (i.e. benzene, toluene, ethyl benzene and xylenes (BTXE)) using EPA Method 8020. Soil sample locations included one in area 3 (former waste oil tank), one in area 5 (former excess material scrap pile), 4 in area 6 (former location of SS-1 tank), one in area 7 (former paint spray canopy area), 2 in area 8 (former garage and former shop area). The highest concentrations of BTXE compounds were found in areas where TPH as gasoline levels were also the highest.

Concentrations of TPH as diesel and oil and grease are shown on Figure 3.1. Concentrations of TPH as gasoline and BTXE compounds are shown on Figure 3.2. A summary table of the above analyses and results is presented in Table 3.2.

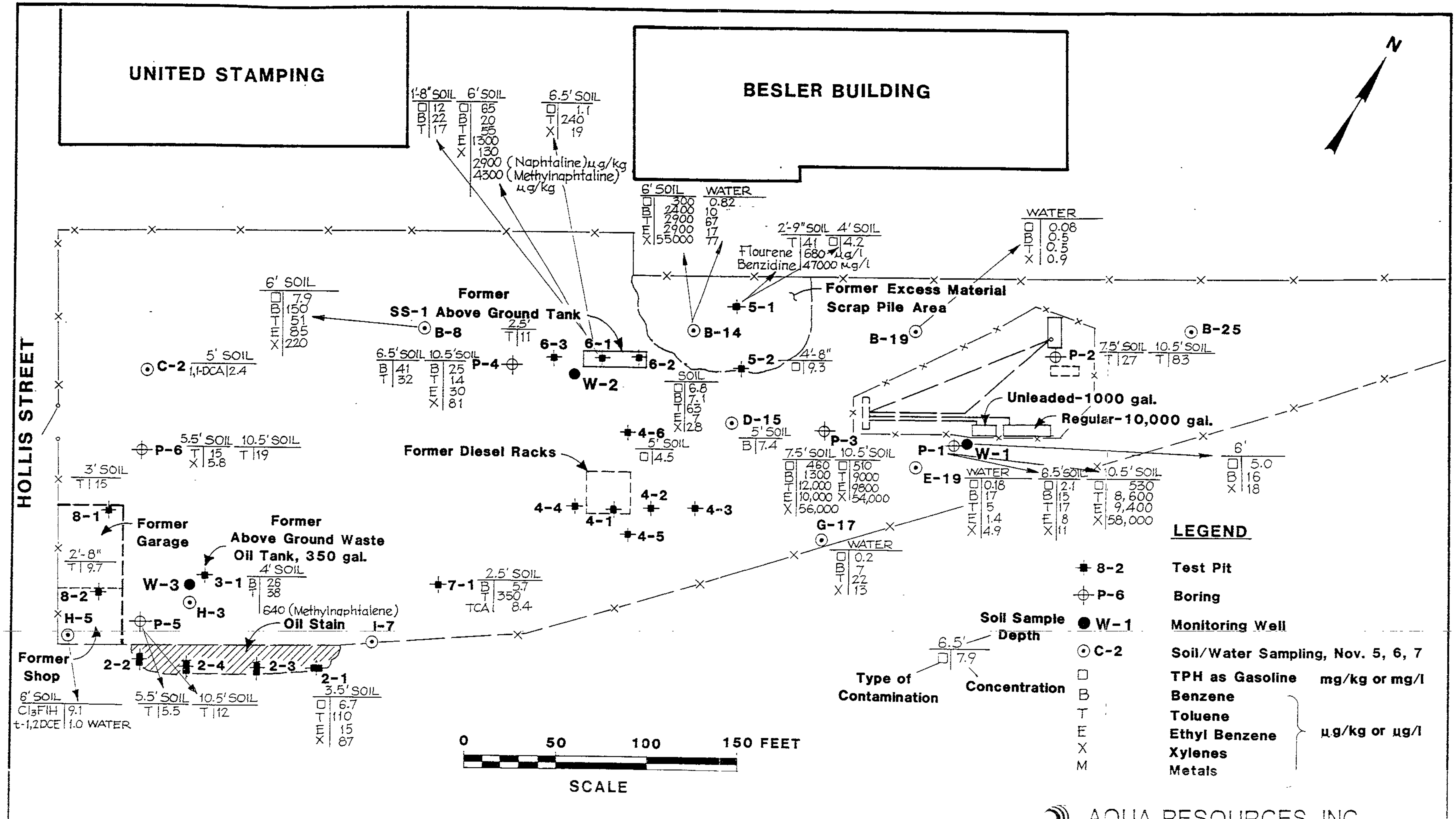
<u>3.4.2 Summary of Groundwater Analyses</u> - "Grab" groundwater samples were obtained from various locations during the phase II sampling. Groundwater samples were also obtained from three monitoring wells installed at the former corporation yard site by ARI and from three monitoring wells installed by Levine-Fricke located upgradient from the former corporation yard site. The results of the grab groundwater tests are summarized in the following table:



CONCENTRATIONS OF TPH AS DIESEL AND OIL AND GREASE

FORMER CORPORATION YARD

FIGURE 3.1



CONCENTRATIONS OF TPH AS GASOLINE AND BTXE COMPOUNDS

FORMER CORPORATION YARD

FIGURE 3.2

JOB #90239.1 DEC. 1990

"Grab" Groundwater Chemical Analysis

Sample Location ------------------------------------ Chemical Constituent	B-25	H-5	G-17	B-14	E-19	B-19
TPH (as Diesel), ppm	ND	ND	ND	ND	NA	NA
TPH (as gasoline), ppm	NA	NA	0.2	0.82	0.18	0.08
Benzene, ppb	NA	NA	ND	10	17	0.5
Toluene, ppb	NA	NA	24	67	5	0.5
Total Xylenes, ppb	NA	NA	14	77	4.9	0.9
Ethyl Benzene, ppb	NA	NA	2.9	17	1.4	ND
Purgeable Halocarbons (EPA Method 8010 compounds)	ND	ND	NA	NA	NA	NA

ND - not detected
NA - not analyzed

Table [redacted]

Summary of Laboratory Results — Hydrocarbons in Soil Samples

Sample I.D.	Depth (feet)	TPH as Gasoline (mg/kg)	TPH as Diesel (mg/kg)	TPH as Kerosine (mg/kg)	Oil & Grease (mg/kg)	Benzene (µg/kg)	Toluene (µg/kg)	Ethyl-Benzene (µg/kg)	Xylenes (µg/kg)	Heavy Extractable Petroleum Hydrocarbons
MDL		1.0	1.0/100	1.0/100	50	5.0	5.0	5.0	5.0	10
2-1	3.5	6.7	350		3,000	N.D.	110	15	87	
2-2	3.5		8 7	ND						
2-3	4		11	ND						
2-4	3.42		4.7							
3-1	4		1,400	ND	6,700	26	38	ND	ND	
3-2	4 5	ND	2.4	ND						
3-3A	6.5	ND	77	ND						
3-3B	6.5		ND	ND						
3-4	6.25		1.9	ND						
3-5	5.5		6.4	ND						
3-6	4		ND	ND						
3-7	9		1,200	ND						
H-5	6									150
H-3	5									21
4-1	3		610	ND	250	2				
4-2	3.75		18	ND						
4-3	4.17		6.6	ND						
4-6	5		19	ND						
5-1	2.75		2,700	ND	1,400					
5-1	4	4.2	22	ND	ND					
5-2	4.67	9.3	4.9	ND						

Sample I.D.	Depth (feet)	TPH as Gasoline (mg/kg)	TPH as Diesel (mg/kg)	TPH as Kerosine (mg/kg)	Oil & Grease (mg/kg)	Benzene (μg/kg)	Toluene (μg/kg)	Ethyl-Benzene (μg/kg)	Xylenes (μg/kg)	Heavy Extractable Petroleum Hydrocarbons
MDL		1.0	1.0/100	1.0/100	50	5.0	5.0	5.0	5.0	10
6-1	1.67	12	260	ND	2,500	22	ND	ND	17	
6-1	6.5	1.1	43	ND		ND	240	ND	19	
6-1	6	65	500	ND		20	55	1,300	130	
6-2	4.5	6.8	6.7	ND		7.1	63	7.0	28	
6-3	2.5	ND	22	ND		ND	11	ND	ND	
B-14			75			2,500	2,500	8,900	59,000	
7-1	2.5		290	ND		5.7	350	ND	ND	
7-1	5		26	ND						
8-1	3		7.0	ND	ND	ND	15	ND	ND	
8-2	2.67		9.7		ND	ND	48			
I-7	4		ND							62
C-2			ND							280
B-19		ND	ND			ND	ND	ND	ND	
D-15		7.6				ND	ND	ND	ND	
E-19		ND	ND			ND	ND	ND	ND	
G-17		ND				ND	ND	ND	ND	
W-1	6	5.0	2.9	ND		16			18	
W-2	6	ND	3.5	ND		ND	ND	ND	ND	
W-3	6	ND	1.6	ND		ND	ND	ND	ND	

ND — Not Detected
MDL — Method Detection Limit

The results of chemical analyses performed on groundwater samples obtained from the three ARI monitoring wells are summarized in the following table:

	Monitoring Well Location		
Chemical Constituent/Method (units)	W-1	W-2	W-3
pH	7.0	6.9	7.0
Total Dissolved Solids (TDS) (mg/l)	640	580	550
Total Petroleum Hydrocarbons (as gasoline) (ppb)	ND	ND	ND
Total Petroleum Hydrocarbons (as diesel) (ppb)	82	100	88
Total Petroleum Hydrocarbons (as kerosene) (ppb)	ND	ND	ND
Semi-volatile Organics (ppb)	NA	NA	ND
Benzene (ppb)	ND	ND	ND
Toluene (ppb)	ND	ND	ND
Ethyl Benzene (ppb)	ND	ND	ND
Total Xylenes (ppb)	ND	ND	ND

ND - not detected
NA - not analyzed

The results of chemical analyses on groundwater samples obtained from the three L-F monitoring wells are summarized in the following table:

	Monitoring Well Location		
Chemical Constituent/Method (units)	LF-7	LF-8	LF-20
pH	6.9	6.9	6.8
Total Dissolved Solids (TDS) (mg/l)	620	370	400
Total Petroleum Hydrocarbons (as gasoline) (ppb)	ND	ND	ND
Total Petroleum Hydrocarbons (as diesel) (ppb)	ND	ND	ND
Total Petroleum Hydrocarbons (as kerosene) (ppb)	ND	ND	ND
Semi-volatile Organics (ppb)	ND	ND	ND
Benzene (ppb)	ND	ND	ND
Toluene (ppb)	ND	ND	0.7
Ethyl Benzene (ppb)	ND	ND	0.6
Total Xylenes (ppb)	5.5	4.7	3.9

Poor correlation was obtained by comparing the results from the "grab" groundwater samples to those obtained from the monitoring wells. Compounds detected in the "grab" samples were not detected in the monitoring well samples, and vise-versa. It is possible that "grab" groundwater samples were cross contaminated from soils above, and that these represent "false positive" results.

However, if the groundwater contamination exists, it is likely that it is local and has not immigrated far. This is supported by the fact that the monitoring wells are either located downgradient from the "grab" sample locations or in very close proximity. For instance, monitoring well W-1 is located within 30 feet of "grab" sample E-19, and W-2 is located about 70 feet directly downgradient from "grab" sample B-14. "Grab" sample B-19 may represent off site contamination, possibly from the adjacent Besler Building site, since no known activities could have led to surface spills in this area. This area is also not located directly downgradient from the previous USTs that were operated nearby and is not considered to have been impacted from any releases from these USTs.

4.0 SITE GEOLOGY AND HYDROGEOLOGY

4.1 Regional Geology

The area lies in the California Coast Ranges section of the Pacific Border physiographic province. The near surface soils at the site and vicinity have been mapped as Holocene interfluvial basin deposits (Helley, Lajoie and Burke), as surficial deposits (Blake, Bartow et.al) and as alluvial fan deposits of the Temescal formation (Radbruch). The interfluvial basin deposits are described as consisting of plastic, poorly sorted, organic-rich clay and silty clays. The alluvial fan deposits are described as interfingering lenses of clayey gravel, sandy silty clay and mixtures of sands, silts and clays. The regional geology of the site and vicinity are shown on the regional geologic map Figure 4.1.

4.2 Site Geology

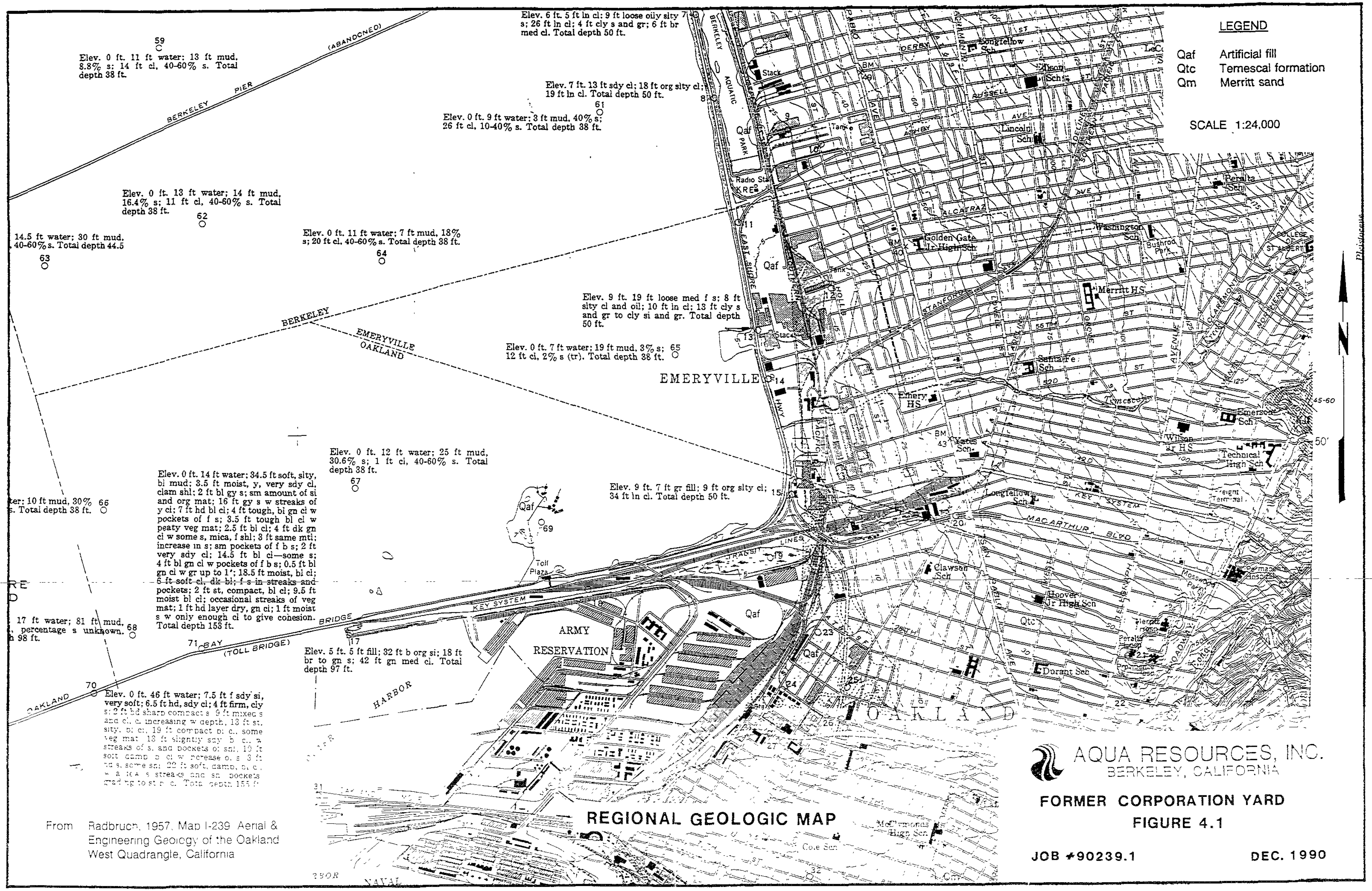
A layer of artificial fill covers the site to a depth of approximately one foot. The fill generally consists of clayey gravelly silt, with sections of the site containing more gravel. Underlying the fill in several areas are pieces of concrete, or layers of asphalt, silt or sand.

Underlying these units is a layer of clay or silty clay, black or dark gray which apparently extends over much of the site, varying from 1-1/2 to 3 feet thick. Underlying this very dark unit is a grayish green clay, which overlies a yellowish brown clay. The lowermost unit consists of a silty or sandy clay, light brown with reddish brown mottling. All of the clay units contain varying amounts of silt, sand and/or gravel. This unit was observed to extend to the depths explored (about 24 feet). They are generally medium stiff to stiff, and slightly plastic.

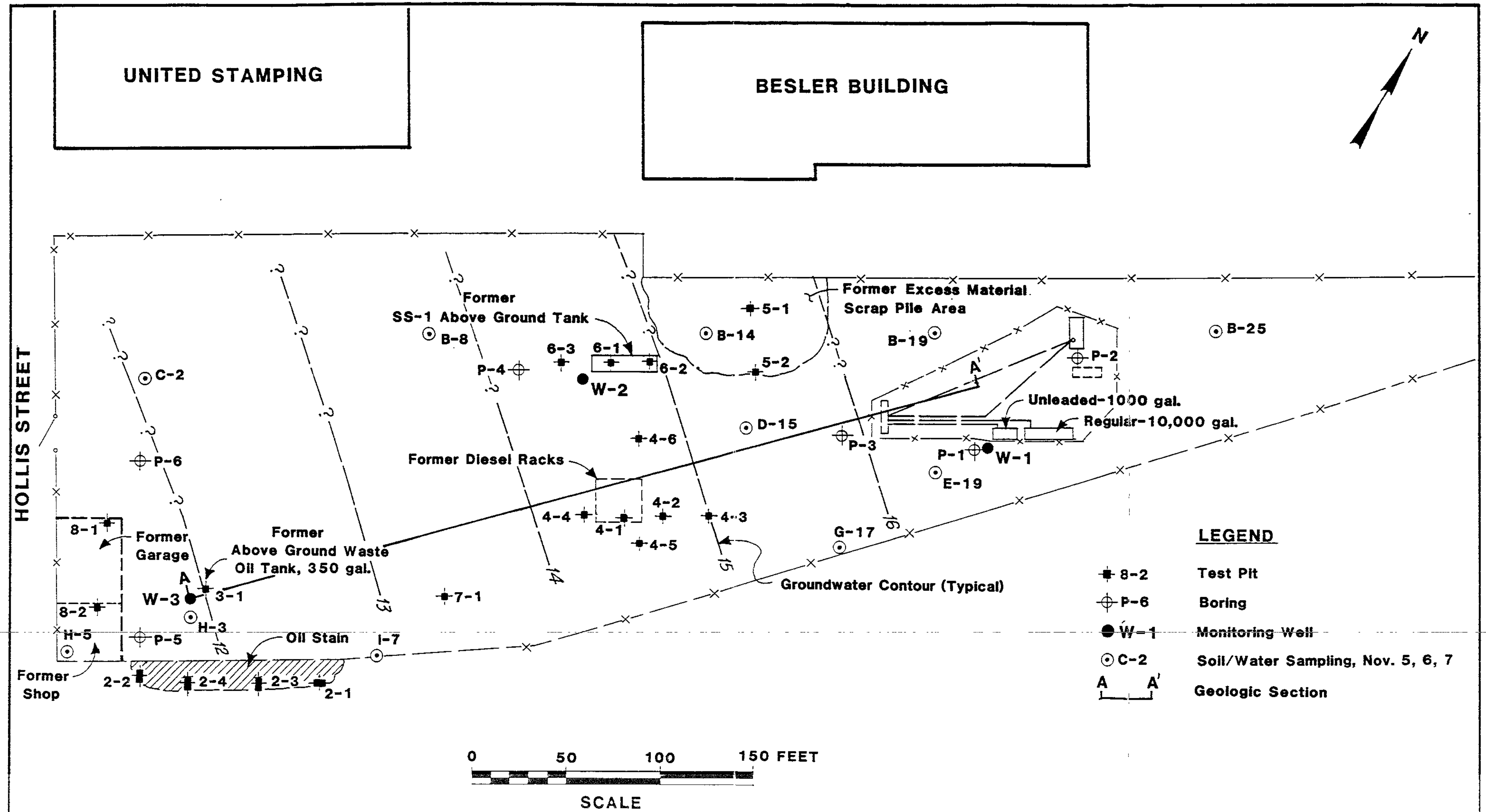
4.3 Site Hydrogeology

Based on measurement of groundwater levels observed in the monitoring well, the free groundwater level ranges from 8½ to 11 feet below the surface. Based on the groundwater elevations observed in the monitoring wells,the direction of groundwater flow is estimated to the southwest. Groundwater elevation contours are shown on Figure 4.2 From the contours, the hydraulic gradient is estimated to be about .001 ft/ft. Both the direction and gradient of groundwater flow are consistent with the reported findings in the previously referenced L-F report.

The soils encountered below the free groundwater were observed to be primarily clays and silts with low to moderate plasticity. Field observations indicate that the soils have very low permeability.



From Radbruch, 1957, Map I-239 Aerial & Engineering Geology of the Oakland West Quadrangle, California



GROUNDWATER ELEVATION CONTOURS

AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA

FORMER CORPORATION YARD
FIGURE 4.2

JOB #90239.1 DEC. 1990

A geologic section through the site taken in the approximate direction of groundwater flow is shown on Figure 4.3. Review of this figure indicates that there were no continuous, permeable units encountered that can be considered to have significant capacity to transmit groundwater.

5.0 REMEDIATION OBJECTIVES

5.1 General Remedial Action Objectives

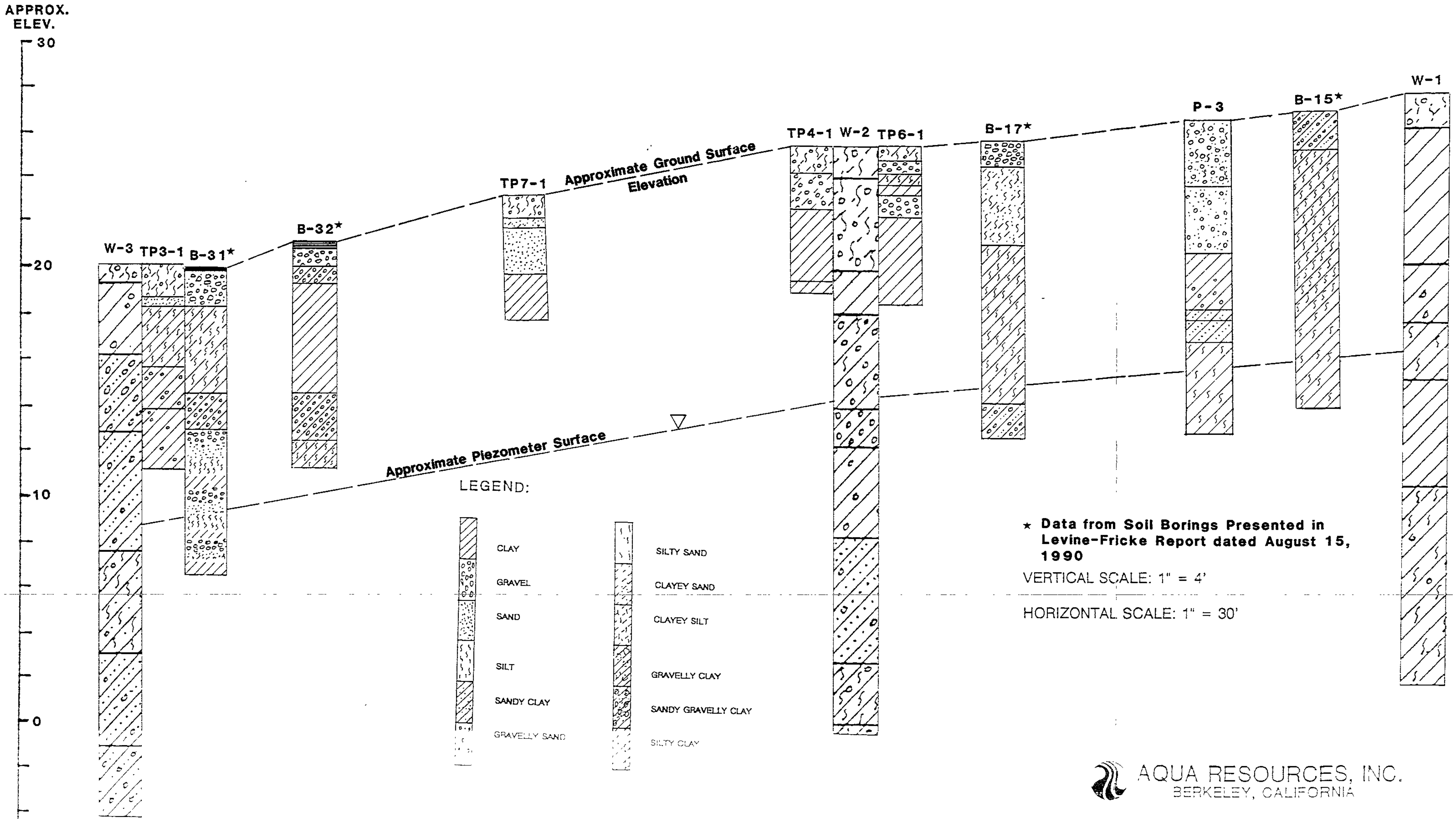
Soil and groundwater have been impacted from releases of hazardous materials/hazardous waste (HM/HW) from prior operations at the site. Results of the RI indicate that the soils have been contaminated primarily from releases in the vicinity of the USTs. Soils outside the UST areas have been impacted from surface spills resulting from a variety of operations conducted at the site ranging from equipment maintenance to releases from the above ground storage tanks.

Groundwater appears to have been impacted from the UST releases and possibly from other operations conducted at the site. The proposed remedial action objectives for each affected media (soil and groundwater) are listed and discussed in the following sections.

5.2 Soil Remediation Objectives

Soil contamination has occurred primarily from releases associated with the former underground and above ground storage tanks. At some locations, it is possible that the contamination extends to the saturated zone, and has impacted groundwater underlying the site. The results of this RI indicate that the major portion of the contamination was caused by releases of petroleum hydrocarbons.

In order to prevent further degradation of groundwater and to assist in the natural and imposed remediation of groundwater underlying the site, it is proposed that contaminated soils be remediated in the immediate vicinity of areas impacted by previous releases. The areas that have been identified as requiring remediation are shown on Figures 5.1 and 5.2. Figure 5.1 shows the areas and estimated soil volumes that will require remediation due to contamination from diesel and waste oils. Figure 5.2 shows the areas and estimated soil volumes that will require remediation due to contamination from gasoline and BTXE compounds at the site. The total volume of soil which will require excavation and treatment is estimated to be about 6,400 cubic yards. Soil volume by areas is shown on the figures, and summarized in the following table.



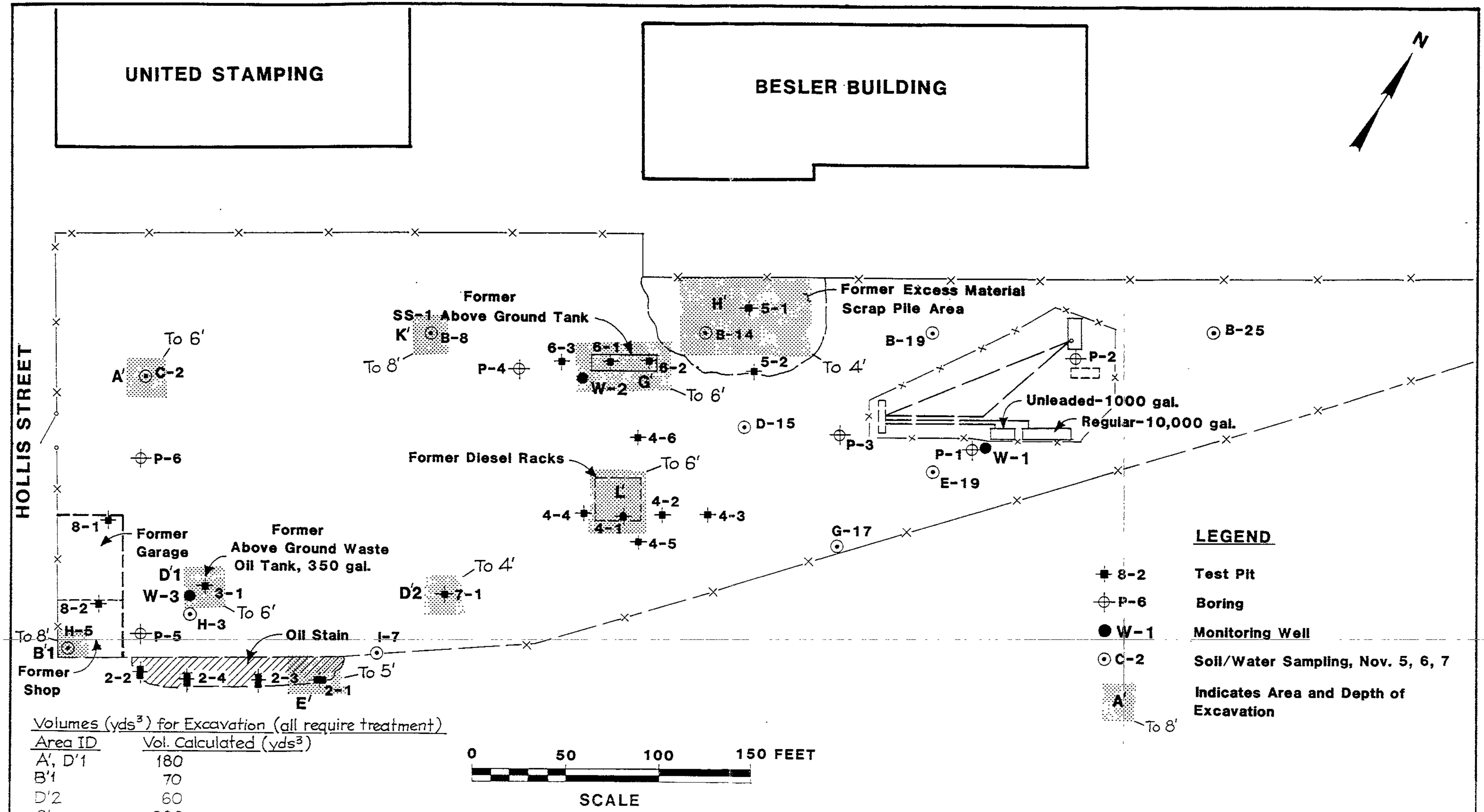
GEOLOGIC CROSS-SECTION
FROM SOIL BORINGS

AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA

FORMER CORPORATION YARD

FIGURE 4.3

JOB #90239.1 DEC. 1990



Volumes (yds³) for Excavation (all require treatment)

Area ID	Vol. Calculated (yds³)
A', D'1	180
B'1	70
D'2	60
G'	280
H'	445
L'	230
K'	120
E'	115

Total = 1500 yds³

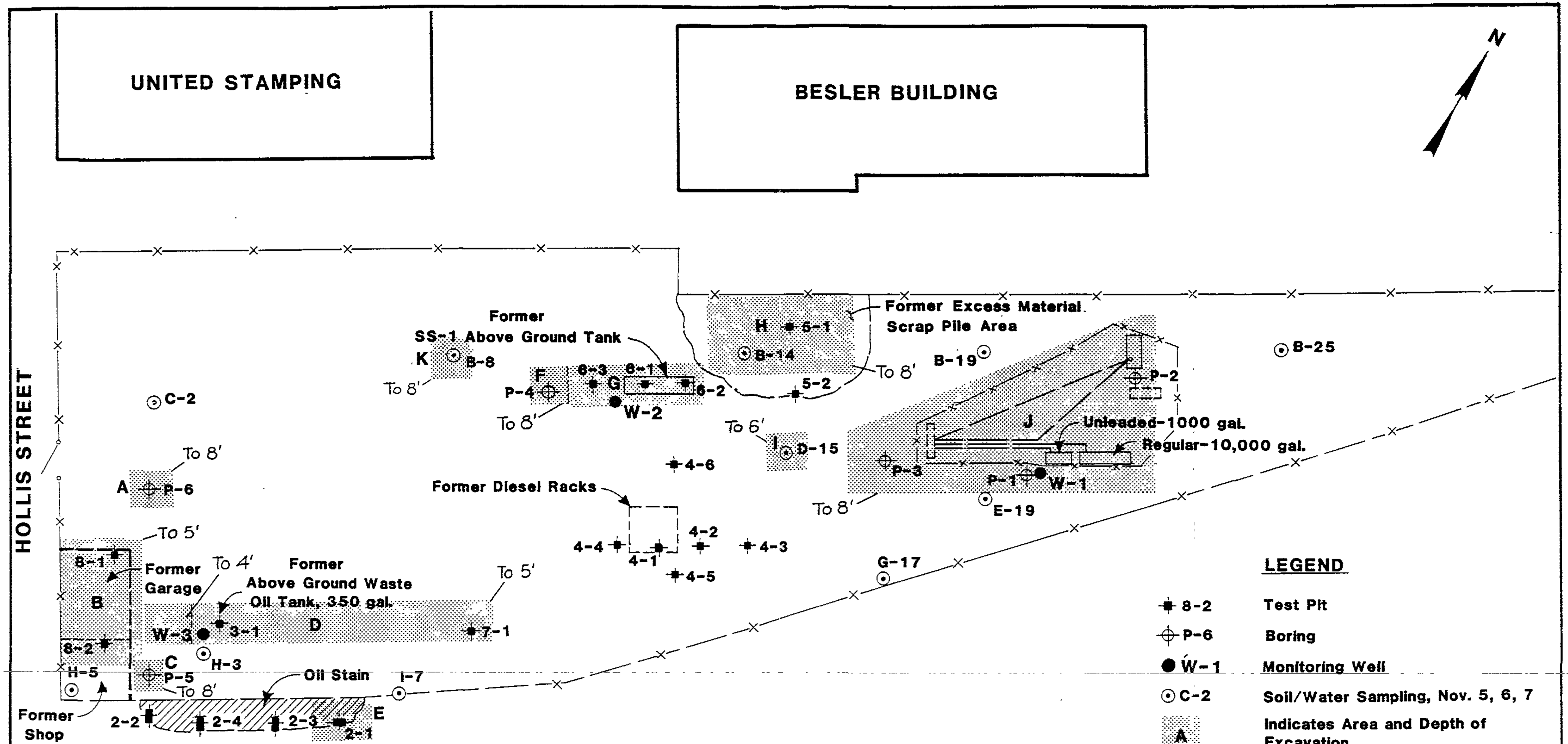
EXCAVATION AND TREATMENT VOLUMES BASED ON DIESEL AND OIL & GREASE CONCENTRATIONS

AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA

FORMER CORPORATION YARD

FIGURE 5.1

JOB #90239.1 DEC. 1990



Volumes (yds³) for Excavation

Area ID	Vol. Calculated (yds³)
A, C, F, K	480
I	90
B	480
D	650
E	115
G	415
H	890
J	2870

Total = 5990 yds³

Overall Total Excavation = 6400 cu. yds.
Total Excavation excludes overlapping Excavation Areas.

0 50 100 150 FEET

SCALE

EXCAVATION AND TREATMENT VOLUMES BASED ON GASOLINE AND BTXE CONCENTRATIONS

AQUA RESOURCES, INC.
BERKELEY, CALIFORNIA

FORMER CORPORATION YARD

FIGURE 5.2

JOB #90239.1 DEC. 1990

Principal Contaminant	Estimated Soil Volume (cubic yards)
Diesel Contaminated Soil	60
Waste Oil Contaminated Soil	160
Diesel and Waste Oil Contaminated Soil	200
Gasoline, BTXE and Waste Oil Contaminated Soil	1,080
Gasoline and BTXE Contaminated Soil	4,900
Total Estimated Volume (combined all types)	6,400

However, for cost estimating purposes, the above soil volumes were categorized by the contaminant that would control the remediation alternative selected. For example, the waste oil in the mixed waste oil/diesel oil contaminated soil would be the controlling contaminant that would likely set the remedial action selected. The controlling contaminant was defined as the principal contaminant. The soil volume breakdown by principal contaminant is given in the following table.

Principal Contaminant	Estimated Soil Volume (cubic yards)
Diesel Contaminated Soil	60
Waste Oil Contaminated Soil	1,440
Gasoline and BTXE Contaminated Soil	4,900
Total Estimated Volume (combined all types)	6,400

These estimated soil volumes requiring remediation are based on concentrations in soil samples collected by ARI and by Levine-Fricke during their survey of the site. The criteria used to determine if soil requires remediation are:

if TPH as gasoline (TPH-G) is greater than 10 ppm
if TPH as diesel (TPH-D) is greater than 100 ppm
BTXE is less than 5 ppb cumulative

These criteria were determined from the leaching potential analyses procedures presented in the Leaking Underground Fuel Manual (LUFT) and additional criteria given in the Tri-

Regional Board recommendations. However, it is understood that final cleanup criteria will be determined by the jurisdictional regulatory authorities (Alameda County Health Care Services Agency).

5.3 Groundwater Objectives

The groundwater must be remediated to the fullest extent feasible, while recognizing that remediating to Federal/State drinking water standards may not be appropriate. This is particularly true where groundwater upgradient from the site is contaminated from operations not associated with those conducted by Ransome Company.

The remedial action objectives for groundwater presented below were determined based on guidance presented in the Tri-Regional Board Staff Recommendations for Preliminary Evaluation of Underground Tank Sites, dated August 10, 1990. Groundwater is considered to be impacted by the RWQCB if the petroleum hydrocarbon concentrations exceed the Practical Quantification Reporting Limits presented in the Tri-Regional guidelines referenced above. The Practical Quantification Reporting Limits as defined in the Tri-Regional guidelines are as follows:

TPH-G	50 ppb
TPH-D	50 ppb
BTX&E (cumulative)	.5 ppb

In our opinion, groundwater samples collected from monitoring wells at the site contained only diesel above the 50 ppb reporting limit. The actual concentration of diesel detected in the groundwater ranged from 85 ppb up to 100 ppb which is only slightly above the 50 ppb reporting limit.

In our opinion, groundwater remediation is not considered necessary because:

- There are no known extensive permeable zones that would tend to expand the plume;
- Soils are tight (low permeability), and thus tend to retain (absorb) certain hydrocarbon compounds;
- There is no known usage of groundwater from this area.

Groundwater monitoring, however, should be performed until it can be demonstrated that contaminant levels are decreasing.

6.0 SOIL REMEDIATION ALTERNATIVES

6.1 Initial Screening Process of Remediation Alternatives

6.1.1 General - Based on the results of the Remedial Investigation, soils were found to be contaminated with three principal-type contaminants. Soils were classified as contaminated with the following contaminants which control remediation methods:

- diesel,
- waste oil or
- gasoline (with BTXE compounds).

Existing treatment technologies were assessed for each contaminant classification during the initial screening phase. Each technology was assessed for technical ability to achieve the regulatory established cleanup levels and for economy.

A specific remediation alternative failed the initial screening if it was determined not to be able to achieve the required cleanup level or if the method could not be implemented economically. Specific remediation alternatives that pass the initial screening will be subjected to detailed screening including economic analysis. Detailed screening of remediation alternatives that pass the initial screening is presented in Section 7.0.

6.1.2 Summary of Remediation Alternatives - Initial screening of remediation alternatives for each soil contaminant classification at the former corporation yard site is as follows:

Diesel Contaminated Soil Remediation Alternatives

- excavation and onsite bioremediation,
- excavation and offsite bioremediation (such as a permitted land-farming facility),
- excavation and offsite incineration,
- excavation and offsite disposal and
- in-situ bioremediation.

Waste Oil Contaminated Soil Remediation Alternatives

- excavation and onsite bioremediation,
- excavation and offsite bioremediation (at a permitted land-farming facility),
- excavation and offsite incineration,
- excavation and offsite disposal and
- in-situ bioremediation.

Gasoline Contaminated Soil Remediation Alternatives

- excavation and aeration,
- in-situ soil vapor extraction

Four of the six remediation alternatives are ex-situ remediation methods. That is, they require removal of the contaminated soil in order for the method to be implemented. The remaining two remediation alternatives would treat the contaminated soils in-place, and would not require removal of the contaminated soil. Each of the these remediation alternatives is discussed in detail below.

<u>6.1.3 General Excavation Considerations</u> – Common to all the ex-situ remediation methods is the need to excavate the contaminated soil so that the contaminants can be remediated. The contaminated soils can be excavated using conventional excavation equipment. Because the anticipated depths of excavation are less than ten feet, conventional rubber-tire backhoe excavators (i.e. Case model 580) could be used. Larger mechanical excavators could also be used; however, mobilization costs for such equipment will be higher.

Despite the higher mobilization costs, the operating time will likely be lower because of increased excavation rates due to their larger bucket volumes and operating flexibility (ability to swing 360 degrees, longer boom lengths etc.). Other earth moving equipment could be used (i.e. loaders or scrapers); however, additional earthwork for constructing access ramps within the excavations would be required.

6.2 Initial Screening of Diesel Contaminated Soil Remediation Alternatives

<u>6.2.1 Excavation with Onsite Bioremediation</u> - In this remediation alternative, the contaminated soils are first excavated and placed in a biotreatment cell. Moisture conditioning and introduction of appropriate nutrients/fertilizers to enhance biodegradation is performed. Biodegradation involves the aerobic biological conversion of organic compounds (petroleum hydrocarbons at the site) in the soil (or groundwater) to carbon dioxide, water, and microbial biomass.

Degradation of organic compounds is a naturally occurring process; however, this process is accelerated by stimulation of indigenous or introduced microbial populations through the addition of oxygen, nutrients, and in some instances an additional carbon source.

<u>6.2.2 Excavation and Offsite Bioremediation</u> - This remediation alternative is similar to onsite bioremediation except that the excavated soils are transported to a permitted land-

farming facility where the actual bioremediation is performed. Where such a permitted facility exists in close proximity to the site, the costs can compare favorably to onsite bioremediation, especially if significant grading is necessary to prepare the onsite biotreatment cell. However, the cost is dependent on the mode of transportation to the land-farming operation (i.e. transported under a manifest or under a bill of lading). There is a permitted landfarming operation located in Stockton which is considered to be in reasonable close proximity to the site. Hence, this remediation alternative was retained for further detailed screening.

6.2.3 Excavation and Offsite Thermal Treatment - Under this alternative, the excavated soils are transported to a facility where the soils are thermally treated. The thermal device can be an incinerator, rotary kiln or some other thermal device that subjects soils to temperatures that exceed the compound's ignition temperature. This remediation alternative is effective for most petroleum contaminated wastes; however, the cost of treatment is sensitive to the supplemental fuel used, the distance the soil must be hauled to the treatment facility and the mode of transportation to the facility (i.e. transported under a manifest or under a bill of lading). This remediation alternative was retained for more detailed analyses.

6.2.4 Excavation and Offsite Disposal - This method of treatment entails simply hauling excavated soils to an appropriate landfill facility (Class III or Class I) for disposal. Saturated soils excavated from below the saturated zone or free groundwater table would require special handling and stabilization of free liquids prior to disposal. Soils would generally have to be below a hydrocarbon concentration of 100 parts per million (ppm) to be acceptable for disposal to a Class III landfill. The actual concentration level is facility dependent, and arrangements must be made prior to transport to the facility. Such soils can generally be transported under a bill of lading. Excavation and direct disposal to a Class III facility was retained for detailed analysis.

For petroleum contaminated soils that exhibit characteristics of hazardous waste (i.e. toxicity, ignitability, corrosivity or reactivity), the soils will be classified as a hazardous waste (HW). If such materials are to be disposed of by landfilling, they must be disposed of at a Class I landfill. The EPA and State of California Land Ban requirements will effectively ban direct disposal of such soil without some pre-treatment. The pretreatment is required to reduce the wastes toxicity before the soils are landfilled. In addition, such soils will have to be transported under a hazardous waste manifest. Continuing liability for the fate of these wastes may be assigned to the generator of the hazardous waste if this method is utilized. Based on the data gathered during this RI, the soils should not exhibit characteristics of a HW. Consequently, this remediation alternative was not considered further.

6.2.5 In-situ Bioremediation - In situ biodegradation involves the in-place aerobic biological conversion of organic contaminants in soil or groundwater to carbon dioxide, water, and microbial biomass. Degradation of organic compounds is a naturally occurring process; however, this process is accelerated by stimulation of indigenous or introduced microbial populations through the addition of oxygen, nutrients, and in some instances an additional carbon source. A typical system includes injection wells for introduction of nutrients and oxygen, and extraction wells for removal and reinjection of groundwater.

This technology is effective on polynuclear aromatic hydrocarbons, such as benzene and xylene, and on straight chain petroleum hydrocarbon compounds. Success of this technology is dependent on the following factors:

- soil permeability and homogeneity;
- soil moisture content;
- groundwater temperature, pH, and copper content;
- availability of nutrients (nitrogen and phosphorous) and
- composition of the natural microbial community.

Implementation of this technology would require the installation of numerous wells and associated piping and equalization tanks. Existing and planned uses of the site and adjacent property may limit the installation of a large number of wells. Electric power for operation of pumps is necessary, and is available on site.

Because of the number of wells that would be required, this remediation alternative was not further considered because of the high costs involved and due to the long time requirements involved.

6.3 Initial Screening of Waste Oil Contaminated Soil Remediation Alternatives

6.3.1 Excavation with Onsite Bioremediation - This remediation alternative is similar to that described for diesel contaminated soils in Section 6.2.1. This method was retained for detailed analysis.

6.3.2 Excavation and Offsite Bioremediation - This remediation alternative is similar to that described for diesel contaminated soils in Section 6.2.2. This method was retained for detailed analysis.

6.3.3 Excavation and Offsite Thermal Treatment - This remediation alternative is similar to that described for diesel contaminated soils in Section 6.2.3. This method was retained for detailed analysis because of the rather small volume of soil that is anticipated for treatment.

6.3.4 Excavation and Offsite Disposal - This remediation alternative is similar to that described for diesel contaminated soils in Section 6.2.4. This method was not retained for detailed analysis because of the high cost and continuing liability.

6.3.5 In-situ Bioremediation - This remediation alternative is similar to that described for diesel contaminated soils in Section 6.2.5. This method was not retained for detailed analysis because of the high cost and continuing liability.

6.4 Initial Screening of Gasoline Contaminated Soil Remediation Alternatives

6.4.1 Excavation and Aeration - Soil aeration involves the exposure of excavated soils to air, so that VOCs are allowed to evaporate. This may be accomplished through mechanical aeration systems, such as soil mixers, low temperature thermal stripping systems, or pneumatic conveyor systems, or by passive methods, such as land spreading. Air can also be forced through the excavated soil through a pipe network set-up in the soil laydown area prior to placement of the excavated soil.

6.4.2 Soil Vapor Extraction - Soil vapor extraction is a process whereby air is either forced by compression or induced by a vacuum to flow through the in-place soil to remove volatile compounds. Excavation of the soil is not required. The air stream may be either pre-heated to accelerate volatilization, or introduced at ambient temperatures. The effluent air must then be treated to remove the extracted compounds, through a process such as vapor phase carbon adsorption, direct combustion, or catalytic oxidation. Feasibility of this process is dependent on a number of factors, including:

- volatility of the compounds to be removed,
- soil water content
- soil porosity and permeability
- soil organic matter and clay content
- soil moisture content
- depth to groundwater
- temperature of soil and influent air

Stripping from soil is generally more effective on compounds with high volatility The principal compounds of interest (diesel and waste oil) at this site are not considered to be highly volatile.

Soils with low porosity, high clay or organic matter content, or high moisture content are all less amenable to soil vapor extraction. The process works in soils of low permeability if the soil has sufficient air-filled porosity. The depth to ground water is not sufficient at this site to prevent substantial short circuiting of air from the ground surface to the extraction system. The effluent air from this system would be regulated by BAAQMD would likely have to be treated to reduce emissions. This remediation alternative was not considered feasible at the former corporation yard site due to the anticipated low permeability of the soil and because this method is not effective in remediating diesel or waste oil contaminants because of their relatively low volatility.

7.0 REMEDIATION ALTERNATIVES

7.1 Remediation Alternatives Remaining after Initial Screening

Of the six remediation alternatives that were assessed during the initial screening process, only four were carried forward to the final screening process. The remediation alternatives that passed the initial screening phase included:

- excavation and onsite bioremediation (diesel and waste oil contaminated soil),
- excavation and offsite bioremediation at a permitted landfarming facility (diesel and waste oil contaminated soil),
- excavation and offsite disposal to a Class III landfill facility (diesel, waste oil and gasoline contaminated soils)
- excavation and off-site incineration (waste oil contaminated soil) and excavation and aeration (gasoline contaminated soil)

Detailed analyses and relative costs for implementing the individual remedial measures are discussed below.

7.2 Volumes of Soil to be Excavated

The volumes of soil to be excavated at the site were determined by using several sources of information. The primary source was the results of analyses of samples collected by ARI. Soils which exceeded an established threshold limit for TPH as gasoline (10 ppm), TPH as diesel (100 ppm), total oil and grease (100 ppm), or Benzene, Ethyl Benzene, Toluene and Xylene (5 ppb cumulative), were considered as above established regulatory limits and were considered to require excavation. Of these soils, additional criteria were used to determine if treatment of the excavated soils would be required before they could be disposed of at a sanitary landfill.

The depths of excavation were based upon the depths of soil samples obtained during the RI. In general, two feet of depth was added to the depth of an offending soil sample if no deeper samples were taken in the vicinity. The free groundwater table was observed to lie at about 8 feet below grade on the site. Hence excavation to depths below 8 feet were not considered practical.

A third source of information, soil borings taken by Levine-Fricke in their survey of the region, was also used to complement our samples and aid in determining the areas and depths for remediation.

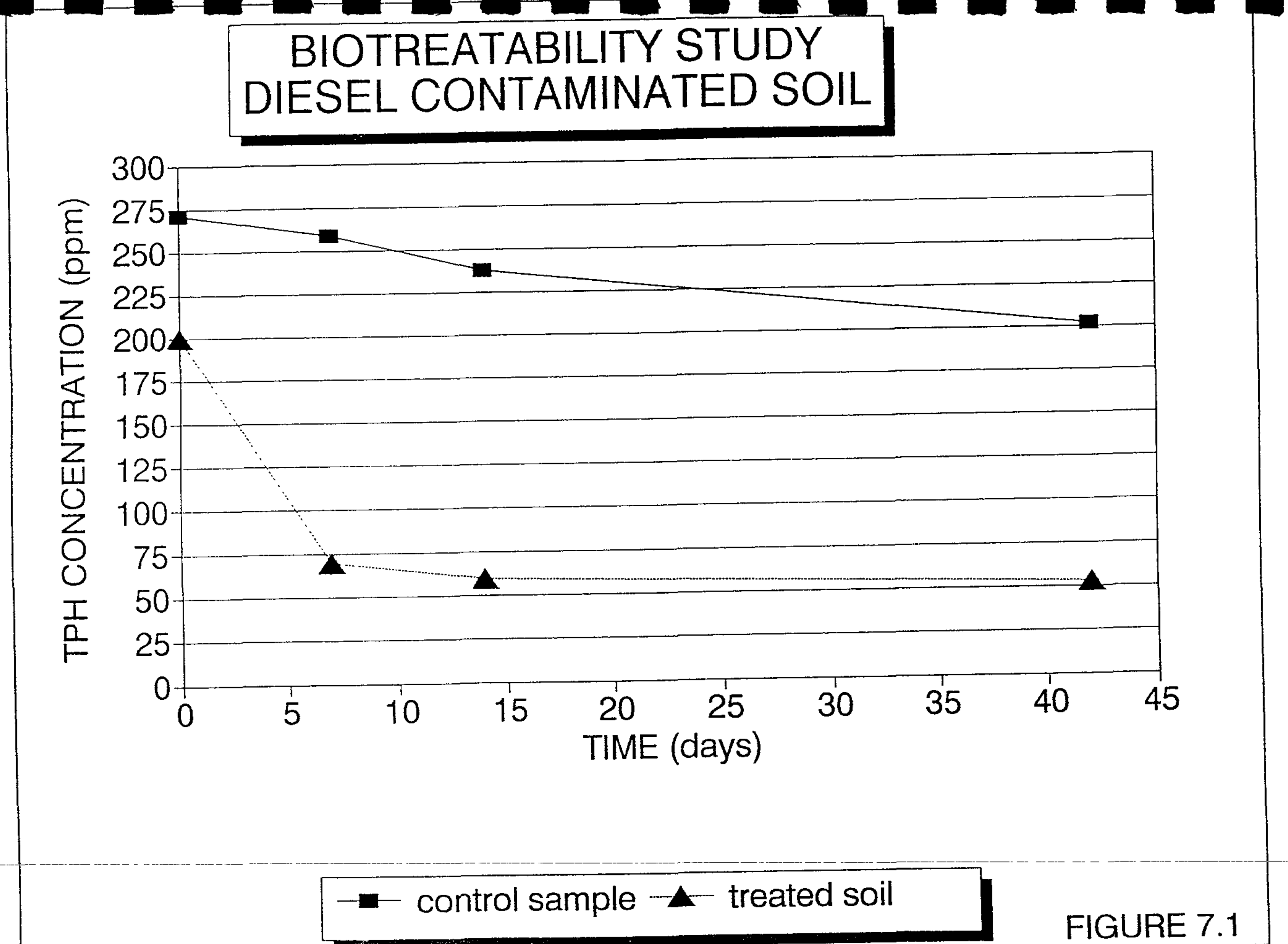
Based upon these sources of information, it is estimated that approximately 6,400 cubic yards of soil will require excavation on the site. The areas and depth of excavation are noted in Figures 5.1 and 5.2.

7.2 Excavation with Onsite Bioremediation

<u>7.2.1 Treatability Study</u> - To determine if onsite bioremediation would be technically able to achieve the regulatory cleanup limits, a pilot Treatability Study was performed on both diesel and waste oil contaminated soil. The Treatability Study was performed by Enviros Applied Technologies in Redmond, Washington. Results of the treatability study are presented in Appendix E. The results of the study indicated that the diesel contaminated soils were amenable to cleanup by bioremediation. Diesel contaminated soils can be bioremediated to about 50 ppm within about five to six weeks under laboratory controlled conditions.

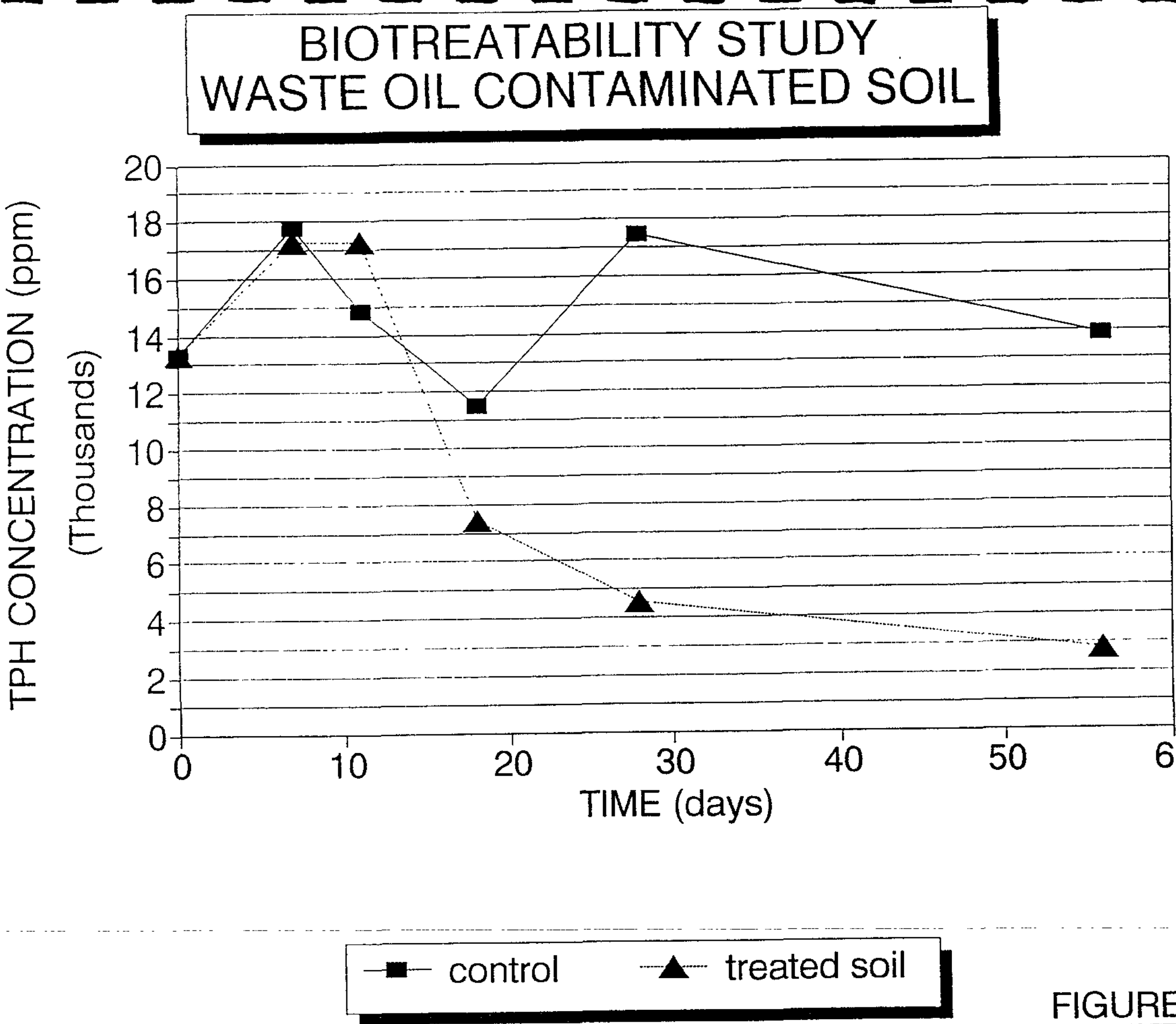
This represents a reduction in the contaminant load in the soil of about 80 percent. A time plot of contaminant load reduction versus time is given in Figure 7.1. The plotted data presented in Figure 7.1 indicate that most of the contaminant load reduction occurs in the first two to three weeks. After the initial two to three weeks, the rate of contaminant load reduction slows down. This suggests that bioremediation to levels below 50 ppm may require significantly more time.

Results of the treatability study performed on the waste oil contaminated soils indicate that these soils may be amenable to bioremediation. The contaminant load was reduced from an average control concentration of 14,800 ppm to about 2,800 ppm in approximately 8 weeks under laboratory controlled conditions. This corresponds to a reduction in contaminant load of about 80 percent. A plot of contaminant concentration over time for the waste oil treatment is shown in Figure 7.2. The plotted data indicate that there is



BIOTREATABILITY STUDY
DIESEL CONTAMINATED SOIL
TPH CONCENTRATION (ppm)
300
275
250
225
200
175
150
125
100
75
50
25
0
0
5
10
15
20
25
30
35
40
45
TIME (days)
control sample
treated soil

FIGURE 7.1



BIOTREATABILITY STUDY
WASTE OIL CONTAMINATED SOIL
TPH CONCENTRATION (ppm)
(Thousands)
20
18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
TIME (days)
control
treated soil

FIGURE 7.2

some "lag" in the bioremediation occurring. Once established, the contaminant load is reduced fairly quickly. However, the rate of contaminant reduction is not as quick as for the diesel contaminated soil, so a longer duration for bioremediation may be necessary, and bioremediation to below 100 ppm may be difficult to achieve.

Review of the chromatographs for the waste oil soil sample indicates that the more volatile fraction is removed initially, and what is left behind are heavy, long chain petroleum hydrocarbons. Such compounds are nearly insoluble in water and tend not to migrate.

Based on the results of the RI, most of the diesel contaminated soil also contains waste oils. Hence, onsite bioremediation may not be able to be accomplished within a short period of time. The actual duration time required could not be estimated from the Treatability Study.

7.2.2 Biotreatment Cell Considerations - As discussed earlier, implementing this remediation alternative requires removing the contaminated soil and placing the soil in a treatment cell. Various engineering controls will be required for the treatment cell. These engineering controls will likely include:

- surface runoff control,
- leachate infiltration control,
- tilling depth management, and
- moisture conditioning, nutrient addition and temperature control.

To stimulate the natural microbial population in the soil, the soil must be maintained at an appropriate moisture content and temperature with the addition of proper nutrients. Because moisture must be added, there is a potential for leachate to be generated. To prevent infiltration of the leachate into the underlying soils an underlayment under the treatment area will be necessary. The underlayment typically consists of a polyethylene membrane. The thickness of the membrane depends on several factors but is generally in the range of 10 mil to 20 mil thickness. Membrane thicknesses greater than this become difficult to handle; while lesser thicknesses are difficult to field seam and are more prone to puncture and damage. Leachate that is generated within the cell must be removed and may require treatment. Collection of the leachate from within the cell is done by grading the subgrade below the treatment cell to provide positive drainage to a collection point.

Tilling of the soil is done using mechanical equipment. To prevent damage to the underlayment, a layer of clean sand is placed on top of the membrane prior to placement of the soil to be bioremediated. The primary purpose of the sand is to act as an "indicator" that the full thickness of the contaminated soil is being tilled. The sand layer will also aid in collection and routing of leachate to the collection point. Surface runoff is generally controlled by covering the cell during periods when the tilling is not being performed and by constructing perimeter containment berms. Covering the cell helps to maintain the soil moisture during warm weather, and also aids in maintaining a uniform soil temperature during period of cold temperature.

7.2.3 Anticipated Remediation Costs - The cost of onsite bioremediation is highly dependent on the following factors:

- site access for excavation equipment,
- area required for treatment,
- grading required for biotreatment cell construction and
- volume of soil to be remediated

Because of the easy site access, rather level site conditions and available space, this remediation alternative was determined to have the lowest unit treatment cost (on a per cubic yard basis) in comparison to the other the remediation alternatives considered. If the soils are bioremediated to a level where the they can be disposed of to a Class III landfill, a 60 percent increase in the unit treatment cost can be expected (a relative cost factor of 1.6).

7.3 Excavation and Offsite Thermal Treatment

As discussed earlier, the contaminated soils would be transported to licensed facility for thermal treatment. This method would be used only for waste oil contaminated soils. Ogden Environmental Services operates a thermal treatment facility that is permitted for petroleum hydrocarbon soils. The facility is located in Stockton. Although this is a rather long haul distance, the volume of soil would be fairly small. In addition, the soils are not anticipated to exhibit any of the four hazardous waste characteristics; hence the soils can be transported under a bill of lading. Consequently, the transporter does not have to have a hazardous waste hauling permit or license.

Assuming that the soil has a unit weight of about 120 pounds per cubic foot, the relative cost for this method would be about 1.65 compared to the onsite bioremediation unit cost. When transportation costs are included (assuming that the treated soil is returned to the site) the relative unit treatment cost factor is increased to about 2.2 over the cost of onsite remediation. The cost of this method is sensitive to transport costs.

7.4 Excavation and Aeration

After aeration, soils can be reused as backfill, provided that the characteristics of the soil are suitable for the intended backfill site. Aerated soils may also be disposed of in a Class III landfill, provided that tests confirm sufficiently low VOC concentrations, and a landfill site can be found. The removability of compounds by aeration is generally governed by the same principles as in situ soil vapor extraction. The compounds of interest at this site are readily removable by either process. Passive aeration requires a relatively impermeable ground surface for soil spreading in order to prevent possible leaching of VOCs back into the ground. Plastic liners can be placed over the laydown area prior to soil spreading. Higher ambient air temperatures and minimal rainfall during spring and summer months will accelerate the aeration process.

Passive aeration requires initial spreading or wind-rowing of soil over the land surface. Subsequent turning or wind rowing is usually required in order to achieve acceptable contaminant removal. Periodic soil sampling will be necessary to determine whether the contaminant level is low enough to allow non-restricted disposal or backfilling.

BAAQMD Regulation 8, Rule 40 regulates aeration of contaminated soil. This rule places a limitation on the rate at which soil can be aerated without providing an emission control system, such as activated carbon adsorption. This rate varies according to the content of volatile halocarbons and aromatics in the soil. The total combined maximum concentration of these compounds found at this site is estimated to be less than 500 ppm. At this concentration level, up to 120 cubic yards of soil can be put into active aeration per day.

At this rate, about 40 days would be required to place all the gasoline and BTXE contaminated soil (estimated at 4900 cubic yards) into an active aeration pile. Soils not subject to active aeration on any one day will be stored on-site in covered storage piles. Soil excavation and aeration must be reported to the BAAQMD prior to initiation of the operation.

The relative unit treatment cost factor for this method was estimated to be about 0.27 of the unit cost of onsite bioremediation. The unit cost estimated assumes that the soils are mechanically aerated once every three days for a period of 12 days once all the excavated soils are in an "active" pile. It was also assumed that the excavated soil would be reused as backfill after treatment.

7.5 Excavation and Offsite Disposal to a Class III Landfill Facility

Under this remediation alternative, the contaminated soils would be excavated and initially stockpiled onsite, pending approval for disposal from the Class III landfill facility. To obtain approval for disposal, soil samples will have to be taken and be analyzed for documentation to be attached to the waste disposal information form. The samples can be taken during actual excavation or from the soil stockpiles once excavation has been completed.

Based upon requirements at the West Contra Costa landfill, soils with concentrations of gasoline, diesel, or oil and grease over 100 ppm must be treated before disposal to the West Contra Costa Landfill facility. Also those soils with concentrations of Benzene or Ethyl Benzene over 0.51 ppm or 6 ppm respectively, or those with Toluene or Xylene concentrations exceeding 28 ppm, require treatment before landfill disposal.

If samples are taken during actual excavation, the sampling frequency is anticipated to be from one sample every 25 cubic yards up to one sample for every 200 yards, depending on the size of the area being excavated. Generally, the larger the area, the lower sampling frequency is used. If sampling is done from the stockpiles, a grid pattern can be established and a statistical-based sampling method can be developed. This method is generally more economical because not as many samples need to be analyzed. However, no matter which method is used, time will be required to have the soils analyzed and to obtain formal acceptance from the disposal facility. Consequently, the excavated soil will be handled twice; once during excavation and stockpiling and again when the soils are transported to the landfill facility.

Based on preliminary cost estimates and discussion with several Class III landfills, we estimate the relative unit cost factor for this method, on a unit cost basis relative to onsite bioremediation, is about 1.13. This method is sensitive to the transport cost, disposal and backfill material costs. For purposes of this cost estimate, it was assumed that the soils would be transported to the West Contra Costa Landfill facility, which is the closest facility to the site. However, the disposal cost is high because of the limited remaining volume at this facility. There are other Class III disposal facilities that would be able to accept this soil at a lower disposal cost; but, the cost savings may be offset by the additional transportation cost due to the longer haul distance.

7.6 Excavation and Offsite Bioremediation

As discussed before, this remediation method involves excavating the contaminated soils and transporting them to a permitted landfarming operation. Forward Inc. operates a permitted landfarming operation in Stockton, California. It was assumed that the soils can be transported directly to the facility once excavated. Hence the cost of handling the soil a second time was not included. Once the soil is at the facility, the soil will be placed in a treatment cell and bioremediated.

Based on preliminary cost analysis, the estimated relative unit cost factor per cubic yard compared to onsite bioremediation is 1.63. However, if soils treated by onsite bioremediation have to be disposed of at a Class III landfill, the relative unit cost factor is very close to 1.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Impact of Releases of Hazardous Materials on Soils

The results of this Remedial Investigation indicate that soils have been contaminated from the release of various kinds of petroleum hydrocarbons. The principal contaminants include diesel, waste oils and gasoline (with BTXE compounds). Soil contamination with other contaminants such as semi-volatile organics (EPA Method 8270 compounds), purgeable halocarbons (EPA Method 8010 compounds) and heavy metals were not considered significant.

The soils that have been impacted will require remediation. The total volume of soil that is estimated to require removal and treatment is about 6,400 cubic yards. However, this volume is obviously dependant upon the agreed levels of contamination limits that are established as requiring remediation. Of this total, approximately 75 percent consists of soils contaminated principally with gasoline and BTXE compounds. The remaining principal contaminants, diesel and waste oil, comprise about 2 percent and 23 percent, respectively.

8.2 Impact of Releases of Hazardous Materials on Groundwater

Groundwater was found to contain diesel above the 50 ppb reporting limit in all three monitoring wells installed at the site during this investigation. Gasoline and BTXE compounds were detected in several of the "grab" groundwater samples; but not in any of the monitoring wells. The "grab" groundwater sample data was concluded to provide qualitative information, but cannot be used as a reliable data source for analyses of groundwater quality.

The concentration of diesel detected in the groundwater was not significantly above the reporting limit. Because the diesel concentration is not significantly above the reporting limit and no free product was observed, groundwater remediation is not recommended at this time. However, since groundwater has been impacted, we recommend that a groundwater monitoring program be established at the site as part of the site closure.

The groundwater monitoring program is recommended to last from one to two years, with groundwater sampling performed quarterly. As part of this program, we recommend that one additional monitoring well be installed near the former fuel island location. This monitoring well should be installed after soils in this area have been excavated and any backfill placed to prevent damage to the monitoring well. In addition, the existing monitoring wells should be protected from damage during remediation activities conducted at the site.

8.3 Recommended Remediation Program and Program Implementation Costs

8.3.1 General - Based on the data obtained from the RI, it appears that there are two feasible Remediation Programs that can be implemented. The Alternate Remediation Programs include:

> Alternate 1: Onsite treatment of contaminated soil using bioremediation and aeration. The soil would be reused onsite as general fill.
>
> Alternate 2: Offsite treatment of waste oil and diesel contaminated soil at a permitted landfarming operation and onsite treatment of gasoline contaminated soil. Soils treated offsite would be replaced with clean imported soils. Soils treated onsite would be reused as general fill.

These alternates are discussed below:

8.3.2 Remediation Program Alternate 1 - Under this alternate, we recommend that soils contaminated with diesel and waste oil be remediated using onsite bioremediation. Where practical, the waste oil contaminated soils should be separated from the diesel contaminated soil, and these soils placed in separate units in the biotreatment cell. This may be practical in the area of the former waste oil tank area (area 3) and in the area where the hydraulic oil and lube oil drippings were discharged onto the ground (area 2).

The volume of soil estimated to require bioremediation is approximately 1500 cubic yards. This will require between one and two acres of open space for setup and operation of the biotreatment cell.

The treatability study however, showed that onsite bioremediation was determined to be feasible for diesel contaminated soil; however, most of the diesel contaminated soil area were also found to contain waste oils. The treatability study indicated that bioremediation is not as effective on waste oil contaminated soils. Enviros concluded that a target concentration for lighter fractions of waste oil to under 100 ppm may be achievable; however, no estimate of how long this would require could be made from the treatability study. This would still leave some heavier fractions in the soil.

The gasoline and BTXE contaminated soils should be treated with conventional aeration. It is estimated that about 4900 cubic yards of soil containing these compounds will have to be aerated. The aeration should be performed in conformance with the requirements established under Regulation 8, Rule 40 administered by the Bay Area Air Quality Management District. Based on the data obtained during the RI, the gasoline and BTXE concentrations are anticipated to be below 500 ppm. Hence, we estimate that about 120 cubic yards per day can be put into an "active" aeration pile. Based on this, it will require about 40 days to have all the excavated soils placed into an active pile. The soils can be excavated on a daily basis and be put into active aeration or all the soils can be excavated and be placed in an "inactive" pile. A aeration stockpile is considered to be "inactive" if it is kept covered with plastic or at least six-inches of uncontaminated soil.

After the excavated soils have been treated, they can be reused as backfill or as general fill on the site, provided the contamination level is reduced to levels agreed to with the RWQCB. As an alternate, the soils can be transported to a Class III facility. However, additional economic analysis will be required to assess the cost savings of this measure since it is highly dependant on the costs of transportation, disposal and import of "clean" fill.

<u>8.3.3 Remediation Program Alternate 2</u> - Under this alternative, we recommend that soils contaminated with diesel and waste oil be remediated using offsite bioremediation. Soils transported offsite for bioremediation would be replaced with clean imported soils. The gasoline and BTXE contaminated soil would be remediated as discussed in Section 8.3.2 above.

<u>8.3.4 Other Considerations</u> - If onsite bioremediation is performed, where the soil would be bioremediated and then disposed of to a Class III facility, the unit cost is comparable to offsite bioremediation. Hence we recommend that a detailed economic comparison be performed to determine whether onsite or offsite bioremediation should be selected.

9.0 LIMITATIONS

Consistent with our discussions with the Client and the lead regulatory agency, namely the Alameda County Health Care Services Agency, our investigation was performed in substantial conformance with the approved Workplan, as amended. Chemical analyses reported herein were performed by others, not under direct ARI supervision. Test results are reported as received. Final determination of additional site remediation, if required, will be determined by the Alameda County Health Care Services Agency.

We cannot guarantee or warrant that soil or groundwater at this site are not contaminated above allowable limits for a given contaminant. All services were performed in substantial conformance with current standards of environmental engineering practice. No other warranty, express or implied, is made.

REFERENCES

Levine-Fricke, 1990. Phase I and Phase II Environmental Investigation, Yerba Buena Project Site, Emeryville, California, August.

Kennedy/Jenks/Chilton, 1989. Baseline Environmental Assessment Report - The Ransome Company, 4030 Hollis Street, Emeryville, California, October.

Radbrush, 1987. Map I-239, Aerial and Engineering Geology of the Oakland West Quadrangle, California, Scale 1:24,000.

Appendix A - Test Pit Logs

TEST PIT LOGS

Test Pit Number	Depth (feet)	Description
TP 2-1	0-1'3"	ARTIFICIAL FILL: clayey gravelly silt, light brown; dry, medium stiff
	1'3"-1'8"	SAND, black; fine grained, dry, loose, contains wood
	1'8"-2'4"	SILT, reddish brown; interbedded with black sand, moist, slightly cemented
	2'4"-3'5"	CLAY, black with grayish green mottling, moist, stiff, slightly plastic
		Total depth 3'5" No free water encountered
TP 2-2	0-9"	ARTIFICIAL FILL: clayey gravelly silt, light brown; dry, medium stiff
	9'-1'8"	ARTIFICIAL FILL: gravelly silt, dark brown; moist, stiff
	1'8"-3'6"	CLAY, black; moist, stiff, slightly plastic
		Total depth 3'6" No free water encountered
TP 2-3	0-11"	ARTIFICIAL FILL: clayey gravelly silt, grayish brown; dry, medium stiff overlying silty clayey gravel grading to gravelly silt, light brown; dry,medium dense, gravel up to 4" diam.
	11"-4'	CLAY, black; moist, stiff, slightly plastic
		Total depth 4' No free water encountered

TEST PIT LOGS

Test Pit Number	Depth (feet)	Description
TP 2-4	0-1'1"	ARTIFICIAL FILL: silty clayey gravel, light brown; angular gravel up to 5" diam., dry, medium stiff
	1'1"-3'5"	CLAY, black; moist, stiff, slightly plastic
		Total depth 3'5"
		No free water encountered
TP 3-1	0-1'5"	ARTIFICIAL FILL: clayey gravelly silt, grayish brown; dry, medium stiff
	1'5"-1'10"	CLAYEY SAND, yellow brown & dark brown; moist, medium dense, fine-grained, contains some wood
	1'10"-4'6"	SILTY CLAY, black & dark gray; moist, stiff, slightly plastic
	4'6"-6'4"	CLAY, grayish green; locally contains gravel, moist, stiff, slightly plastic
	6'4"-9'	CLAY, yellow brown; some gravel, wet, medium stiff, slightly plastic
		Total depth 9'3"
		Free water encountered at 9'

TEST PIT LOGS

Test Pit Number	Depth (feet)	Description
TP 4-1	0-1'2"	ARTIFICIAL FILL: clayey gravelly silt, light brown; dry, medium stiff
	1'2"-2'9"	CLAYEY GRAVEL, light brown, dry, medium dense, angular pieces up to 4" diam., contains wires
	2'9"-6'	CLAY, black; moist, stiff, slightly plastic
	6'-6'6"	CLAY, gray with grayish green mottling; moist, stiff, moderately plastic
		Total depth 6'6" No free water encountered
TP 4-2	0-11"	ARTIFICIAL FILL: clayey gravelly silt, light brown; dry, medium stiff
	11"-2'	ARTIFICIAL FILL: clayey gravel & pieces of broken concrete up to 15" long and 2" thick, contains wires
	2'-3'9"	CLAY, black; moist, stiff, slightly plastic
		Total depth 3'9" No free water encountered
TP 4-3	0-8"	ARTIFICIAL FILL: clayey gravelly silt; light brown, dry
	8"-1'11"	ARTIFICIAL FILL: concrete; pieces up to 15" long & 8" thick, overlying clayey gravel, light brown; dry, medium dense
	1'11"-4'2"	CLAY, black; moist, stiff, slightly plastic
		Total depth 4'2" No free water encountered

TEST PIT LOGS

Test Pit Number	Depth (feet)	Description
TP 4-4	0-10"	ARTIFICIAL FILL: clayey gravelly silt, light brown; dry, medium stiff
	10"-2'4"	CEMENT; pieces up to 8" long, approx. 3" thick, with angular gravel, light brown; dry, medium dense
	2'4"-2'5"	CLAY, grayish green; moist, stiff, moderately plastic, contains gravel
	2'5"-2'7"	CLAY, black; moist, stiff, slightly plastic
		Total depth 2'7"
		No free water encountered
TP 4-5	0-5"	ARTIFICIAL FILL: clayey gravelly silt; light brown, dry, medium stiff
	5"-9"	CLAYEY GRAVEL, reddish brown; dry, medium dense, angular pieces up to 2" diam.
	9"-2'8"	CLAY, black; moist, stiff, slightly plastic, contains heavy oil or other semi-liquid petroleum product
		Total depth 2'8"
		No free watered encountered
TP 4-6	0-10"	ARTIFICIAL FILL: clayey gravelly silt, light brown; dry, medium stiff
	10"-1'7"	ARTIFICIAL FILL: concrete & gravel up to 6" diam. with some black clay, dry, medium dense
	1'7"-2'2"	CLAY, black; moist, stiff, slightly plastic, contains coiled wire
	2'2"-4'11"	CLAY, black; moist, stiff, slightly plastic, contains thick pieces of wood, tree branches & roots
		Total depth 4'11"
		No free water encountered

TEST PIT LOGS

Test Pit Number	Depth (feet)	Description
TP 5-1	0-1'8"	ARTIFICIAL FILL: clayey gravelly silt; light brown, dry, medium stiff
	1'8"-4'	SILTY CLAY, black & dark gray; some sand, moist, medium stiff, slightly plastic
		Total depth 4'
		No free water encountered
TP 5-2	0-1'6"	ARTIFICIAL FILL: clayey gravelly silt; light brown, dry, medium stiff
	1'6"-2'	ARTIFICIAL FILL: cement, light gray
	2'-4'9"	SILTY CLAY, black; moist, stiff, slightly plastic
		Total depth 4'9"
		No free water encountered
TP 6-1	0-8"	ARTIFICIAL FILL: clayey gravelly silt; grayish brown, dry, medium stiff
	8"-1'3"	ARTIFICIAL FILL: angular gravel, light brown; dry, medium dense, overlying asphalt with heavy oil or other semi-liquid petroleum product
	1'3"-1'9"	SILTY CLAY, dark brown with grayish green mottling; moist, stiff, slightly plastic
	1'9"-2'2"	CLAY, dark brown interbedded with light brown clay; moist, stiff, slightly plastic
	2'2"-3'2"	GRAVEL, light brown; dry, medium dense, angular, contains wires
	3'2"-7'	CLAY, black & dark gray; moist, stiff, slightly plastic
		Total depth 7'
		No free water encountered

TEST PIT LOGS

Test Pit Number	Depth (feet)	Description
TP 6-2	0-10"	ARTIFICIAL FILL: clayey gravelly silt; grayish brown, dry, medium stiff
	10"-1'6"	GRAVELLY CLAY, black; moist, medium stiff, slightly plastic
	1'6"-2'6"	SILTY CLAY, black; moist, stiff, slightly plastic
	2'6"-3'	GRAVELLY CLAY, black; moist, medium stiff, slightly plastic
	3'-4'6"	CLAY, black & dark gray; moist, stiff, slightly plastic
		Total depth 4'6" No free water encountered
TP 6-3	0-1'	ARTIFICIAL FILL: clayey gravelly silt; grayish brown, dry, medium stiff
	1'-1'3"	ARTIFICIAL FILL: asphalt layer, black; cemented
	1'3"-1'6"	SILTY CLAY, grayish green with black mottling; moist, stiff, slightly plastic
	1'6"-1'11"	GRAVELLY CLAY, dark brown; moist, medium stiff, slightly plastic
	1'11"-3'3"	SILTY CLAY, black; moist, stiff, slightly plastic
		Total depth 3'3" No free water encountered

TEST PIT LOGS

Test Pit Number	Depth (feet)	Description
TP 7-1	0-1'	ARTIFICIAL FILL: clayey gravelly silt; grayish brown, dry, medium stiff
	1'-1'5"	CLAYEY SAND, brown; dry, loose
	1'5"-3'6"	SAND, light brown; dry, loose; interbedded with cemented black sand
	3'6"-5'6"	CLAY, black; moist, stiff, moderately plastic
		Total depth 5'6" No free water encountered
TP 8-1	0-8"	ARTIFICIAL FILL: clayey gravelly silt; grayish brown, dry, medium stiff
	8"-3'6"	CLAY, black; moist, stiff, moderately plastic
		Total depth 3'6" No free water encountered
TP 8-2	0-1'	ARTIFICIAL FILL: clayey gravelly silt; grayish brown, dry, medium stiff; locally overlying thin asphalt layer
	1'-1'7"	CLAY, interbedded gray and blackish brown; moist, stiff, moderately plastic
	1'7"-2'5"	ARTIFICIAL FILL: cement, light gray; overlying angular gravel or broken cement up to 6" diam., dry, medium dense
	2'5"-3'	CLAY; black, moist, stiff, moderately plastic
		Total depth 3' No free water encountered

Appendix B - Soil Boring Logs

LOCATION & NOTES

LOCATION Former Corporation Site	JOB NAME Ransome	JOB NO 90239
DRILLING COMPANY Exeltech		BORING NO. P-1
DRILLER'S NAME		SHEET OF
DRILL RIG [ ] Solid Flight Auger [x] Hollow Auger [ ] Rotary Wash		
SAMPLER TYPE: [ ] 2.5" I D Split Barrel [ ] 2.8" I D Shelby Tube [X] SPT		
DRIVE WEIGHT LB.	FALL IN.	START TIME AM PM / FINISH TIME AM PM
WATER LEVEL (Feet)		
TIME		
DATE		DATE 10/17/90
CASING DEPTH (FEET)		
ELEVATION FEET	FIELD ENGINEER	

DATUM: [ ] Mean Sea Level [X] Other ground surface

SURFACE CONDITIONS

BLOWS PER HALF FOOT			BLOWS/ft.	MOISTURE CONTENT %	DRY UNIT WEIGHT (pcf)	DEPTH IN FEET	USCS CLASSIFI-CATION	DESCRIPTION
						0		
						1		Clayey gravelly silt (fill)
						2		
						3		Sandy clay, some gravel
						4		
						5		
8	14	17						Sandy clay, black; some gravel up to 1/4" diam.; samples at 5.5'
						6		
						7		
						8		
9	16	24				9		Gravelly silty clay, grayish blue-green; sampled at 9'
						0		
						1		Silty clay, brown; with gravel
						2		
						3		
8	8	10				4		Clay, brown; sampled at 14'
						5		
						6		Clay, brown; some gravel, sampled at 19'
						7		
						8		
5	7	10				9		
						0		

LOCATION & NOTES

LOCATION Former Corporation Site	JOB NAME Ransome	JOB NO 90239
DRILLING COMPANY Exeltech		BORING NO. P-2
DRILLER'S NAME		SHEET OF
DRILL RIG [ ] Solid Flight Auger [X] Hollow Auger [ ] Rotary Wash		
SAMPLER TYPE: [ ] 2.5" I D Split Barrel [ ] 2.0" I D Shelby Tube [X] SPT		
DRIVE WEIGHT LB.	FALL IN.	START TIME AM PM / FINISH TIME AM PM
WATER LEVEL (Feet)		
TIME		
DATE		DATE 10/17/90
CASING DEPTH (FEET)		

DATUM: [ ] Mean Sea Level [X] Other ground surfac

ELEVATION FEET | FIELD ENGINEER

BLOWS PER HALF FOOT			BLOWS/ft.	MOISTURE CONTENT %	DRY UNIT WEIGHT (pcf)	DEPTH IN FEET	USCS CLASSIFI-CATION	SURFACE CONDITIONS
						0		
						1		Clayey gravelly silt (fill)
						2		
						3		
						4		
						5		
8	9	12				6		Clay, black; sampled at 6'
						7		
						8		
6	18	20				9		Gravelly clay, grayish green; sampled at 9'
						0		
						1		
						2		Clay, brown, sampled at 14'
						3		
6	7	9				4		
						5		
						6		
						7		
						8		
						9		
						0		

LOCATION & NOTES

LOCATION Former Corporation Site	JOB NAME Ransome	JOB NO 90239
DRILLING COMPANY Exceltech		BORING NO. P-3
DRILLER'S NAME		SHEET OF
DRILL RIG [ ] Solid Flight Auger [x] Hollow Auger [ ] Rotary Wash		
SAMPLER TYPE: [ ] 2.5" I D Split Barrel [ ] 2.8" I D Shelby Tube [x] SPT		
DRIVE WEIGHT LB.	FALL IN.	START TIME AM PM / FINISH TIME AM PM
WATER LEVEL (Feet)		
TIME		
DATE		DATE 10/17/90
CASING DEPTH (FEET)		
ELEVATION FEET	FIELD ENGINEER	

DATUM: [ ] Mean Sea Level [x] Other ground surfac

BLOWS PER HALF FOOT	BLOWS/ft.	MOISTURE CONTENT %	DRY UNIT WEIGHT (pcf)	DEPTH IN FEET	USCS CLASSIFICATION	SURFACE CONDITIONS
				0		
				1		Clayey gravelly silt (fill)
				2		
				3		Sandy clay; gravel up to 1/2" diam.
				4		
				5		
6 8 12				6		Clay, grayish green, with gravel; sampled at 6'
				7		
				8		
9 10 14				9		Sandy clay, brown
				0		Sandy clay, greenish brown; sampled at 9'
				1		
				2		Clays and silts, grayish green
				3		
10 17 14				4		
				5		Clay, brown; sampled at 14'
				6		
				7		
				8		
				9		
				0		

LOCATION & NOTES

LOCATION Former Corporation Site	JOB NAME Ransome	JOB NO 90239
DRILLING COMPANY Exeltech		BORING NO. P-4
DRILLER'S NAME		
DRILL RIG [ ] Solid Flight Auger [x] Hollow Auger [ ] Rotary Wash		SHEET OF
SAMPLER TYPE: [ ] 2.5" I D Split Barrel [ ] 2.8" I D Shelby Tube [x] SPT		
DRIVE WEIGHT LB.	FALL IN.	START / FINISH
WATER LEVEL (Feet)		TIME AM PM / TIME AM PM
TIME		
DATE		DATE 10/17/90
CASING DEPTH (FEET)		
ELEVATION FEET	FIELD ENGINEER	

DATUM: [ ] Mean Sea Level [x] Other ground surface

BLOWS PER HALF FOOT	BLOWS/ft.	MOISTURE CONTENT %	DRY UNIT WEIGHT [pcf]	DEPTH IN FEET	USCS CLASSIFICATION	SURFACE CONDITIONS
				0		
				1		Clayey gravelly silt (fill)
				2		
				3		
				4		
8 11 13				5		Silty clay, black; sampled at 5'
				6		
				7		
				8		Clay, grayish green, some sand and gravel
8 14 20				9		
				0		
				1		Clay, grayish green, sampled at 9'
				2		
				3		Sandy silty clay, brown; some gravel
6 6 9				4		Sandy silty clay, low plasticity; sampled at 14'
				5		Sandy clay
				6		
				7		
				8		
				9		
				0		

LOCATION & NOTES

LOCATION Former Corporation Site	JOB NAME Ransome
JOB NO 90239	BORING NO. P-5
DRILLING COMPANY Exeltech	
DRILLER'S NAME	
DRILL RIG [ ] Solid Flight Auger [x] Hollow Auger [ ] Rotary Wash	SHEET OF
SAMPLER TYPE: [ ] 2.5" I D Split Barrel [ ] 2.8" I D Shelby Tube [x] SPT	
DRIVE WEIGHT LB.	FALL IN.
WATER LEVEL (Feet)	START TIME AM PM / FINISH TIME AM PM
TIME	
DATE	DATE 10/17/90
CASING DEPTH (FEET)	
ELEVATION FEET	FIELD ENGINEER

DATUM: [ ] Mean Sea Level [x] Other ground surfac

SURFACE CONDITIONS

BLOWS PER HALF FOOT	BLOWS/ft.	MOISTURE CONTENT %	DRY UNIT WEIGHT (pcf)	DEPTH IN FEET	USCS CLASSIFI-CATION	DESCRIPTION
				0		
				1		
				2		Sandy clay, black
				3		
9 13 22				4		Sandy clay; some gravel; sampled at 4'
				5		Silty clay
				6		
				7		
				8		Clay, grayish green; small amount of gravel
9 11 13				9		Sandy clay, brown
				0		Clay, brown, some gravel in top 6"; sampled at 9'
				1		
				2		
				3		
				4		
				5		
				6		
				7		
				8		
				9		
				0		

LOCATION & NOTES

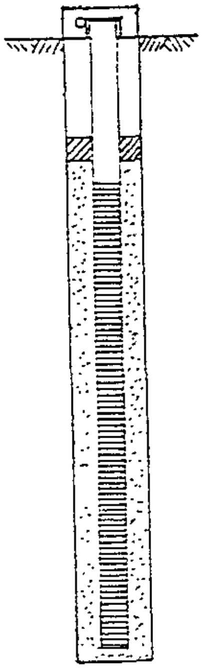
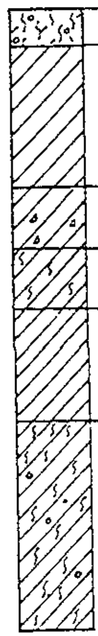
LOCATION Former Corporation Site	JOB NAME Ransome	JOB NO 90239
DRILLING COMPANY Exeltech		BORING NO. P-6
DRILLER'S NAME		
DRILL RIG [ ] Solid Flight Auger [x] Hollow Auger [ ] Rotary Wash		SHEET OF
SAMPLER TYPE: [ ] 2.5" I D Split Barrel [ ] 2.8" I D Shelby Tube [x] SPT		
DRIVE WEIGHT LB.	FALL IN.	START / FINISH
WATER LEVEL (Feet)		TIME AM PM / TIME AM PM
TIME		
DATE		DATE 10/17/90
CASING DEPTH (FEET)		
ELEVATION FEET	FIELD ENGINEER	

DATUM: [ ] Mean Sea Level [x] Other ground surface

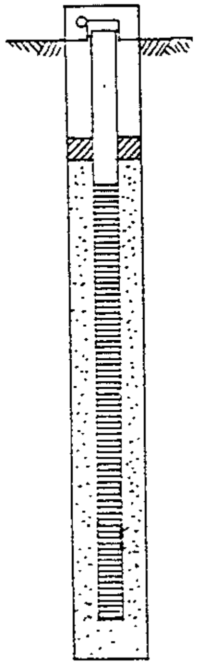
SURFACE CONDITIONS

BLOWS PER HALF FOOT	BLOWS/ft.	MOISTURE CONTENT %	DRY UNIT WEIGHT (pcf)	DEPTH IN FEET	USCS CLASSIFICATION	DESCRIPTION
				0		
				1		Silty clay, black; some gravel
				2		
8 17 28				3		
				4		Clay, grayish blue-green; some gravel; sampled at 4'
				5		Sandy clay, brown; fine to medium grained
				6		
				7		Clay, grayish green; some gravel
16 30 31				8		
				9		
				0		Silty clay, sampled at 9'
				1		
				2		
				3		
				4		
				5		
				6		
				7		
				8		
				9		
				0		

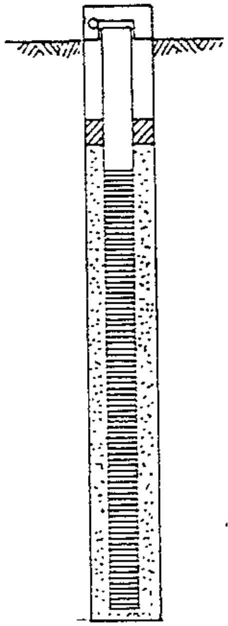
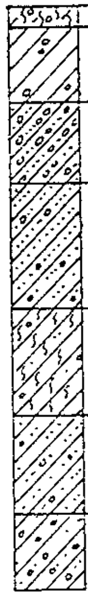
Appendix C - Monitoring Wells Boring Logs

Depth	Elevation	Well Development Log	Water Level	Lithologic Log	Summary Description	Samples No.	Samples Blows/ft.	Contamination Levels (PPB)	Other Tests	Depth
0	27.27				Clayey gravelly silt (fill), light brown, dry, medium stiff (ML)			TVH 5 ppm benzene 16 ppb toluene ND at 5 ppb ethyl benzene ND at 5 ppb xylenes 18 ppb diesel range 2.9 ppm		0
					Clay, very dark gray, moist, stiff, slightly plastic (CL)	1	16			
					Clay, grayish green, 5% gravel & decomposed rock, moist, hard, slightly plastic (CL)					
10	17.27				Silty clay, yellowish brown with greenish brown mottling moist, stiff, slightly plastic (CL)	2	18			10
					Clay, yellowish brown with tan mottling moist, stiff, slightly plastic (CL)	3	15			
					Silty clay, tan with reddish brown mottling, 5% gravel up to 1/4" diam., moist, medium stiff, slightly plastic (CL)	4	11			
20	7.27									20
						5	12			
30										30
40										40
50										50

WELL DATA LOG **W-1**

Depth	Elev-ation	Well Development Log	Water Level	Lithologic Log	Summary Description	Samples No.	Samples Blows/ft.	Contamination Levels (PPB)	Other Tests	Depth
0	24.52				Clayey gravelly silt (fill), light brown, dry, medium stiff (ML)			TVH ND at 1 ppm benzene ND at 5 ppb toluene ND at 5 ppb ethyl benzene ND at 5 ppb xylenes ND at 5 ppb diesel range 3.5 ppm		0
					Gravelly clayey silt (fill), dark brown, dry, medium stiff (ML)					
					Clay, very dark gray, moist, medium stiff, slightly plastic (CL)	1	11			
10	14.52				Silty gravelly clay, dark gray, gravel up to 1/2" diam., moist, stiff, slightly plastic (CL)	2	14			10
					Gravelly clay, grayish green with reddish brown mottling, moist, stiff, slightly plastic (CL)					
					Clay, yellowish brown with tan mottling, 3-5% gravel up to 1/4" diam., wet, soft slightly plastic (CL)	3	6			
20	4.52				Sandy clay, yellowish brown, 10% gravel up to 1" diam., saturated soft (CL)	4	5			20
					Silty clay, yellowish brown, 3% gravel up to 1/4" diam., wet, medium stiff, slightly plastic (CL)					
					Silty gravelly clay, yellowish brown, 30% gravel up to 3/4" diam, wet, stiff, slightly plastic (CL)	5	13			
30										30
40										40
50										50

WELL DATA LOG **W-2**

Depth	Elevation	Well Development Log	Water Level	Lithologic Log	Summary Description	Samples No.	Samples Blows/ft.	Contamination Levels (PPB)	Other Tests	Depth
0	20.01				Clayey gravelly silt (fill), light brown, dry, medium stiff (ML)			TVH ND at 1 ppm benzene ND at 5 ppb toluene ND at 5 ppb ethyl benzene ND at 5 ppb xylenes ND at 5 ppb diesel range 1.6 ppm		0
					Clay, grayish black, some gravel, moist, medium stiff, slightly plastic (CL)					
					Sandy gravelly clay, dark gray with grayish green mottling, 30-40% gravel up to 1-1/2" diam., moist, stiff (CL)	1	19			
10	10.01				Sandy clay, light brown, 15% gravel up to 1/4" diam., moist, medium stiff, slightly plastic (CL)	2	10			10
					Silty clay, yellowish brown, 3-5% sand & gravel up to 1/4" diam., moist, medium stiff, moderately plastic (CL)	3	7			
					Sandy clay, light brown with reddish brown and dark brown mottling 1-3% gravel up to 1/8" diam saturated, medium stiff, moderately plastic (CL)	4	8			
20	0.01				Sandy clay, light brown with reddish brown mottling 15-20% gravel up to 1/4" diam., saturated, stiff, slightly plastic (CL)	5	17			20
30										30
40										40
50										50

WELL DATA LOG W-3

Appendix D - Chain of Custody Forms and Certified Chemical Analyses

SOIL SAMPLES

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 11/14/90
DATE REPORTED: 11/26/90

AQUA RESOURCES, INC
RECEIVED
DEC - 7 1990
JOB NO. 90239.1
FILE lab analyses

LAB NUMBER: 102272

CLIENT: AQUA RESOURCES, INC.

REPORT ON: 5 SOIL SAMPLES

PROJECT #: 90239.1
LOCATION: RANSOME

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102272
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1
JOB LOCATION: RANSOME

DATE RECEIVED: 11/14/90
DATE ANALYZED: 11/16/90
DATE REPORTED: 11/26/90

Total Volatile Hydrocarbons with BTXE in Soils & Wastes
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	SAMPLE ID	TVH AS GASOLINE (mg/Kg)	BENZENE (ug/Kg)	TOLUENE (ug/Kg)	ETHYL BENZENE (ug/Kg)	TOTAL XYLENES (ug/Kg)
102272-1	W-1 6'-6.5'	5.0	16	ND(5.0)	ND(5.0)	18
102272-4	W-2 6'-6.5'	ND(1.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)
102272-7	B-8R 8'-8.5'	7.9	150	51	85	220
102272-8	B-25R 6'-6.5'	ND(1.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)
102272-9	W-3 6'-6.5'	ND(1.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)

ND = Not detected at or above reporting limit; Reporting limit indicated in parentheses.

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	94

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102272
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1
LOCATION: RANSOME

DATE RECEIVED: 11/14/90
DATE EXTRACTED: 11/16/90
DATE ANALYZED: 11/20/90
DATE REPORTED: 11/26/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	SAMPLE ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
102272-1	W-1 6'- 6.5'	ND	2.9	1.0
102272-4	W-2 6'- 6.5'	ND	3.5	1.0
102272-7	B-8R 8'-8.5'	ND	37	1.0
102272-8	B-25R 6'-6.5'	ND	ND	1.0
102272-9	W-3 6'-6.5'	ND	1.6	1.0

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	10
RECOVERY, %	89

102272

AQUA RESOURCES, INC.

SHIPMENT NO.: ______

PAGE 1 OF 1

CHAIN OF CUSTODY RECORD

DATE 11/14/90

PROJECT NAME: RANSOME

PROJECT NO.: 90239.1

	Sample Number	Location	Type of Sample		Type of Container	Type of Preservation		Analysis Required
			Material	Method		Temp	Chemical	
					brass tube	±4°	NONE	TPH, TVH, BTXE
-1	W-1	6'-6.5'	soil					HOLD
-2	W-1	11-11.5	soil					HOLD
-3	W-1	14.5'-15'	soil					~~HOLD~~
-4	~~W-1~~	~~19.5-20~~	~~soil~~					TPH, TVH, BTXE
-5	W-2	6'-6.5'	soil					HOLD
-5	W-2	11'-11.5'	soil					HOLD
-6	W-2	16'-16.5'	soil					TPH, TVH, BTXE
-7	B-8R	8'-8.5'	soil					TPH, TVH, BTXE
-8	B-25R	6'-6.5'	soil					TPH, TVH, BTXE
-9	W-3	6-6.5	soil					HOLD
-10	W-3	9'-9.5'						HOLD
-11	W-3	14.5-15						~~HOLD~~
	~~B-29~~	~~24.5-25~~						

Total Number of Samples Shipped: 12

Sampler's Signature: [signature] Patricia Rodgers

Relinquished By:	Received By:	Date / Time
Signature [signature] Printed Name BAJSAROWICZ Company ARI Reason ANALYSES	Signature [signature] Printed Name Nancy J. Wilson Company Curtis & Tompkins	Date 11/14/90 Time 11:20
Signature ______ Printed Name ______ Company ______ Reason ______	Signature ______ Printed Name ______ Company ______	Date / / Time

REMARKS:

Special Shipment / Handling / Storage Requirements:

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014
CLIENT: AQUA RESOURCES
JOB #: 90239
LOCATION: RANSOME

DATE RECEIVED: 10/19/90
DATE EXTRACTED: 11/01/90
DATE ANALYZED: 11/07/90
DATE REPORTED: 11/07/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
102014-1	P-6 5.5'	ND	4.8 *	1.0
102014-2	P-6 10.5	ND	5.9	1.0
102014-3	P-5 5.5	ND	4.3 *	1.0
102014-4	P-5 10.5	ND	1.9 *	1.0
102014-6	P-4 6.5	ND	2.4 *	1.0
102014-7	P-4 10.5	ND	2.8 *	1.0
102014-8	P-3 10.5	ND	29	10
102014-10	P-3 7.5	ND	ND	10
102014-12	P-2 10.5	ND	7.2	1.0
102014-13	P-2 7.5	ND	2.0 *	1.0
102014-16	P-1 6.5	ND	8.6 *	1.0

ND = Not Detected at or above reporting limit.

* Unknown compounds were quantitated based on the diesel standard although the compounds elute after the diesel range.

QA/QC SUMMARY

RPD, %	14
RECOVERY, %	110

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014-4
CLIENT: AQUA RESOURCES
PROJECT #: 90239
SAMPLE ID: P-5 10.5

DATE RECEIVED: 10/19/90
DATE ANALYZED: 10/24/90
DATE REPORTED: 11/01/90

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	5	EPA 6010
Arsenic	ND	2.5	EPA 6010
Barium	65	0.5	EPA 6010
Beryllium	ND	0.5	EPA 6010
Cadmium	0.93	0.5	EPA 6010
Chromium (total)	12	0.5	EPA 6010
Cobalt	4.5	0.5	EPA 6010
Copper	10	1	EPA 6010
Lead	ND	2.5	EPA 7420
Mercury	ND	0.1	EPA 7471
Molybdenum	ND	0.5	EPA 6010
Nickel	29	0.5	EPA 6010
Selenium	ND	2.5	EPA 7740
Silver	ND	1	EPA 6010
Thallium	ND	5	EPA 6010
Vanadium	6	1	EPA 6010
Zinc	23	0.5	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%		RPD,%	RECOVERY,%
Antimony	2	102	Mercury	2	107
Arsenic	3	103	Molybdenum	<1	102
Barium	1	102	Nickel	1	114
Beryllium	2	111	Selenium	1	108
Cadmium	3	112	Silver	7	89
Chromium	2	112	Thallium	4	95
Cobalt	2	113	Vanadium	1	108
Copper	1	103	Zinc	2	113
Lead	2	119			

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014
CLIENT: AQUA RESOURCES
JOB #: 90239
LOCATION: RANSOME

DATE RECEIVED: 10/19/90
DATE EXTRACTED: 10/25/90
DATE ANALYZED: 10/30/90
DATE REPORTED: 11/01/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
102014-15	P-1 10.5	ND	ND	1.0

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	106

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 102014
CLIENT: AQUA RESOURCES
PROJECT ID: 90239
LOCATION: RANSOME

DATE RECEIVED: 10/19/90
DATE ANALYZED: 10/24/90
DATE REPORTED: 11/01/90

ANALYSIS: LEAD
ANALYSIS METHOD: EPA 7420

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
102014-6	P-4 6.5	ND	mg/Kg	2.5
102014-7	P-4 10.5	ND	mg/Kg	2.5
102014-8	P-3 10.5	ND	mg/Kg	2.5
102014-10	P-3 7.5	ND	mg/Kg	2.5
102014-15	P-1 10.5	ND	mg/Kg	2.5
102014-16	P-1 6.5	ND	mg/Kg	2.5

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	87

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014
CLIENT: AQUA RESOURCES
JOB NUMBER: 90239
JOB LOCATION: RANSOME

DATE RECEIVED: 10/19/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 11/01/90

Total Volatile Hydrocarbons with BTXE in Soils & Wastes
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	CLIENT ID	TVH AS GASOLINE (mg/Kg)	BENZENE (ug/Kg)	ETHYL BENZENE (ug/Kg)	TOLUENE (ug/Kg)	TOTAL XYLENES (ug/Kg)
102014-1	P-6 5.5	ND(1.0)	ND(5.0)	ND(5.0)	15	5.8
102014-2	P-6 10.5	ND(1.0)	ND(5.0)	ND(5.0)	19	ND(5.0)
102014-6	P-4 6.5	ND(1.0)	41	ND(5.0)	32	ND(5.0)
102014-7	P-4 10.5	ND(1.0)	25	30	14	81
102014-8	P-3 10.5	510	ND(800)	9,800	9,000	54,000
102014-10	P-3 7.5	460	1,300	10,000	12,000	56,000
102014-12	P-2 10.5	ND(1.0)	ND(5.0)	ND(5.0)	83	ND(5.0)
102014-13	P-2 7.5	ND(1.0)	ND(5.0)	ND(5.0)	27	ND(5.0)
102014-15	P-1 10.5	530	ND(800)	9,400	8,600	58,000
102014-16	P-1 6.5	2.1	15	8.0	17	11

ND = Not detected at or above reporting limit; Reporting limit indicated in parentheses.

QA/QC SUMMARY

RPD, %	10
RECOVERY, %	100

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 102014-3
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: P-5 5.5

DATE RECEIVED: 10/19/90
DATE EXTRACTED: 10/24/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 11/02/90

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1650
2,4-Dinitrophenol	ND	1650
4-Nitrophenol	ND	1650
4,6-Dinitro-2-methylphenol	ND	1650
Pentachlorophenol	ND	1650

BASE/NEUTRAL COMPOUNDS

N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	ND	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	ND	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1650

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014-3
SAMPLE ID: P-5 5.5

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	ND	330
4-Nitroaniline	ND	1650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	ND	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1650
Benzo (a) anthracene	ND	330
Chrysene	ND	330
Bis (2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo (b) fluoranthene	ND	330
Benzo (k) fluoranthene	ND	330
Benzo (a) pyrene	ND	330
Indeno (1,2,3-cd) pyrene	ND	330
Dibenzo (a,h) anthracene	ND	330
Benzo (g,h,i) perylene	ND	330

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	105	Nitrobenzene-d5	88
Phenol-d6	107	2-Fluorobiphenyl	76
2,4,6-Tribromophenol	107	Terphenyl-d14	55

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014-4
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: P-5 10.5

DATE RECEIVED: 10/19/90
DATE EXTRACTED: 10/24/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 11/02/90

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phènol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1650
2,4-Dinitrophenol	ND	1650
4-Nitrophenol	ND	1650
4,6-Dinitro-2-methylphenol	ND	1650
Pentachlorophenol	ND	1650
BASE/NEUTRAL COMPOUNDS		
N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	ND	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	ND	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1650

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014-4
SAMPLE ID: P-5 10.5

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	ND	330
4-Nitroaniline	ND	1650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	ND	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1650
Benzo (a) anthracene	ND	330
Chrysene	ND	330
Bis (2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo (b) fluoranthene	ND	330
Benzo (k) fluoranthene	ND	330
Benzo (a) pyrene	ND	330
Indeno (1,2,3-cd) pyrene	ND	330
Dibenzo (a,h) anthracene	ND	330
Benzo (g,h,i) perylene	ND	330

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	100	Nitrobenzene-d5	86
Phenol-d6	104	2-Fluorobiphenyl	74
2,4,6-Tribromophenol	104	Terphenyl-d14	55

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014-3
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: P-5 5.5

DATE RECEIVED: 10/19/90
DATE ANALYZED: 10/31/90
DATE REPORTED: 11/02/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	10
Spike: Average % Recovery	102

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 102014-4
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: P-5 10.5

DATE RECEIVED: 10/19/90
DATE ANALYZED: 10/31/90
DATE REPORTED: 11/02/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	10
Spike: Average % Recovery	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014-3
CLIENT: AQUA RESOURCES
PROJECT: 90239
LOCATION: RANSOME
SAMPLE ID: P-5 5.5

DATE RECEIVED: 10/19/90
DATE ANALYZED: 10/31/90
DATE REPORTED: 11/02/90

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	5.5	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	8
RECOVERY, %	98

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102014-4
CLIENT: AQUA RESOURCES
PROJECT: 90239
LOCATION: RANSOME
SAMPLE ID: P-5 10.5

DATE RECEIVED: 10/19/90
DATE ANALYZED: 10/31/90
DATE REPORTED: 11/02/90

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	12	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	8
RECOVERY, %	98

102014

AQUA RESOURCES, INC.

CHAIN OF CUSTODY RECORD

SHIPMENT NO.: ______

PAGE 1 OF ______

DATE 10/19/90

PROJECT NAME: Ransome

PROJECT NO.: 90239

	Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required
1	P-6	5.5'	soil	drive	brass Tube	± 4°C	—	TVH, BTXE
2	P-6	10.5						TPH
3	P-5	5.5						TPH-D, TOG, CAC Metals
4	P-5	10.5						8010, 8020, 8270
5	P-4	15.5						TPH as D
6	P-4	6.5						TVH
7	P-4	10.5						BTXE
8	P-3	10.5						TVH, BTXE
9	P-3	15.5						TPH as D
10	P-3	7.5						Lead as TTLC
11	P-2	15.5						TPH as D
12	P-2	10.5						TVH
13	P-2	7.5						BTXE
14	P-1	15.5						TPH as D
15	P-1	10.5						TVH
16	P-1	6.5						BTXE
17	P-1	20.5						Lead by TTLC

Total Number of Samples Shipped: 17

Sampler's Signature: [signature] / Wojciech Bajsarowicz

Relinquished By:
Signature [signature]
Printed Name BAJSAROWICZ
Company ARI
Reason ______

Received By:
Signature [signature]
Printed Name N. Patten
Company CET

Date 10/19/90
Time 3:50p

Relinquished By:
Signature ______
Printed Name ______
Company ______
Reason ______

Received By:
Signature ______
Printed Name ______
Company ______

Date / /
Time ______

REMARKS:

Special Shipment / Handling / Storage Requirements:

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 10/18/90
DATE REPORTED: 11/06/90

LAB NUMBER: 101992

CLIENT: AQUA RESOURCES

6 1990

REPORT ON: 20 SOIL SAMPLES

90239.1
lab anal.

PROJECT #: 90239
LOCATION: RANSOME

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992
CLIENT: AQUA RESOURCES
JOB #: 90239
LOCATION: RANSOME

DATE RECEIVED: 10/18/90
DATE EXTRACTED: 10/29/90
DATE ANALYZED: 11/06/90
DATE REPORTED: 11/06/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
101992-2	2-2 3'6"	ND	8.7	1.0
101992-3	2-3 4'	ND	11	1.0
101992-4	2-4 3'5"	ND	4.7	1.0
101992-6	3-2 4'6"	ND	2.4	1.0
101992-7	3-3A 6'6"	ND	77	1.0
101992-8	3-3B 6'6"	ND	ND	1.0
101992-9	3-4 6'3"	ND	1.9	1.0
101992-10	3-5 5'6"	ND	6.4	1.0
101992-11	3-6 4'	ND	ND	1.0
101992-12	3-7 9'	ND	1,200	100
101992-15	4-2 3'9"	ND	18	1.0
101992-16	4-3 4'2"	ND	6.6	1.0
101992-17	4-6 5'	ND	19	1.0
101992-18	5-1 2'9"	ND	2,700	100
101992-19	5-1 4'	ND	22	1.0
101992-20	5-2 4'8"	ND	4.9	1.0

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	11
RECOVERY, %	107

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992
CLIENT: AQUA RESOURCES
JOB #: 90239
LOCATION: RANSOME

DATE RECEIVED: 10/18/90
DATE EXTRACTED: 10/23/90
DATE ANALYZED: 10/25/90
DATE REPORTED: 10/29/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
101992-1	2-1 3'6"	ND	350	100
101992-5	3-1 4'	ND	1,400	100
101992-13	4-1 3'	ND	610	10

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	82

Curtis & Tompkins, Ltd

LAB NUMBER: 101992
CLIENT: AQUA RESOURCES
PROJECT # : 90239

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/24/90
DATE REPORTED: 10/29/90

ANALYSIS: HYDROCARBON OIL AND GREASE
METHOD: SMWW 17:5520EF

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
101992-1	2-1 3'6"	3,000	mg/kg	50
101992-5	3-1 4'	6,700	mg/kg	50
101992-13	4-1 3'	250	mg/kg	50
101992-18	5-1 2'9"	1,400	mg/kg	50

QA/QC SUMMARY

RPD, %	1
RECOVERY, %	89

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992
CLIENT: AQUA RESOURCES
JOB NUMBER: 90239
JOB LOCATION: RANSOME

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 10/29/90

Total Volatile Hydrocarbons with BTXE in Soils & Wastes
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	CLIENT ID	TVH AS GASOLINE (mg/Kg)	BENZENE (ug/Kg)	TOLUENE (ug/Kg)	ETHYL BENZENE (ug/Kg)	TOTAL XYLENES (ug/Kg)
101992-1	2-1 3'6"	6.7	ND(5.0)	110	15	87

ND = Not detected at or above reporting limit; Reporting limit indicated in parentheses.

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	103

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992
CLIENT: AQUA RESOURCES
JOB #: 90239
LOCATION: RANSOME

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 10/29/90

Total Volatile Hydrocarbons as Gasoline in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	TVH AS GASOLINE (mg/Kg)	REPORTING LIMIT (mg/Kg)
101992-17	4-6 5'	4.5	1.0
101992-19	5-1 4'	4.2	1.0
101992-20	5-2 4'8"	9.3	1.0

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	103

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101992-1
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: 2-1 3'6"

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/25/90
DATE REPORTED: 11/01/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	5
Spike: Average % Recovery	83

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992-5
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: 3-1 4'

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 11/01/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY
===

Duplicate: Relative % Difference	10
Spike: Average % Recovery	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992-5
CLIENT: AQUA RESOURCES
PROJECT #: 90239
LOCATION: RANSOME
SAMPLE ID: 3-1 4'

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 11/01/90

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	26	5.0
Toluene	38	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	8
RECOVERY, %	98

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992-18
CLIENT: AQUA RESOURCES
PROJECT #: 90239
LOCATION: RANSOME
SAMPLE ID: 5-1 2'9"

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 11/01/90

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	10
Toluene	41	10
Ethyl Benzene	ND	10
Total Xylenes	ND	10
Chlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
1,3-Dichlorobenzene	ND	10
1,2-Dichlorobenzene	ND	10

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	8
RECOVERY, %	98

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992-1
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: 2-1 3'6"

DATE RECEIVED: 10/18/90
DATE EXTRACTED: 10/24/90
DATE ANALYZED: 10/29/90
DATE REPORTED: 11/01/90

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1650
2,4-Dinitrophenol	ND	1650
4-Nitrophenol	ND	1650
4,6-Dinitro-2-methylphenol	ND	1650
Pentachlorophenol	ND	1650
BASE/NEUTRAL COMPOUNDS		
N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	ND	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	ND	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1650

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992-1
SAMPLE ID: 2-1 3'6"

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	ND	330
4-Nitroaniline	ND	1650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	ND	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1650
Benzo (a) anthracene	ND	330
Chrysene	ND	330
Bis (2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo (b) fluoranthene	ND	330
Benzo (k) fluoranthene	ND	330
Benzo (a) pyrene	ND	330
Indeno (1,2,3-cd) pyrene	ND	330
Dibenzo (a,h) anthracene	ND	330
Benzo (g,h,i) perylene	ND	330

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	83%	Nitrobenzene-d5	63%
Phenol-d6	91%	2-Fluorobiphenyl	64%
2,4,6-Tribromophenol	58%	Terphenyl-d14	47%

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101992-5
CLIENT: AQUA RESOURCES
JOB #: 90239
SAMPLE ID: 3-1 4'

DATE RECEIVED: 10/18/90
DATE EXTRACTED: 10/24/90
DATE ANALYZED: 10/25/90
DATE REPORTED: 11/01/90

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1650
2,4-Dinitrophenol	ND	1650
4-Nitrophenol	ND	1650
4,6-Dinitro-2-methylphenol	ND	1650
Pentachlorophenol	ND	1650

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	ND	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	640	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1650

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101992-5
SAMPLE ID: 3-1 4'

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	ND	330
4-Nitroaniline	ND	1650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	ND	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1650
Benzo (a) anthracene	ND	330
Chrysene	ND	330
Bis (2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo (b) fluoranthene	ND	330
Benzo (k) fluoranthene	ND	330
Benzo (a) pyrene	ND	330
Indeno (1,2,3-cd) pyrene	ND	330
Dibenzo (a,h) anthracene	ND	330
Benzo (g,h,i) perylene	ND	330

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	81%	Nitrobenzene-d5	60%
Phenol-d6	96%	2-Fluorobiphenyl	60%
2,4,6-Tribromophenol	70%	Terphenyl-d14	44%

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992-1
CLIENT: AQUA RESOURCES
PROJECT #: 90239
SAMPLE ID: 2-1 3'6"

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/24/90
DATE REPORTED: 10/29/90

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	5	EPA 6010
Arsenic	ND	2.5	EPA 6010
Barium	160	0.5	EPA 6010
Beryllium	ND	0.5	EPA 6010
Cadmium	1.5	0.5	EPA 6010
Chromium (total)	18	0.5	EPA 6010
Cobalt	9.5	0.5	EPA 6010
Copper	20	1	EPA 6010
Lead	4.8	2.5	EPA 7420
Mercury	ND	0.1	EPA 7471
Molybdenum	ND	0.5	EPA 6010
Nickel	32	0.5	EPA 6010
Selenium	ND	2.5	EPA 7740
Silver	ND	1	EPA 6010
Thallium	ND	5	EPA 6010
Vanadium	17	1	EPA 6010
Zinc	34	0.5	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%
Antimony	2	102
Arsenic	3	103
Barium	1	102
Beryllium	2	111
Cadmium	3	112
Chromium	2	112
Cobalt	2	113
Copper	1	103
Lead	2	119
Mercury	2	101
Molybdenum	<1	102
Nickel	1	114
Selenium	1	108
Silver	7	88
Thallium	4	94
Vanadium	1	108
Zinc	2	113

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101992-5
CLIENT: AQUA RESOURCES
PROJECT #: 90239
SAMPLE ID: 3-1 4'

DATE RECEIVED: 10/18/90
DATE ANALYZED: 10/24/90
DATE REPORTED: 10/29/90

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	5	EPA 6010
Arsenic	ND	2.5	EPA 6010
Barium	90	0.5	EPA 6010
Beryllium	ND	0.5	EPA 6010
Cadmium	0.8	0.5	EPA 6010
Chromium (total)	10	0.5	EPA 6010
Cobalt	6.5	0.5	EPA 6010
Copper	11	1	EPA 6010
Lead	6.9	2.5	EPA 7420
Mercury	ND	0.1	EPA 7471
Molybdenum	ND	0.5	EPA 6010
Nickel	16	0.5	EPA 6010
Selenium	ND	2.5	EPA 6010
Silver	ND	1	EPA 6010
Thallium	ND	5	EPA 6010
Vanadium	9	1	EPA 6010
Zinc	14	0.5	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%
Antimony	2	102
Arsenic	3	103
Barium	1	102
Beryllium	2	111
Cadmium	3	112
Chromium	2	112
Cobalt	2	113
Copper	1	103
Lead	2	119
Mercury	2	101
Molybdenum	<1	102
Nickel	1	114
Selenium	1	108
Silver	7	88
Thallium	4	94
Vanadium	1	108
Zinc	2	113

Login # 101992

AQUA RESOURCES, INC.

CHAIN OF CUSTODY RECORD

SHIPMENT NO.: ______

PAGE 1 OF ______

DATE 10/18/90

PROJECT NAME: Ransome

PROJECT NO.: 90239

Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required
2-1	3'6"	soil	drive	brass tube	4°C	—	Note 1
2-2	3'6"						NOTE 2
2-3	4'						NOTE 2
2-4	3'5"						NOTE 2
3-1	4'						NOTE 3
3-2	4'6"						NOTE 3
3-3A	6½'						NOTE 3
3-3B	6½'						NOTE 3
3-4	6'3"						NOTE 3
3-5	5½'						NOTE 3
3-6	4'						NOTE 3
3-7	9'						NOTE 4
4-1	3'						NOTE 4
4-1	6'						NOTE 5
4-2	3'9"						NOTE 5
4-3	4'2"						NOTE 6
4-6	5'						NOTE 6
5-1	2'9"						NOTE 6
5-1	4'						NOTE 6
5-2	4'8" ~~1½~~						

Total Number of Samples Shipped: 20

Sampler's Signature: [signature]

Relinquished By:	Received By:	Date / Time
Signature [signature] Printed Name BADSARQUIER Company ARI Reason	Signature [signature] Printed Name Adriane Lee Company Curtis & Tompkins	Date 10/18/90 Time 5:40 pm.
Relinquished By: Signature Printed Name Company Reason	Received By: Signature Printed Name Company	Date / / Time

REMARKS:

NOTE 1: TPH, TOG, 8010, 8020, 8270, CAC Metals by TTLC only

NOTE 2: TPH, TOG

NOTE 3: TPH, TOG, 8010, 8020, 8270, CAC Metals by TTLC only

NOTE 4: TPH, TOG

NOTE 5: TPH

NOTE 6: TPH, TVH, 8020, TOG

Special Shipment / Handling / Storage Requirements:

TOG is method 503 E 2ᐳ5520EF

TPH is as diesel

TVH is as gasoline

Cooler is in cold room.

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 10/17/90
DATE REPORTED: 11/06/90

LAB NUMBER: 101974

CLIENT: AQUA RESOURCES

REPORT ON: 13 SOIL SAMPLES

NOV - 6 1990

PROJECT #: 90239.1
LOCATION: RANSOME

90239.1
lab anal.

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101974
CLIENT: AQUA RESOURCES
JOB #: 90239.1
LOCATION: RANSOME

DATE RECEIVED: 10/17/90
DATE EXTRACTED: 10/29/90
DATE ANALYZED: 11/06/90
DATE REPORTED: 11/06/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
101974-1	6-3 2'-6"	ND	22	1.0
101974-3	6-1 1'-8"	ND	260	10
101974-4	6-2 4.5'	ND	6.7	1.0
101974-7	6-1 6.5'	ND	43	1.0
101974-10	7-1 2.5'	ND	290	100
101974-11	8-1 3'	ND	7.0	1.0
101974-13	8-2 2'8"	ND	9.7	1.0

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	2
RECOVERY, %	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974
CLIENT: AQUA RESOURCES
JOB #: 90238.1
LOCATION: RANSOME

DATE RECEIVED: 10/17/90
DATE EXTRACTED: 10/23/90
DATE ANALYZED: 10/30/90
DATE REPORTED: 11/01/90

Extractable Petroleum Hydrocarbons in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (mg/Kg)	DIESEL RANGE (mg/Kg)	REPORTING LIMIT (mg/Kg)
101974-2	6-1 6'	ND	500	10
101974-9	7-1 5'	ND	26	1.0

ND = Not Detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	94

Curtis & Tompkins, Ltd.

LAB NUMBER: 101974
CLIENT: AQUA RESOURCES
PROJECT # : 90238.1
LOCATION: RANSOME

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/24/90
DATE REPORTED: 11/01/90

ANALYSIS: HYDROCARBON OIL AND GREASE
METHOD: SMWW 17:5520EF

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
101974-11	8-1 3'	ND	mg/Kg	50
101974-13	8-2 2'-8"	ND	mg/Kg	50

ND = Not detected at or above reporting limit

QA/QC SUMMARY

RPD, %	1
RECOVERY, %	89

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974
CLIENT: AQUA RESOURCES
JOB #: 90238.1
LOCATION: RANSOME

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 10/29/90

Total Volatile Hydrocarbons as Gasoline in Soils & Wastes
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	TVH AS GASOLINE (mg/Kg)	REPORTING LIMIT (mg/Kg)
101974-3	6-1 1'-8"	12	1.0

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	103

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974
CLIENT: AQUA RESOURCES
JOB NUMBER: 90238.1
JOB LOCATION: RANSOME

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 10/29/90

Total Volatile Hydrocarbons with BTXE in Soils & Wastes
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	CLIENT ID	TVH AS GASOLINE (mg/Kg)	BENZENE (ug/Kg)	TOLUENE (ug/Kg)	ETHYL BENZENE (ug/Kg)	TOTAL XYLENES (ug/Kg)
101974-1	6-3 2'-6"	ND(1.0)	ND(5.0)	11	ND(5.0)	ND(5.0)
101974-2	6-1 6'	65	20	55	1,300	130
101974-4	6-2 4.5'	6.8	7.1	63	7.0	28
101974-7	6-1 6.5'	1.1	ND(5.0)	240	ND(5.0)	19

ND = Not detected at or above reporting limit; Reporting limit indicated in parentheses.

QA/QC SUMMARY

RPD, %	3
RECOVERY, %	103

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-9
CLIENT: AQUA RESOURCES
JOB #: 90238.1
SAMPLE ID: 7-1 5'

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	10
Spike: Average % Recovery	90

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101974-10
CLIENT: AQUA RESOURCES
JOB #: 90238.1
SAMPLE ID: 7-1 2.5'

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	8.4	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	10
Spike: Average % Recovery	90

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-11
CLIENT: AQUA RESOURCES
JOB #: 90238.1
SAMPLE ID: 8-1 3'

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

==

Duplicate: Relative % Difference	10
Spike: Average % Recovery	90

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101974-13
CLIENT: AQUA RESOURCES
JOB #: 90238.1
SAMPLE ID: 8-2 2'-8"

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
1,2-dichloroethene (total)	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Duplicate: Relative % Difference	10
Spike: Average % Recovery	90

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-10
CLIENT: AQUA RESOURCES
PROJECT #: 90238.1
LOCATION: RANSOME
SAMPLE ID: 7-1 2.5'

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	5.7	5.0
Toluene	350	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	9
RECOVERY, %	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-11
CLIENT: AQUA RESOURCES
PROJECT #: 90238.1
LOCATION: RANSOME
SAMPLE ID: 8-1 3'

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	15	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	9
RECOVERY, %	102

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101974-13
CLIENT: AQUA RESOURCES
PROJECT #: 90238.1
LOCATION: RANSOME
SAMPLE ID: 8-2 2'-8"

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	48	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

RPD, %	9
RECOVERY, %	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-2
CLIENT: AQUA RESOURCES
PROJECT #: 90238.1
SAMPLE ID: 6-1 6'

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	5	EPA 6010
Arsenic	ND	2.5	EPA 6010
Barium	93	0.5	EPA 6010
Beryllium	ND	0.5	EPA 6010
Cadmium	ND	0.5	EPA 6010
Chromium (total)	10	0.5	EPA 6010
Cobalt	8.6	0.5	EPA 6010
Copper	12	1	EPA 6010
Lead	6.4	2.5	EPA 7420
Mercury	ND	0.1	EPA 7471
Molybdenum	ND	0.5	EPA 6010
Nickel	12	0.5	EPA 6010
Selenium	ND	2.5	EPA 6010
Silver	ND	1	EPA 6010
Thallium	ND	5	EPA 6010
Vanadium	11	1	EPA 6010
Zinc	18	0.5	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%
Antimony	1	87
Arsenic	7	90
Barium	1	96
Beryllium	<1	91
Cadmium	3	86
Chromium	5	92
Cobalt	1	92
Copper	1	94
Lead	2	85
Mercury	14	103
Molybdenum	3	90
Nickel	2	92
Selenium	2	87
Silver	4	85
Thallium	4	87
Vanadium	3	93
Zinc	3	96

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-11
CLIENT: AQUA RESOURCES
PROJECT #: 90238.1
SAMPLE ID: 8-1 3'

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	5	EPA 6010
Arsenic	ND	2.5	EPA 6010
Barium	76	0.5	EPA 6010
Beryllium	ND	0.5	EPA 6010
Cadmium	0.7	0.5	EPA 6010
Chromium (total)	13	0.5	EPA 6010
Cobalt	6.4	0.5	EPA 6010
Copper	15	1	EPA 6010
Lead	2.5	2.5	EPA 7420
Mercury	ND	0.1	EPA 7471
Molybdenum	ND	0.5	EPA 6010
Nickel	17	0.5	EPA 6010
Selenium	ND	2.5	EPA 7740
Silver	ND	1	EPA 6010
Thallium	ND	5	EPA 6010
Vanadium	13	1	EPA 6010
Zinc	19	0.5	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%
Antimony	1	87
Arsenic	7	90
Barium	1	96
Beryllium	<1	91
Cadmium	3	86
Chromium	5	92
Cobalt	1	92
Copper	1	94
Lead	2	85
Mercury	14	103
Molybdenum	3	90
Nickel	2	92
Selenium	2	87
Silver	4	85
Thallium	4	87
Vanadium	3	93
Zinc	3	96

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-13
CLIENT: AQUA RESOURCES
PROJECT #: 90238.1
SAMPLE ID: 8-2 2'-8"

DATE RECEIVED: 10/17/90
DATE ANALYZED: 10/23/90
DATE REPORTED: 10/29/90

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	5	EPA 6010
Arsenic	ND	2.5	EPA 6010
Barium	180	0.5	EPA 6010
Beryllium	0.5	0.5	EPA 6010
Cadmium	1.4	0.5	EPA 6010
Chromium (total)	19	0.5	EPA 6010
Cobalt	11	0.5	EPA 6010
Copper	40	1	EPA 6010
Lead	12	2.5	EPA 7420
Mercury	ND	0.1	EPA 7471
Molybdenum	ND	0.5	EPA 6010
Nickel	32	0.5	EPA 6010
Selenium	ND	2.5	EPA 6010
Silver	ND	1	EPA 6010
Thallium	ND	5	EPA 6010
Vanadium	21	1	EPA 6010
Zinc	46	0.5	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%
Antimony	1	87
Arsenic	7	90
Barium	1	96
Beryllium	<1	91
Cadmium	3	86
Chromium	5	92
Cobalt	1	92
Copper	1	94
Lead	2	85
Mercury	14	103
Molybdenum	3	90
Nickel	2	92
Selenium	2	87
Silver	4	85
Thallium	4	87
Vanadium	3	93
Zinc	3	96

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-2
CLIENT: AQUA RESOURCES
JOB #: 90239.1
SAMPLE ID: 6-1 6'

DATE RECEIVED: 10/17/90
DATE EXTRACTED: 10/24/90
DATE ANALYZED: 10/25/90
DATE REPORTED: 11/02/90

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1,650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1,650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2,4-Dinitrophenol	ND	1,650
4-Nitrophenol	ND	1,650
4,6-Dinitro-2-methylphenol	ND	1,650
Pentachlorophenol	ND	1,650
BASE/NEUTRAL COMPOUNDS		
N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	2,900	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	4,300	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1,650

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-2
SAMPLE ID: 6-1 6'

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1,650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	ND	330
4-Nitroaniline	ND	1,650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	ND	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1,650
Benzo (a) anthracene	ND	330
Chrysene	ND	330
Bis (2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo (b) fluoranthene	ND	330
Benzo (k) fluoranthene	ND	330
Benzo (a) pyrene	ND	330
Indeno (1,2,3-cd) pyrene	ND	330
Dibenzo (a,h) anthracene	ND	330
Benzo (g,h,i) perylene	ND	330

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	100	Nitrobenzene-d5	80
Phenol-d6	105	2-Fluorobiphenyl	75
2,4,6-Tribromophenol	112	Terphenyl-d14	53

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 101974-10
CLIENT: AQUA RESOURCES
JOB #: 90239.1
SAMPLE ID: 7-1 2.5'

DATE RECEIVED: 10/17/90
DATE EXTRACTED: 10/24/90
DATE ANALYZED: 10/26/90
DATE REPORTED: 11/02/90

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3580 Waste Dilution

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	3,300
2-Chlorophenol	ND	3,300
Benzyl Alcohol	ND	3,300
2-Methylphenol	ND	3,300
4-Methylphenol	ND	3,300
2-Nitrophenol	ND	16,500
2,4-Dimethylphenol	ND	3,300
Benzoic Acid	ND	16,500
2,4-Dichlorophenol	ND	3,300
4-Chloro-3-methylphenol	ND	3,300
2,4,6-Trichlorophenol	ND	3,300
2,4,5-Trichlorophenol	ND	16,500
2,4-Dinitrophenol	ND	16,500
4-Nitrophenol	ND	16,500
4,6-Dinitro-2-methylphenol	ND	16,500
Pentachlorophenol	ND	16,500
BASE/NEUTRAL COMPOUNDS		
N-Nitrosodimethylamine	ND	3,300
Aniline	ND	3,300
Bis(2-chloroethyl)ether	ND	3,300
1,3-Dichlorobenzene	ND	3,300
1,4-Dichlorobenzene	ND	3,300
1,2-Dichlorobenzene	ND	3,300
Bis(2-chloroisopropyl)ether	ND	3,300
N-Nitroso-di-n-propylamine	ND	3,300
Hexachloroethane	ND	3,300
Nitrobenzene	ND	3,300
Isophorone	ND	3,300
Bis(2-chloroethoxy)methane	ND	3,300
1,2,4-Trichlorobenzene	ND	3,300
Naphthalene	ND	3,300
4-Chloroaniline	ND	3,300
Hexachlorobutadiene	ND	3,300
2-Methylnaphthalene	ND	3,300
Hexachlorocyclopentadiene	ND	3,300
2-Chloronaphthalene	ND	3,300
2-Nitroaniline	ND	16,500

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 101974-10
SAMPLE ID: 7-1 2.5'

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	3,300
Acenaphthylene	ND	3,300
2,6-Dinitrotoluene	ND	3,300
3-Nitroaniline	ND	16,500
Acenaphthene	ND	3,300
Dibenzofuran	ND	3,300
2,4-Dinitrotoluene	ND	3,300
Diethylphthalate	ND	3,300
4-Chlorophenyl-phenylether	ND	3,300
Fluorene	ND	3,300
4-Nitroaniline	ND	16,500
N-Nitrosodiphenylamine	ND	3,300
Azobenzene	ND	3,300
4-Bromophenyl-phenylether	ND	3,300
Hexachlorobenzene	ND	3,300
Phenanthrene	ND	3,300
Anthracene	ND	3,300
Di-n-butylphthalate	ND	3,300
Fluoranthene	ND	3,300
Benzidine	ND	3,300
Pyrene	ND	3,300
Butylbenzylphthalate	ND	3,300
3,3'-Dichlorobenzidine	ND	16,500
Benzo (a) anthracene	ND	3,300
Chrysene	ND	3,300
Bis (2-ethylhexyl)phthalate	ND	3,300
Di-n-octylphthalate	ND	3,300
Benzo (b) fluoranthene	ND	3,300
Benzo (k) fluoranthene	ND	3,300
Benzo (a) pyrene	ND	3,300
Indeno (1,2,3-cd) pyrene	ND	3,300
Dibenzo (a,h) anthracene	ND	3,300
Benzo (g,h,i) perylene	ND	3,300

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

Data not available due to waste dilution.

1124

AQUA RESOURCES, INC.

SHIPMENT NO.:

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

DATE 10/17/90

PROJECT NAME: RANSOME

PROJECT NO.: 90239.1

Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required
6-3	2'-6"	soil		brass tube	±4°		TVH, TPH, TOG
6-1	6'						CAC METALS'
6-1	1'-8"						TTLC ONLY
6-2	4.5'						8020 (BTXE)
6-1	5'						
6-1	1.5'						
6-1	6.5'						TPH, 8010, 8020
7-1	1'-10"						
7-1	5'						
7-1	2.5'						TPH, TOG, 8010
8-1	3'						8020, CAC METALS
8-1	3'						TTLC ONLY
8-2	2'-8"						

all these samples receive all of these analyses
"
"

Total Number of Samples Shipped:

Sampler's Signature: [signature] / Wojciech Bajs[signature]

Relinquished By:
Signature Wojciech Baj[signature]
Printed Name BAJSAROWICZ
Company AQUA RESOURCES INC
Reason ANALYSES

Received By:
Signature Jeanne Evans
Printed Name Jeanne Evans
Company Curtis & Tompkins

Date 10/17/90

Time 5:10

Relinquished By:
Signature
Printed Name
Company
Reason

Received By:
Signature
Printed Name
Company

Date / /

Time

REMARKS:

Special Shipment / Handling / Storage Requirements:

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 10/17-18/90
DATE REQUESTED: 11/02/90
DATE REPORTED: 11/07/90

LAB NUMBER: 102153

CLIENT: AQUA RESOURCES, INC.

REPORT ON: 3 SOIL SAMPLES

PROJECT #: 90239.1/90239
PROJECT: RANSOME

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd.

LAB NUMBER: 102153
CLIENT: AQUA RESOURCES, INC.
PROJECT # : 90239.1/90239
LOCATION: RANSOME

DATE RECEIVED: 10/17-18/90
DATE REQUESTED: 11/02/90
DATE ANALYZED: 11/05/90
DATE REPORTED: 11/05/90

ANALYSIS: HYDROCARBON OIL AND GREASE
METHOD: SMWW 17:5520 E&F

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
102153-1	6-1 1'-8"	2,500	mg/Kg	50
102153-3	5-1 4'	ND	mg/Kg	50

ND = Not detected at or above reporting limit

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	88

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102153
CLIENT: AQUA RESOURCES, INC.
JOB NUMBER: 90239.1/90239
JOB LOCATION: RANSOME

DATE RECEIVED: 10/17-18/90
DATE REQUESTED 11/02/90
DATE ANALYZED: 11/05/90
DATE REPORTED: 11/05/90

Benzene, Toluene, Ethyl Benzene, Xylenes by EPA 8020
Extraction by EPA 5030 Purge and Trap

LAB ID	CLIENT ID	BENZENE (ug/kg)	TOLUENE (ug/kg)	TOTAL XYLENES (ug/kg)	ETHYL BENZENE (ug/kg)	REPORTING LIMIT * (ug/kg)
102153-1	6-1 1'-8''	22	ND	17	ND	5.0

ND = Not detected at or above reporting limit.

* Reporting Limit applies to all analytes.

QA/QC SUMMARY

RPD, %	7
RECOVERY, %	99

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102153-2
CLIENT: AQUA RESOURCES
JOB #: 90239.1/90239
SAMPLE ID: 5-1 2'9''

DATE RECEIVED: 10/17-18/90
DATE REQUESTED: 11/02/90
DATE EXTRACTED: 11/02/90
DATE ANALYZED: 11/05/90
DATE REPORTED: 11/07/90

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1650
2,4-Dinitrophenol	ND	1650
4-Nitrophenol	ND	1650
4,6-Dinitro-2-methylphenol	ND	1650
Pentachlorophenol	ND	1650
BASE/NEUTRAL COMPOUNDS		
N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	ND	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	ND	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1650

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102153-2 EPA 8270
SAMPLE ID: 5-1 2'9''

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	680	330
4-Nitroaniline	ND	1650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	47,000	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1650
Benzo (a) anthracene	ND	330
Chrysene	ND	330
Bis (2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo (b) fluoranthene	ND	330
Benzo (k) fluoranthene	ND	330
Benzo (a) pyrene	ND	330
Indeno (1,2,3-cd) pyrene	ND	330
Dibenzo (a,h) anthracene	ND	330
Benzo (g,h,i) perylene	ND	330

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	106 %	Nitrobenzene-d5	103 %
Phenol-d6	113 %	2-Fluorobiphenyl	93 %
2,4,6-Tribromophenol	99 %	Terphenyl-d14	60 %

VERBAL ADDITIONS / CANCELLATIONS TO ANALYSIS REQUEST SHEET

CLIENT: ARI DATE: 11/2/90

REQUESTED BY: Voytek TIME: ______ am 2:30 pm

RECORDED BY: Mary Privitera

Current Lab ID (Previous Lab ID)	Client ID	Circle matrix	Specify add or cancel	Analysis	Due date
102153-1 (101974-3)	6-1 1'8"	(soil) water other	add	BTXE O&G(E)(hydro)	11/5
102153-2 (101992-18)	5-1 2'9"	(soil) water other		8270	↓
102153-3 (101992-19)	5-1 4'	(soil) water other		O&G	↓
(-)		soil water other			
(-)		soil water other			
(-)		soil water other			
(-)		soil water other			
(-)		soil water other			

Original in job jacket. Copies to analytical departments.

\ ' 2 \

AQUA RESOURCES, INC.

CHAIN OF CUSTODY RECORD

SHIPMENT NO.:

PAGE 1 OF 1

DATE 10/17/90

PROJECT NAME: RANSOME

PROJECT NO.: 90239.1

Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required
6-3	2'-6"	soil		brass tube	+4°		TVH, TPH, TOG
6-1	6'						CAC METALS
6-1	1'-8"		new login-102153-1				TTLC ONLY
6-2	4.5'						8020 (BTXE)
6-1	5'						
6-1	1.5'						
6-1	6.5'						
7-1	1'-10"						TPH, 8010, 8020
7-1	5'						
7-1	2.5'						
8-1	3'						TPH, TOG, 8010
8-1	3'						8020, CAC METALS
8-2	2.'-8"						TTLC ONLY

all these samples receive all of these analyses. " "

Total Number of Samples Shipped: Sampler's Signature: [signature] / Wojciech Bajs[signature]

Relinquished By:	Received By:	Date / Time
Signature [signature]	Signature [signature]	Date 10/17/90
Printed Name BAJSAROWICZ	Printed Name Jeanne Evans	
Company AQUA RESOURCES INC	Company Curtis + Tompkins	Time 5:10
Reason ANALYSES		

Relinquished By:	Received By:	Date / Time
Signature	Signature	Date / /
Printed Name	Printed Name	
Company	Company	Time
Reason		

REMARKS:

Special Shipment / Handling / Storage Requirements:

Login # 101992

AQUA RESOURCES, INC.

CHAIN OF CUSTODY RECORD

SHIPMENT NO.:

PAGE 1 OF

DATE 10/18/90

PROJECT NAME: Ransome

PROJECT NO.: 90239

	Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required
1	2-1	3'6"	soil	drive	brass tube	4°C	—	~~[illegible]~~ NOTE 1
	2-2	3'6"						NOTE 2
3	2-3	4'						NOTE 2
4	2-4	3'5"						NOTE 2
	3-1	4'						NOTE 3
6	3-2	4'6"						NOTE 3
7	3-3A	6 ½'						NOTE 3
	3-3B	6 ½'						NOTE 3
9	3-4	6'3"						NOTE 3
10	3-5	5 ½'						NOTE 3
11	3-6	4'						NOTE 3
12	3-7	9'						NOTE 3
13	4-1	3'						NOTE 3
14	4-1	6'						NOTE 4
15	4-2	3'9"						NOTE ~~4~~ 4
16	4-3	4'2"						NOTE 5
17	4-6	5'						NOTE 5
18	5-1	2'9"			new login -102153-2			NOTE 6
19	5-1	4'			↓ 102153-3			NOTE 6
20	5-2	4'8" ~~1½'~~						NOTE 6

Total Number of Samples Shipped: 20

Sampler's Signature: [signature]

Relinquished By:	Received By:	
Signature [signature]	Signature [signature]	Date 10/18/90
Printed Name BADSARO ???	Printed Name Adriane Lee	
Company ARI	Company Curtis & Tompkins	Time 5:40 pm.
Reason		

Relinquished By:	Received By:	
Signature	Signature	Date / /
Printed Name	Printed Name	
Company	Company	Time
Reason		

REMARKS: NOTE 1: TPH, TOG, 8010, 8020, 8270, CAC Metals by TTLC only

NOTE 2: TPH, TOG

NOTE 3: TPH, TOG, 8010, 8020, 8270, CAC Metals by TTLC only

NOTE 4: TPH, TOG

NOTE 5: TPH

NOTE 6: TPH, TVH, 8020, TOG

Special Shipment / Handling / Storage Requirements:

TOG is method 503 E ⇒ 5520EF

Cooler is in cold room.

TPH is as diesel

TVH is as gasoline

SOIL & GRAB
WATER SAMPLES

NET

NATIONAL ENVIRONMENTAL TESTING, INC.®

NET Pacific, Inc.
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

Jack Alt
Aqua Resources
2030 Addison Way
Berkeley, CA 94704

Date: 12-12-90
NET Client Acct. No: 424
NET Pacific Log No: 4773
Received: 11-13-90 0800
Revised: 12-12-90

Client Reference Information

4030 Hollis St., Emeryville

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Jules Skamarack
Laboratory Manager

AQUA RESOURCES, INC
RECEIVED
DEC 13 1990
JOB NO. 90239.1
FILE lab results

Enclosure(s)

NET

NET Pacific, Inc

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: B-25 11-05-90 0845
LAB Job No: (-68083)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			1	
DATE ANALYZED			11-07-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg
as Motor Oil		10	56	mg/Kg
METHOD 8010				
DATE ANALYZED			11-05-90	
DILUTION FACTOR*			--	
Bromodichloromethane		5	ND	ug/Kg
Bromoform		100	ND	ug/Kg
Bromomethane		4	ND	ug/Kg
Carbon tetrachloride		2	ND	ug/Kg
Chlorobenzene		10	ND	ug/Kg
Chloroethane		4	ND	ug/Kg
2-Chloroethylvinyl ether		15	ND	ug/Kg
Chloroform		2	ND	ug/Kg
Chloromethane		4	ND	ug/Kg
Dibromochloromethane		10	ND	ug/Kg
1,2-Dichlorobenzene		5	ND	ug/Kg
1,3-Dichlorobenzene		5	ND	ug/Kg
1,4-Dichlorobenzene		5	ND	ug/Kg
Dichlorodifluoromethane		2	ND	ug/Kg
1,1-Dichloroethane		2	ND	ug/Kg
1,2-Dichloroethane		4	ND	ug/Kg
1,1-Dichloroethene		2	ND	ug/Kg
trans-1,2-Dichloroethene		2	ND	ug/Kg
1,2-Dichloropropane		4	ND	ug/Kg
cis-1,3-Dichloropropene		4	ND	ug/Kg
trans-1,3-Dichloropropene		10	ND	ug/Kg
Methylene Chloride		2	ND	ug/Kg
1,1,2,2-Tetrachloroethane		5	ND	ug/Kg
Tetrachloroethene		4	ND	ug/Kg
1,1,1-Trichloroethane		2	ND	ug/Kg
1,1,2-Trichloroethane		2	ND	ug/Kg
Trichloroethene		4	ND	ug/Kg
Trichlorofluoromethane		50	ND	ug/Kg
Vinyl chloride		5	ND	ug/Kg
cis-1,2-Dichloroethene		2	ND	ug/Kg

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 3

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: H-5 11-05-90 1005
LAB Job No: (-68084)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			1	
DATE ANALYZED			11-07-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg
as Motor Oil		10	150	mg/Kg
METHOD 8010				
DATE ANALYZED			11-05-90	
DILUTION FACTOR*			--	
Bromodichloromethane		5	ND	ug/Kg
Bromoform		100	ND	ug/Kg
Bromomethane		4	ND	ug/Kg
Carbon tetrachloride		2	ND	ug/Kg
Chlorobenzene		10	ND	ug/Kg
Chloroethane		4	ND	ug/Kg
2-Chloroethylvinyl ether		15	ND	ug/Kg
Chloroform		2	ND	ug/Kg
Chloromethane		4	ND	ug/Kg
Dibromochloromethane		10	ND	ug/Kg
1,2-Dichlorobenzene		5	ND	ug/Kg
1,3-Dichlorobenzene		5	ND	ug/Kg
1,4-Dichlorobenzene		5	ND	ug/Kg
Dichlorodifluoromethane		2	ND	ug/Kg
1,1-Dichloroethane		2	ND	ug/Kg
1,2-Dichloroethane		4	ND	ug/Kg
1,1-Dichloroethene		2	ND	ug/Kg
trans-1,2-Dichloroethene		2	ND	ug/Kg
1,2-Dichloropropane		4	ND	ug/Kg
cis-1,3-Dichloropropene		4	ND	ug/Kg
trans-1,3-Dichloropropene		10	ND	ug/Kg
Methylene Chloride		2	ND	ug/Kg
1,1,2,2-Tetrachloroethane		5	ND	ug/Kg
Tetrachloroethene		4	ND	ug/Kg
1,1,1-Trichloroethane		2	ND	ug/Kg
1,1,2-Trichloroethane		2	ND	ug/Kg
Trichloroethene		4	ND	ug/Kg
Trichlorofluoromethane		50	ND	ug/Kg
Vinyl chloride		5	ND	ug/Kg
cis-1,2-Dichloroethene		2	ND	ug/Kg

NET

NET Pacific, Inc

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: H-3 11-05-90 1100
LAB Job No: (-68085)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			1	
DATE ANALYZED			11-07-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg
as Motor Oil		10	21	mg/Kg
METHOD 8010				
DATE ANALYZED			11-05-90	
DILUTION FACTOR*			--	
Bromodichloromethane		5	ND	ug/Kg
Bromoform		100	ND	ug/Kg
Bromomethane		4	ND	ug/Kg
Carbon tetrachloride		2	ND	ug/Kg
Chlorobenzene		10	ND	ug/Kg
Chloroethane		4	ND	ug/Kg
2-Chloroethylvinyl ether		15	ND	ug/Kg
Chloroform		2	ND	ug/Kg
Chloromethane		4	ND	ug/Kg
Dibromochloromethane		10	ND	ug/Kg
1,2-Dichlorobenzene		5	ND	ug/Kg
1,3-Dichlorobenzene		5	ND	ug/Kg
1,4-Dichlorobenzene		5	ND	ug/Kg
Dichlorodifluoromethane		2	ND	ug/Kg
1,1-Dichloroethane		2	ND	ug/Kg
1,2-Dichloroethane		4	ND	ug/Kg
1,1-Dichloroethene		2	ND	ug/Kg
trans-1,2-Dichloroethene		2	ND	ug/Kg
1,2-Dichloropropane		4	ND	ug/Kg
cis-1,3-Dichloropropene		4	ND	ug/Kg
trans-1,3-Dichloropropene		10	ND	ug/Kg
Methylene Chloride		2	ND	ug/Kg
1,1,2,2-Tetrachloroethane		5	ND	ug/Kg
Tetrachloroethene		4	ND	ug/Kg
1,1,1-Trichloroethane		2	ND	ug/Kg
1,1,2-Trichloroethane		2	ND	ug/Kg
Trichloroethene		4	ND	ug/Kg
Trichlorofluoromethane		50	ND	ug/Kg
Vinyl chloride		5	ND	ug/Kg
cis-1,2-Dichloroethene		2	ND	ug/Kg

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 5

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: I-7 11-05-90 1215
LAB Job No: (-68086)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			1	
DATE ANALYZED			11-07-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg
as Motor Oil		10	62	mg/Kg
METHOD 8010				
DATE ANALYZED			11-05-90	
DILUTION FACTOR*			--	
Bromodichloromethane		5	ND	ug/Kg
Bromoform		100	ND	ug/Kg
Bromomethane		4	ND	ug/Kg
Carbon tetrachloride		2	ND	ug/Kg
Chlorobenzene		10	ND	ug/Kg
Chloroethane		4	ND	ug/Kg
2-Chloroethylvinyl ether		15	ND	ug/Kg
Chloroform		2	ND	ug/Kg
Chloromethane		4	ND	ug/Kg
Dibromochloromethane		10	ND	ug/Kg
1,2-Dichlorobenzene		5	ND	ug/Kg
1,3-Dichlorobenzene		5	ND	ug/Kg
1,4-Dichlorobenzene		5	ND	ug/Kg
Dichlorodifluoromethane		2	ND	ug/Kg
1,1-Dichloroethane		2	ND	ug/Kg
1,2-Dichloroethane		4	ND	ug/Kg
1,1-Dichloroethene		2	ND	ug/Kg
trans-1,2-Dichloroethene		2	ND	ug/Kg
1,2-Dichloropropane		4	ND	ug/Kg
cis-1,3-Dichloropropene		4	ND	ug/Kg
trans-1,3-Dichloropropene		10	ND	ug/Kg
Methylene Chloride		2	ND	ug/Kg
1,1,2,2-Tetrachloroethane		5	ND	ug/Kg
Tetrachloroethene		4	ND	ug/Kg
1,1,1-Trichloroethane		2	ND	ug/Kg
1,1,2-Trichloroethane		2	ND	ug/Kg
Trichloroethene		4	ND	ug/Kg
Trichlorofluoromethane		50	ND	ug/Kg
Vinyl chloride		5	ND	ug/Kg
cis-1,2-Dichloroethene		2	ND	ug/Kg

NET

NET Pacific, Inc

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: C-2 11-05-90 1305
LAB Job No: (-68087)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			1	
DATE ANALYZED			11-07-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg
as Motor Oil		10	280	mg/Kg
METHOD 8010				
DATE ANALYZED			11-05-90	
DILUTION FACTOR*			--	
Bromodichloromethane		5	ND	ug/Kg
Bromoform		100	ND	ug/Kg
Bromomethane		4	ND	ug/Kg
Carbon tetrachloride		2	ND	ug/Kg
Chlorobenzene		10	ND	ug/Kg
Chloroethane		4	ND	ug/Kg
2-Chloroethylvinyl ether		15	ND	ug/Kg
Chloroform		2	ND	ug/Kg
Chloromethane		4	ND	ug/Kg
Dibromochloromethane		10	ND	ug/Kg
1,2-Dichlorobenzene		5	ND	ug/Kg
1,3-Dichlorobenzene		5	ND	ug/Kg
1,4-Dichlorobenzene		5	ND	ug/Kg
Dichlorodifluoromethane		2	ND	ug/Kg
1,1-Dichloroethane		2	2.4	ug/Kg
1,2-Dichloroethane		4	ND	ug/Kg
1,1-Dichloroethene		2	ND	ug/Kg
trans-1,2-Dichloroethene		2	ND	ug/Kg
1,2-Dichloropropane		4	ND	ug/Kg
cis-1,3-Dichloropropene		4	ND	ug/Kg
trans-1,3-Dichloropropene		10	ND	ug/Kg
Methylene Chloride		2	ND	ug/Kg
1,1,2,2-Tetrachloroethane		5	ND	ug/Kg
Tetrachloroethene		4	ND	ug/Kg
1,1,1-Trichloroethane		2	ND	ug/Kg
1,1,2-Trichloroethane		2	ND	ug/Kg
Trichloroethene		4	ND	ug/Kg
Trichlorofluoromethane		50	ND	ug/Kg
Vinyl chloride		5	ND	ug/Kg
cis-1,2-Dichloroethene		2	ND	ug/Kg

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: B-19 11-05-90 1600
LAB Job No: (-68088)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (SOIL)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/5030			--	
as Gasoline		1	ND	mg/Kg
METHOD 8020			--	
Benzene		5	ND	ug/Kg
Ethylbenzene		5	ND	ug/Kg
Toluene		5	ND	ug/Kg
Xylenes		5	ND	ug/Kg
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 8

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: D-15 11-06-90 1155
LAB Job No: (-68089)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (SOIL)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/5030			--	
as Gasoline		1	7.6	mg/Kg
METHOD 8020			--	
Benzene		5	ND	ug/Kg
Ethylbenzene		5	ND	ug/Kg
Toluene		5	ND	ug/Kg
Xylenes		5	ND	ug/Kg
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			11	
DATE ANALYZED			11-06-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 9

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: B-14 11-06-90
LAB Job No: (-68090)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (SOIL)			--	
DILUTION FACTOR *			263	
DATE ANALYZED			11-06-90	
METHOD GC FID/5030			--	
as Gasoline		1	300	mg/Kg
METHOD 8020			--	
Benzene		5	2,500	ug/Kg
Ethylbenzene		5	8,900	ug/Kg
Toluene		5	2,500	ug/Kg
Xylenes		5	59,000	ug/Kg
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			8	
DATE ANALYZED			11-06-90	
METHOD GC FID/3550			--	
as Diesel		1	75	mg/Kg

NET

NET Pacific, Inc

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: E-19 11-06-90
LAB Job No: (-68091)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (SOIL)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/5030			--	
as Gasoline		1	ND	mg/Kg
METHOD 8020			--	
Benzene		5	ND	ug/Kg
Ethylbenzene		5	ND	ug/Kg
Toluene		5	ND	ug/Kg
Xylenes		5	ND	ug/Kg
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (SOIL)			--	
DILUTION FACTOR*			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/3550			--	
as Diesel		1	ND	mg/Kg

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 11

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: G-17 11-06-90 1050
LAB Job No: (-68092)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (SOIL)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/5030			--	
as Gasoline		1	ND	mg/Kg
METHOD 8020			--	
Benzene		5	ND	ug/Kg
Ethylbenzene		5	ND	ug/Kg
Toluene		5	ND	ug/Kg
Xylenes		5	ND	ug/Kg

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 12

Ref: 4030 Hollis St, Emeryville

SAMPLE DESCRIPTION: B-25 11-05-90 1530
LAB Job No: (-68093)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (WATER)			--	
DILUTION FACTOR*			2	
DATE ANALYZED			11-07-90	
METHOD GC FID/3550			--	
as Diesel		0.05	ND	mg/L
as Motor Oil		0.5	ND	mg/L
METHOD 8010				
DATE ANALYZED			11-05-90	
DILUTION FACTOR*			--	
Bromodichloromethane		1.0	ND	ug/L
Bromoform		20	ND	ug/L
Bromomethane		0.8	ND	ug/L
Carbon tetrachloride		0.4	ND	ug/L
Chlorobenzene		2.0	ND	ug/L
Chloroethane		0.8	ND	ug/L
2-Chloroethylvinyl ether		3.0	ND	ug/L
Chloroform		0.4	ND	ug/L
Chloromethane		0.8	ND	ug/L
Dibromochloromethane		2.0	ND	ug/L
1,2-Dichlorobenzene		1.0	ND	ug/L
1,3-Dichlorobenzene		1.0	ND	ug/L
1,4-Dichlorobenzene		1.0	ND	ug/L
Dichlorodifluoromethane		0.4	ND	ug/L
1,1-Dichloroethane		0.4	ND	ug/L
1,2-Dichloroethane		0.8	ND	ug/L
1,1-Dichloroethene		0.4	ND	ug/L
trans-1,2-Dichloroethene		0.4	ND	ug/L
1,2-Dichloropropane		0.7	ND	ug/L
cis-1,3-Dichloropropene		0.7	ND	ug/L
trans-1,3-Dichloropropene		2.0	ND	ug/L
Methylene Chloride		0.4	ND	ug/L
1,1,2,2-Tetrachloroethane		1.0	ND	ug/L
Tetrachloroethene		0.7	ND	ug/L
1,1,1-Trichloroethane		0.4	ND	ug/L
1,1,2-Trichloroethane		0.4	ND	ug/L
Trichloroethene		0.7	ND	ug/L
Trichlorofluoromethane		10	ND	ug/L
Vinyl chloride		1.0	ND	ug/L
cis-1,2-Dichloroethene		0.5	ND	ug/L

NET

NET Pacific, Inc

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Ref: 4030 Hollis St, Emeryville

SAMPLE DESCRIPTION: H-5 11-05-90 1430
LAB Job No: (-68094)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (WATER)			--	
DILUTION FACTOR*			2	
DATE ANALYZED			11-06-90	
METHOD GC FID/3550			--	
as Diesel		0.05	ND	mg/L
as Motor Oil		0.5	ND	mg/L
METHOD 8010				
DATE ANALYZED			11-05-90	
DILUTION FACTOR*			--	
Bromodichloromethane		1.0	ND	ug/L
Bromoform		20	ND	ug/L
Bromomethane		0.8	ND	ug/L
Carbon tetrachloride		0.4	ND	ug/L
Chlorobenzene		2.0	ND	ug/L
Chloroethane		0.8	ND	ug/L
2-Chloroethylvinyl ether		3.0	ND	ug/L
Chloroform		0.4	ND	ug/L
Chloromethane		0.8	ND	ug/L
Dibromochloromethane		2.0	ND	ug/L
1,2-Dichlorobenzene		1.0	ND	ug/L
1,3-Dichlorobenzene		1.0	ND	ug/L
1,4-Dichlorobenzene		1.0	ND	ug/L
Dichlorodifluoromethane		0.4	ND	ug/L
1,1-Dichloroethane		0.4	ND	ug/L
1,2-Dichloroethane		0.8	ND	ug/L
1,1-Dichloroethene		0.4	ND	ug/L
trans-1,2-Dichloroethene		0.4	1.0	ug/L
1,2-Dichloropropane		0.7	ND	ug/L
cis-1,3-Dichloropropene		0.7	ND	ug/L
trans-1,3-Dichloropropene		2.0	ND	ug/L
Methylene Chloride		0.4	ND	ug/L
1,1,2,2-Tetrachloroethane		1.0	ND	ug/L
Tetrachloroethene		0.7	ND	ug/L
1,1,1-Trichloroethane		0.4	ND	ug/L
1,1,2-Trichloroethane		0.4	ND	ug/L
Trichloroethene		0.7	ND	ug/L
Trichlorofluoromethane		10	ND	ug/L
Vinyl chloride		1.0	ND	ug/L
cis-1,2-Dichloroethene		0.5	ND	ug/L

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: G-17 11-06-90 1155
LAB Job No: (-68095)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (WATER)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/5030			--	
as Gasoline		0.05	0.2	mg/L
METHOD 602			--	
Benzene		0.5	ND	ug/L
Ethylbenzene		0.5	2.9	ug/L
Toluene		0.5	24	ug/L
Xylenes		0.5	14	ug/L
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (WATER)			--	
DILUTION FACTOR*			2	
DATE ANALYZED			11-06-90	
METHOD GC FID/3550			--	
as Diesel		0.05	ND	mg/L

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: B-14 11-07-90
LAB Job No: (-68096)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (WATER)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-07-90	
METHOD GC FID/5030			--	
as Gasoline		0.05	0.82	mg/L
METHOD 602			--	
Benzene		0.5	10	ug/L
Ethylbenzene		0.5	17	ug/L
Toluene		0.5	67	ug/L
Xylenes		0.5	77	ug/L
PETROLEUM HYDROCARBONS			--	
EXTRACTABLE (WATER)			--	
DILUTION FACTOR*			2	
DATE ANALYZED			11-07-90	
METHOD GC FID/3550			--	
as Diesel		0.05	ND	mg/L

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 16

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: E-19 11-07-90
LAB Job No: (-68097)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (WATER)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-07-90	
METHOD GC FID/5030			--	
as Gasoline		0.05	0.18	mg/L
METHOD 602			--	
Benzene		0.5	17	ug/L
Ethylbenzene		0.5	1.4	ug/L
Toluene		0.5	5.0	ug/L
Xylenes		0.5	4.9	ug/L

NET

NET Pacific, Inc.

Client Acct: 424
Client Name: Aqua Resources
NET Log No: 4773

Date: 12-12-90
Page: 17

Ref: 4030 Hollis St., Emeryville

SAMPLE DESCRIPTION: B-19 11-06-90
LAB Job No: (-68098)

Parameter	Method	Reporting Limit	Results	Units
PETROLEUM HYDROCARBONS			--	
VOLATILE (WATER)			--	
DILUTION FACTOR *			1	
DATE ANALYZED			11-06-90	
METHOD GC FID/5030			--	
as Gasoline		0.05	0.08	mg/L
METHOD 602			--	
Benzene		0.5	0.5	ug/L
Ethylbenzene		0.5	ND	ug/L
Toluene		0.5	0.5	ug/L
Xylenes		0.5	0.9	ug/L

NET

NET Pacific, Inc.

KEY TO ABBREVIATIONS and METHOD REFERENCES

<	:	Less than; When appearing in results column indicates analyte not detected at the value following. This datum supercedes the listed Reporting Limit.
*	:	Reporting Limits are a function of the dilution factor for any given sample. To obtain the actual reporting limits for this sample, multiply the stated Reporting Limits by the dilution factor (but do not multiply reported values).
ICVS	:	Initial Calibration Verification Standard (External Standard).
mean	:	Average; sum of measurements divided by number of measurements.
mg/Kg (ppm)	:	Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million).
mg/L	:	Concentration in units of milligrams of analyte per liter of sample.
mL/L/hr	:	Milliliters per liter per hour.
MPN/100 mL	:	Most probable number of bacteria per one hundred milliliters of sample.
N/A	:	Not applicable.
NA	:	Not analyzed.
ND	:	Not detected; the analyte concentration is less than applicable listed reporting limit.
NTU	:	Nephelometric turbidity units.
RPD	:	Relative percent difference, 100 [Value 1 - Value 2]/mean value.
SNA	:	Standard not available.
ug/Kg (ppb)	:	Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion).
ug/L	:	Concentration in units of micrograms of analyte per liter of sample.
umhos/cm	:	Micromhos per centimeter.

Method References

Methods 100 through 493: see "Methods for Chemical Analysis of Water & Wastes", U.S. EPA, 600/4-79-020, rev. 1983.

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, rev. 1988.

Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986.

SM: see "Standard Methods for the Examination of Water & Wastewater, 16th Edition, APHA, 1985.

Chromatograms to Voytek STD (Diesel, M.O) samples C-2, B-25

NET Pacific, Inc.
...SCONI CIRCLE
...ROSA, CA 95401
TEL: 707-526-7200
FAX: 707-526-9623

CHAIN OF CUSTODY RECORD

...ROJ NO: ...773

PROJECT NAME: 4030 Hollis St., Emeryville
Aqua Resource, Voytek

...PLERS (Signature): [signature]

...NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH-Gas	BTEX	TPH-D	TPH-MO	8010s		REMARKS
...-25	11/5	0845		X	6'	~~45~~ 2	•	WM	•		•		~~1 groundwater~~ 1 soil
...-5		1005		X	6'	1X~~3~~		WW	•	•	•		~~2 groundwater~~
...-3		1100		X	5'	~~X~~ 1			•	•	•		~~1 groundwater~~
...-7		1215		X	4'	~~X~~ 1			•	•	•		~~1 groundwater~~
...-2		1305		X	5'	1			•	•	•		↓
...-25		1530		X	15'	1	•	•	•			(12)	groundwater
...-5		1430		X	15'	3		WW	•	•	•		↓
...-19	↓	1600		X	6'	1	•	•	•				soil
	11/6					1							↓
...-17		11:55			15'	8						(12)	groundwater
...-15		11:55			5'	1							soil
...-17		10:50			~~7~~ 7'	1							↓
...-25		11:00			18'	3	,						groundwater
~~...-5~~		~~9:00~~			~~20'~~	1						(12)	↓
~~...-3~~		~~9:00~~			~~20'~~	1							

...inquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]					

...inquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

...elinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
				Hold all samples

NET Pacific, Inc.
5 TESCONI CIRCLE
SANTA ROSA, CA 95401
TEL. 707-526-7200
FAX: 707-526-9623

CHAIN OF CUSTODY RECORD

PROJ. NO. 4773

PROJECT NAME 4030 Hollis St., Emeryville
Aqua Resource, Voytec

SAMPLERS: (Signature)

STA NO	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH-G	BTEX	TPH-D	TPH-MO	8010's	REMARKS
I-7	11/6	9:00			20'	1						groundwater
B-14	11/6					1						soil
~~B-25~~	~~11/7~~											
B-14	11/7				15'	3						(1), 2VOA water
E-19	↓				15'	1						1VOA water
E-19	11/6					1						soil
~~D-15~~												
B-19	11/6											water

not enough sample per Troy 11/26 to Kelly

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
				Hold all samples

WELL WATER
SAMPLES

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
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DATE RECEIVED: 11/19/90
DATE REPORTED: 12/05/90

AQUA RESOURCES, INC
RECEIVED
DEC 10 1990
JOB NO. 90239.1
FILE lab results

LAB NUMBER: 102343

CLIENT: AQUA RESOURCES, INC.

REPORT ON: 3 WATER SAMPLES

PROJECT #: 90239.1
LOCATION: RANSOME

RESULTS: SEE ATTACHED

QA/QC Approval

Final Approval

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 102343
CLIENT: AQUA RESOURCES, INC.
PROJECT ID:90239.1
LOCATION: RANSOME

DATE RECEIVED: 11/19/90
DATE ANALYZED: 12/01/90
DATE REPORTED: 12/04/90

ANALYSIS: pH
ANALYSIS METHOD: EPA 9040

LAB ID	SAMPLE ID	RESULT	UNITS
102343-1	W-1	7.0	SU
102343-2	W-2	6.9	SU
102343-3	W-3	7.0	SU

QA/QC SUMMARY

RPD, %	<1

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102343
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1
JOB LOCATION: RANSOME

DATE RECEIVED: 11/19/90
DATE ANALYZED: 11/21/90
DATE REPORTED: 12/04/90

Total Volatile Hydrocarbons with BTXE in Aqueous Solutions
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	SAMPLE ID	TVH AS GASOLINE (ug/L)	BENZENE (ug/L)	TOLUENE (ug/L)	ETHYL BENZENE (ug/L)	TOTAL XYLENES (ug/L)
102343-1	W-1	ND(50)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
102343-2	W-2	ND(50)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)
102343-3	W-3	ND(50)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)

ND = Not detected at or above reporting limit; Reporting limit indicated in parentheses.

QA/QC SUMMARY

RPD, %	5
RECOVERY, %	92

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 102343
CLIENT: AQUA RESOURCES, INC.
PROJECT ID:90239.1
LOCATION: RANSOME

DATE RECEIVED: 11/19/90
DATE ANALYZED: 11/30/90
DATE REPORTED: 12/04/90

ANALYSIS: TOTAL DISSOLVED SOLIDS
ANALYSIS METHOD: EPA 160.1

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
102343-1	W-1	640	mg/L	10
102343-2	W-2	580	mg/L	10
102343-3	W-3	550	mg/L	10

QA/QC SUMMARY

RPD, %	2

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102343
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1
LOCATION: RANSOME

DATE RECEIVED: 11/19/90
DATE EXTRACTED: 11/21/90
DATE ANALYZED: 12/05/90
DATE REPORTED: 12/05/90

Extractable Petroleum Hydrocarbons in Aqueous Solutions
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (ug/L)	DIESEL RANGE (ug/L)	REPORTING LIMIT* (ug/L)
102343-1	W-1	ND	82	50
102343-2	W-2	ND	100	50
102343-3	W-3	ND	88	50

ND = Not detected at or above reporting limit.

*Reporting limit applies to all analytes.

QA/QC SUMMARY

RPD, %	6
RECOVERY, %	103

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102343-3
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1 - RANSOME
SAMPLE ID: W-3

DATE RECEIVED: 11/19/90
DATE EXTRACTED: 11/30/90
DATE ANALYZED: 12/03/90
DATE REPORTED: 12/05/90

EPA 8270: Base/Neutral and Acid Extractables in Water
Extraction Method: EPA 3520 Liquid/Liquid

ACID COMPOUNDS	RESULT ug/L	REPORTING LIMIT ug/L
Phenol	ND	5.0
2-Chlorophenol	ND	5.0
Benzyl Alcohol	ND	5.0
2-Methylphenol	ND	5.0
4-Methylphenol	ND	5.0
2-Nitrophenol	ND	25
2,4-Dimethylphenol	ND	5.0
Benzoic Acid	ND	25
2,4-Dichlorophenol	ND	25
4-Chloro-3-methylphenol	ND	5.0
2,4,6-Trichlorophenol	ND	5.0
2,4,5-Trichlorophenol	ND	25
2,4-Dinitrophenol	ND	25
4-Nitrophenol	ND	25
4,6-Dinitro-2-methylphenol	ND	25
Pentachlorophenol	ND	25
BASE/NEUTRAL COMPOUNDS		
N-Nitrosodimethylamine	ND	5.0
Aniline	ND	5.0
Bis(2-chloroethyl)ether	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
Bis(2-chloroisopropyl)ether	ND	5.0
N-Nitroso-di-n-propylamine	ND	5.0
Hexachloroethane	ND	5.0
Nitrobenzene	ND	5.0
Isophorone	ND	5.0
Bis(2-chloroethoxy)methane	ND	5.0
1,2,4-Trichlorobenzene	ND	5.0
Naphthalene	ND	5.0
4-Chloroaniline	ND	5.0
Hexachlorobutadiene	ND	5.0
2-Methylnaphthalene	ND	5.0
Hexachlorocyclopentadiene	ND	5.0
2-Chloronaphthalene	ND	5.0
2-Nitroaniline	ND	25

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102343-3 EPA 8270
SAMPLE ID: W-3

BASE/NEUTRAL COMPOUNDS	RESULT ug/L	REPORTING LIMIT ug/L
Dimethylphthalate	ND	5.0
Acenaphthylene	ND	5.0
2,6-Dinitrotoluene	ND	5.0
3-Nitroaniline	ND	25
Acenaphthene	ND	5.0
Dibenzofuran	ND	5.0
2,4-Dinitrotoluene	ND	5.0
Diethylphthalate	ND	5.0
4-Chlorophenyl-phenylether	ND	5.0
Fluorene	ND	5.0
4-Nitroaniline	ND	25
N-Nitrosodiphenylamine	ND	5.0
Azobenzene	ND	5.0
4-Bromophenyl-phenylether	ND	5.0
Hexachlorobenzene	ND	5.0
Phenanthrene	ND	5.0
Anthracene	ND	5.0
Di-n-butylphthalate	ND	5.0
Fluoranthene	ND	5.0
Benzidine	ND	5.0
Pyrene	ND	5.0
Butylbenzylphthalate	ND	5.0
3,3'-Dichlorobenzidine	ND	25
Benzo (a) anthracene	ND	5.0
Chrysene	ND	5.0
Bis (2-ethylhexyl)phthalate	ND	5.0
Di-n-octylphthalate	ND	5.0
Benzo (b) fluoranthene	ND	5.0
Benzo (k) fluoranthene	ND	5.0
Benzo (a) pyrene	ND	5.0
Indeno (1,2,3-cd) pyrene	ND	5.0
Dibenzo (a,h) anthracene	ND	5.0
Benzo (g,h,i) perylene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	79 %	Nitrobenzene-d5	75 %
Phenol-d6	99 %	2-Fluorobiphenyl	66 %
2,4,6-Tribromophenol	87 %	Terphenyl-d14	51 %

102343

AQUA RESOURCES, INC.

CHAIN OF CUSTODY RECORD

SHIPMENT NO.:

PAGE 1 OF 1

DATE 11/19/90

PROJECT NAME: Ransome

PROJECT NO.: 90239.1

Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required
W-1		water		bottles & VOAS	ice		☆
2 W-2		↓		↓	↓		☆
W-3							☆
							☆
W-3		water		2 liter amber	ice		EPA 625

Total Number of Samples Shipped: 14

Sampler's Signature: Patricia Rodgers

Relinquished By:	Received By:	Date / Time
Signature: Patricia Rodgers Printed Name: PATRICIA RODGERS Company: AQUA RESOURCES Reason: analysis	Signature: Nancy Wilson Printed Name: Nancy Wilson Company: C&T Labs	Date 11/19/90 Time 5:20
Signature Printed Name Company Reason	Signature Printed Name Company	Date / / Time

REMARKS:

☆ analyzing for TDS, pH, TPH as diesel, TVH as gasoline and BTXE

water temp in well W-1: 18.0°C
W-2: 18.5°C, W-3: 17.5°C

Special Shipment / Handling / Storage Requirements:

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2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 12/04/90
DATE REPORTED: 12/17/90

AQUA RESOURCES, INC
RECEIVED
DEC 2 0 1990
JOB NO. ____________
FILE ____________

LAB NUMBER: 102451

CLIENT: AQUA RESOURCES, INC.

REPORT ON: 3 WATER SAMPLES

PROJECT #: 90239.1
LOCATION: RANSOME

RESULTS: SEE ATTACHED

____
QA/QC Approval

____
Final Approval

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102451
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1

DATE RECEIVED: 12/04/90
DATE ANALYZED: 12/10/90
DATE REPORTED: 12/17/90

ANALYSIS: pH
ANALYSIS METHOD: EPA 9040

LAB ID	SAMPLE ID	RESULT	UNIT
102451-1	LF-7	6.9	SU
102451-2	LF-8	6.9	SU
102451-3	LF-20	6.8	SU

QA/QC SUMMARY

RPD, %	<1

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 102451
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1

DATE RECEIVED: 12/04/90
DATE ANALYZED: 12/14/90
DATE REPORTED: 12/17/90

ANALYSIS: TOTAL DISSOLVED SOLIDS
ANALYSIS METHOD: EPA 160.1

LAB ID	SAMPLE ID	RESULT	UNITS	REPORTING LIMIT
102451-1	LF-7	620	mg/L	10
102451-2	LF-8	370	mg/L	10
102451-3	LF-20	400	mg/L	10

QA/QC SUMMARY

RPD, %	<1

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102451
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1
JOB LOCATION: RANSOME

DATE RECEIVED: 12/04/90
DATE ANALYZED: 12/07/90
DATE REPORTED: 12/18/90

Total Volatile Hydrocarbons with BTXE in Aqueous Solutions
TVH by California DOHS Method/LUFT Manual October 1989
BTXE by EPA 5030/8020

LAB ID	SAMPLE ID	TVH AS GASOLINE (ug/L)	BENZENE (ug/L)	TOLUENE (ug/L)	ETHYL BENZENE (ug/L)	TOTAL XYLENES (ug/L)
102451-1	LF-7	ND(50)	ND(0.5)	ND(0.5)	ND(0.5)	5.5
102451-2	LF-8	ND(50)	ND(0.5)	ND(0.5)	ND(0.5)	4.7
102451-3	LF-20	ND(50)	ND(0.5)	0.7	0.6	3.9

ND = Not detected at or above reporting limit; Reporting limit indicated in parentheses.

QA/QC SUMMARY

RPD, %	4
RECOVERY, %	90

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102451
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1
LOCATION: RANSOME

DATE RECEIVED: 12/04/90
DATE EXTRACTED: 12/11/90
DATE ANALYZED: 12/17/90
DATE REPORTED: 12/17/90

Extractable Petroleum Hydrocarbons in Aqueous Solutions
California DOHS Method
LUFT Manual October 1989

LAB ID	CLIENT ID	KEROSENE RANGE (ug/L)	DIESEL RANGE (ug/L)	REPORTING LIMIT* (ug/L)
102451-1	LF-7	ND	ND	50
102451-2	LF-8	ND	ND	50
102451-3	LF-20	ND	ND	50

ND = Not detected at or above reporting limit.

*Reporting limit applies to all analytes.

QA/QC SUMMARY

RPD, %	<1
RECOVERY, %	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102451-2
CLIENT: AQUA RESOURCES, INC.
PROJECT ID: 90239.1 - RANSOME
SAMPLE ID: LF-8

DATE RECEIVED: 12/04/90
DATE EXTRACTED: 12/07/90
DATE ANALYZED: 12/07/90
DATE REPORTED: 12/17/90

EPA 8270: Base/Neutral and Acid Extractables in Water
Extraction Method: EPA 3520 Liquid/Liquid

ACID COMPOUNDS	RESULT ug/L	REPORTING LIMIT ug/L
Phenol	ND	5.0
2-Chlorophenol	ND	5.0
Benzyl Alcohol	ND	5.0
2-Methylphenol	ND	5.0
4-Methylphenol	ND	5.0
2-Nitrophenol	ND	25
2,4-Dimethylphenol	ND	5.0
Benzoic Acid	ND	25
2,4-Dichlorophenol	ND	25
4-Chloro-3-methylphenol	ND	5.0
2,4,6-Trichlorophenol	ND	5.0
2,4,5-Trichlorophenol	ND	25
2,4-Dinitrophenol	ND	25
4-Nitrophenol	ND	25
4,6-Dinitro-2-methylphenol	ND	25
Pentachlorophenol	ND	25
BASE/NEUTRAL COMPOUNDS		
N-Nitrosodimethylamine	ND	5.0
Aniline	ND	5.0
Bis(2-chloroethyl)ether	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
Bis(2-chloroisopropyl)ether	ND	5.0
N-Nitroso-di-n-propylamine	ND	5.0
Hexachloroethane	ND	5.0
Nitrobenzene	ND	5.0
Isophorone	ND	5.0
Bis(2-chloroethoxy)methane	ND	5.0
1,2,4-Trichlorobenzene	ND	5.0
Naphthalene	ND	5.0
4-Chloroaniline	ND	5.0
Hexachlorobutadiene	ND	5.0
2-Methylnaphthalene	ND	5.0
Hexachlorocyclopentadiene	ND	5.0
2-Chloronaphthalene	ND	5.0
2-Nitroaniline	ND	25

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 102451-2
SAMPLE ID: LF-8

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/L	REPORTING LIMIT ug/L
Dimethylphthalate	ND	5.0
Acenaphthylene	ND	5.0
2,6-Dinitrotoluene	ND	5.0
3-Nitroaniline	ND	25
Acenaphthene	ND	5.0
Dibenzofuran	ND	5.0
2,4-Dinitrotoluene	ND	5.0
Diethylphthalate	ND	5.0
4-Chlorophenyl-phenylether	ND	5.0
Fluorene	ND	5.0
4-Nitroaniline	ND	25
N-Nitrosodiphenylamine	ND	5.0
Azobenzene	ND	5.0
4-Bromophenyl-phenylether	ND	5.0
Hexachlorobenzene	ND	5.0
Phenanthrene	ND	5.0
Anthracene	ND	5.0
Di-n-butylphthalate	ND	5.0
Fluoranthene	ND	5.0
Benzidine	ND	5.0
Pyrene	ND	5.0
Butylbenzylphthalate	ND	5.0
3,3'-Dichlorobenzidine	ND	25
Benzo (a) anthracene	ND	5.0
Chrysene	ND	5.0
Bis (2-ethylhexyl)phthalate	ND	5.0
Di-n-octylphthalate	ND	5.0
Benzo (b) fluoranthene	ND	5.0
Benzo (k) fluoranthene	ND	5.0
Benzo (a) pyrene	ND	5.0
Indeno (1,2,3-cd) pyrene	ND	5.0
Dibenzo (a,h) anthracene	ND	5.0
Benzo (g,h,i) perylene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

2-Fluorophenol	97 %	Nitrobenzene-d5	69 %
Phenol-d6	97 %	2-Fluorobiphenyl	65 %
2,4,6-Tribromophenol	97 %	Terphenyl-d14	48 %

102451

AQUA RESOURCES, INC.

CHAIN OF CUSTODY RECORD

SHIPMENT NO.: ____

PAGE 1 OF 1

DATE 12/4/90

PROJECT NAME: Ransom

PROJECT NO.: 90239.1

	Sample Number	Location	Type of Sample: Material	Type of Sample: Method	Type of Container	Type of Preservation: Temp	Type of Preservation: Chemical	Analysis Required
1	LF-7		water		VOAs, bottles	blue ice		A
2	LF-8		|		|	|		A
3	LF-20							A
	LF-8		water		bottles	blue ice		625

Total Number of Samples Shipped: 14

Sampler's Signature: Patricia Rodgers

Relinquished By:	Received By:	Date / Time
Signature: Patricia Rodgers	Signature: Norma Wilson	Date: 12/04/90
Printed Name: PATRICIA RODGERS	Printed Name: Norma Wilson	Time: 11:13
Company: AQUA RESOURCES	Company: CIT Labs	
Reason: analyses		

Relinquished By:	Received By:	Date / Time
Signature:	Signature:	Date: / /
Printed Name:	Printed Name:	Time:
Company:	Company:	
Reason:		

REMARKS:

A TEH as diesel, TVH as gasoline, BTXE, TDS, pH

temperature of water in well LF-7 20°C
LF-8 18.8°C
LF-20 18.5

Special Shipment / Handling / Storage Requirements:

Appendix E - Enviros Biotreatability Report

ORIGINAL

Final Report to Aqua Resources: Biotreatability Evaluation on diesel and waste oil contaminated soil at the Ransome property, Emeryville, California.

Background and Treatment design

Soil samples were received from Aqua Resources on June 29, 1990. These samples were contaminated but also frozen and could not be used for a biotreatability evaluation since the majority of the natural microbes were most likely killed. Additional samples were requested and received on July 18, 1990. The sample labeled "waste oil" had both diesel and waste oil contamination as TPH > 15,000 ppm by modified EPA 418.1. The sample labeled "diesel" had < 20 ppm TPH by the same method. These samples were also very wet (> 35% moisture). A joint decision was made between Aqua Resources and Enviros that a 1:1 mixture of "frozen contaminated" soil from the initial shipment and "clean" soil from the second shipment would be used for the biotreatability evaluation of "diesel" contaminated soil. The mixing of this "clean" unfrozen soil would reintroduce the natural microbes.

Diesel contaminated soil from area 2 was mixed 1:1 as described above and placed in containers to a depth of 4 inches. One portion was kept as a cold control to serve as an internal control of the analytical method (a perpetual T_0) and as a measure of abiotic loss due to volatilization. The other portion was treated with inorganic nutrient addition, tilling and moisture control. An additional portion of diesel contaminated soil from area 1 was treated with tilling and moisture control to observe the physical properties of the soil during this treatment. Waste oil contaminated soil was divided into 3 equal portions and placed in containers to a depth of 5 inches. One portion was kept as a cold control, one treatment received nutrient addition with tilling and moisture control; the second treatment received nutrient and surfactant addition with tilling and moisture control. Surfactants increase the solubility of hydrocarbons, especially heavier components like waste oil and increased solubility enhances biodegradation. Treatments were monitored for moisture content and adjusted to approximately 15%. Tilling was done after moisture adjustment by mixing the soil with a spatula for 1 minute.

Results

The analytical results for TPH by EPA modified 418.1 during the treatability evaluations are in the tables following. Contaminant characterization and relative contaminant loss is shown in the GC chromatograms. The chromatograms of "Diesel" contaminated soil shows it to be contaminated with a product similar to a weathered diesel #2 at ~ 500 ppm (before 1:1 dilution) with the majority of the contaminant eluting between 8 and 20' on the chromatogram. "Waste Oil" contaminated soil appears to be contaminated with a weathered motor oil fraction and fractions that include diesel #2 and a lighter contaminant at a total concentration near 15,000 ppm. Variability in the "waste oil" control samples is due to uneven distribution of contaminant in this sample which shows up in 10 gr subsamples. The average concentration was 14,800 ppm and did not appear to decrease significantly during the treatment time.

pH for waste oil contaminated soil started and remained above pH 8 (8.0 - 8.8) for the entire treatment. Optimal pH range is 6 - 8 but large pH changes are of greater concern than actual pH. pH adjustment was attempted on a small portion of this soil and was unsuccessful in that the amount of acid required to bring the pH to 7.0 was deemed to be unrealistic for full scale field application. The initial pH was high, but in our experience that appears to be normal for Bay area soils and pH often drops due to acid production during biodegradation of high levels of contaminant. pH for the diesel contaminated soil remained near pH 7.5 for the entire treatment. Moisture measurements indicated that moisture loss was rapid from both soils in uncovered pans.

Moisture adjustment was necessary two times a week. Pans were lightly covered for the remainder of the evaluation to reduce this loss.

Diesel contaminated soil from area 2 appears to contain some clay-like material and tended to form small clumps during sequential wetting, tilling and drying episodes. Soil from area 1 showed this same characteristic to a lesser extent. Soil contaminated with waste oil and diesel did not appear to have a significant clay fraction and maintained a fine grained texture throughout treatment. All soils were returned for visual observation of their characteristics.

Conclusions

Diesel Contaminated Soil

Soil from this site contaminated with ***diesel fuel only***, appears to be amenable to biotreatment to < 100 ppm (possibly 50 ppm) as measured by modified EPA 418.1. Although it is possible a target of < 10 ppm can be reached, that conclusion or how long it might take to reach that concentration can not be determined from this evaluation. Treatment time in the field can not be predicted exactly and will depend on such factors as temperature and precipitation. A treatment time of 2 weeks or less for every 250 ppm of contamination is conceivable (6-8 weeks for 1000 ppm) if this project is initiated during the summer months.

Waste Oil Contaminated Soil

Soil from this site contaminated with ***waste oil and lighter petroleum hydrocarbons***, appears to be amenable to contaminant reduction by biotreatment. Although it is possible a target of < 100 ppm as measured by a modified EPA 418.1 can be reached, that conclusion or how long it might take to reach that concentration can not be determined from this evaluation. Observation of contaminant loss by GC analysis indicates the diesel and lighter fractions of the contamination is highly susceptible to biotreatment. The TPH fraction which is heavier than diesel (waste oil) and is observable by GC analysis appears to be only partially susceptible to biotreatment. There may be a waste oil portion which is not observable by GC.

Recommendations

Diesel Contaminated Soil

Treatment of this soil will be enhanced by tilling (for aeration) and moisture control and would most likely be enhanced by the addition of inorganic nutrients. Enviros recommends the addition of a fixed nitrogen and a phosphate source as urea (.42 lbs./ton of soil) and ammonium phosphate (.06 lbs/ton of soil) for every 250 ppm of contaminant. Moisture control which maintains water content around 15% by weight, and tilling on at least a weekly basis are also recommended.

Waste Oil Contaminated Soil

Treatment of the contaminants in this soil will be enhanced by tilling (for aeration) and moisture control and would most likely be enhanced by the addition of inorganic nutrients. Enviros would recommend the addition of a fixed nitrogen and a phosphate source as urea (1.6 lbs./ton of soil) and ammonium phosphate (.25 lbs/ton of soil) for every 1000 ppm of contaminant (see Additional Field Recommendations). Moisture control which maintains water content around 15% by weight, and tilling on at least a weekly basis would also be recommended. pH adjustment is not recommended unless field pH is monitored and it appears that a pH change of 1 unit or more may take place.

Additional Field Recommendations

Treatment Design

This biotreatability evaluation simulated a thinspread field design (generic design enclosed). In our experience, this is the most cost/time efficient design for the bioremediation of petroleum hydrocarbons of the type and concentration found at this site. If there is insufficient space to spread the contaminated soil at a depth of 12", a "thickspread" treatment up to 3 - 4' thick can be used. In this design the soil is treated in "lifts" of a given thickness. The thickness or depth of treatment for an individual lift depends on the effective tilling depth of the tilling equipment since aeration is usually the limiting factor for treatment time. Treated soil can be sampled and removed from the top down. Treatment time is obviously longer since the bottom layer is being treated very slowly if at all. One advantage is the tiller operator does not have to be concerned about tearing the liner until the final lift. These treatment designs can handle approximately 100 yds^3 per acre for every 1" of thickness. 4800 yds^3 of soil would require approximately 4 acres for a 12" thinspread; a thickspread of 4 feet would require approximately 1 acre.

If there is a serious concern about poor weather during treatment time (a rainy season), there is insufficient space even for a thickspread, or if regulatory agencies involved are concerned about volatile emissions, a forced aeration biopile is an alternative design. This design can handle as much as 6000 yds^3/acre, is completely covered with plastic so that rain is not a concern, and can use negative pressure aeration so that emissions can be run through vapor phase carbon if necessary. This design is not recommended for soils with high contaminant concentrations because of the difficulty of adding nutrients or controlling pH during treatment. It is also not recommended for soils with a high clay or silt content. The aeration of soils with clay or silt in this design is very inefficient.

For the Ransome site, we would recommend a thin- or thickspread design if sufficient space is available. The soil from this site has enough clay in it to be a concern in a pile design. If poor weather (rain) or volatile emissions are an issue, covering a thinspread or thickspread between tillings is an alternative. This cover is more difficult to manage than one on a pile but there are regulatory agencies in the Bay area that are currently allowing this type of treatment.

Nutrient Application

For contaminant concentrations in excess of 2000 ppm, inorganic nutrients should be applied at intervals throughout treatment and be monitored in the field. Addition of these nutrients should not exceed the amount needed for 2000 ppm of contaminant in any one application since excessive levels of ammonia can be toxic to bacteria and ammonia addition raises pH.

REPORT LIMITATIONS

This report was prepared for Aqua Resources and its client and is not intended for use by others. The information contained herein is applicable to the soil samples received at Enviros and is not applicable to other sites.

Aqua Resources Treatability Evaluation Final Results: Diesel

TPH Concentration in Treatment Soil over Time

Timepoint	Cold Control	Treatment 1*	
T_0**	271 ppm	200 ppm	
T_7	259 ppm	70 ppm	
T_{14}	238 ppm	60 ppm#	
T_{42}	202 ppm	53 ppm	

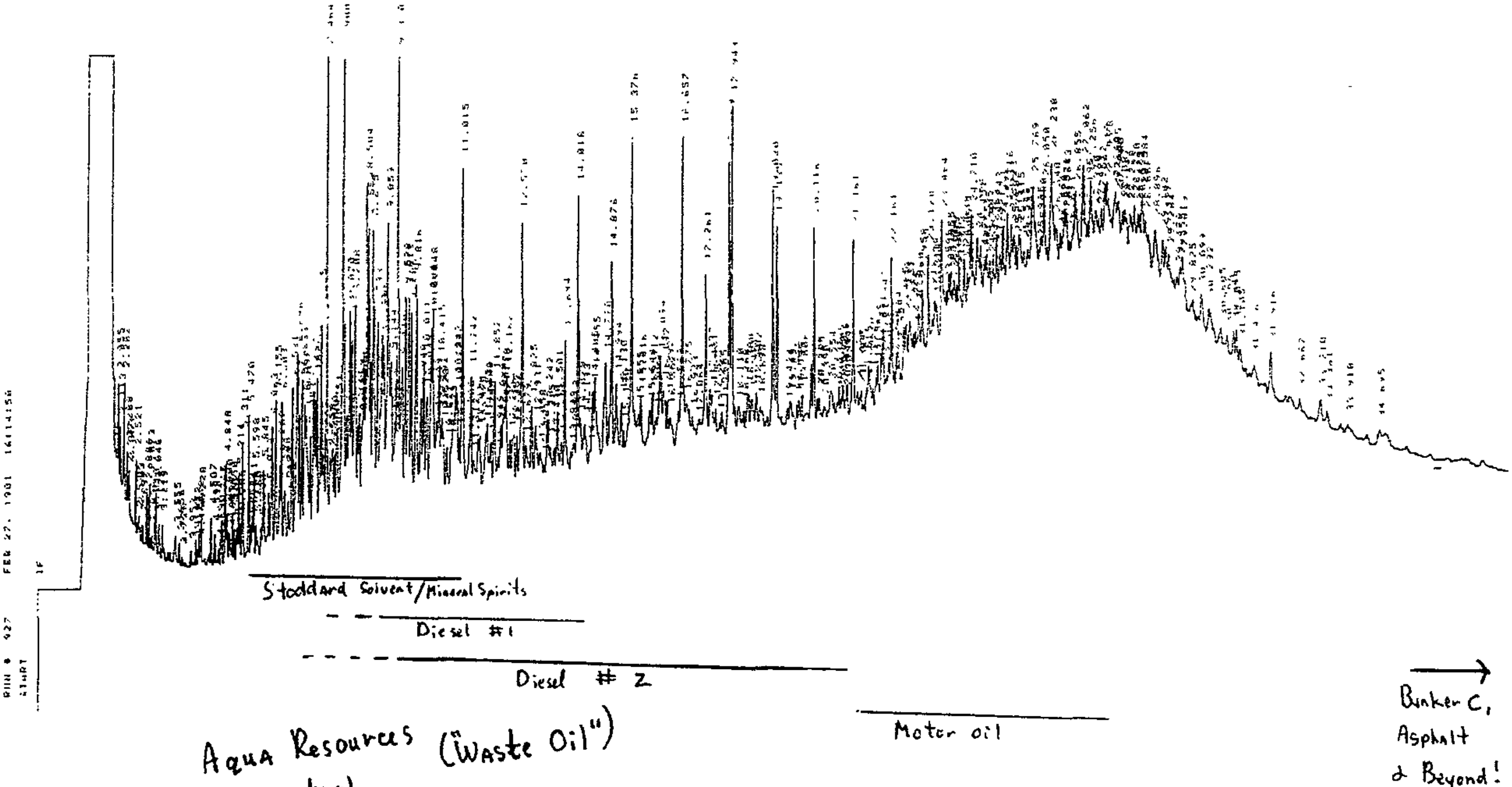
TPH by modified EPA 418.1
* Inorganic Nutrient addition plus tilling and moisture control
** Started 8/3/90
# Average of duplicate samples (58 & 62 ppm)

Aqua Resources Treatability Evaluation Final Results: "Waste Oil"

TPH Concentration in Treatment Soil over Time

Timepoint	Cold Control	Treatment 1*	Treatment 2**
T_0***	13,350	13,350	13,350
T_7	17,746	17,276	13,122
T_{11}	14,841	17,231	13,065
T_{18}	11,494	7422	7165
T_{28}	17,464	4582	4651
T_{56}	13,890	2820	4760

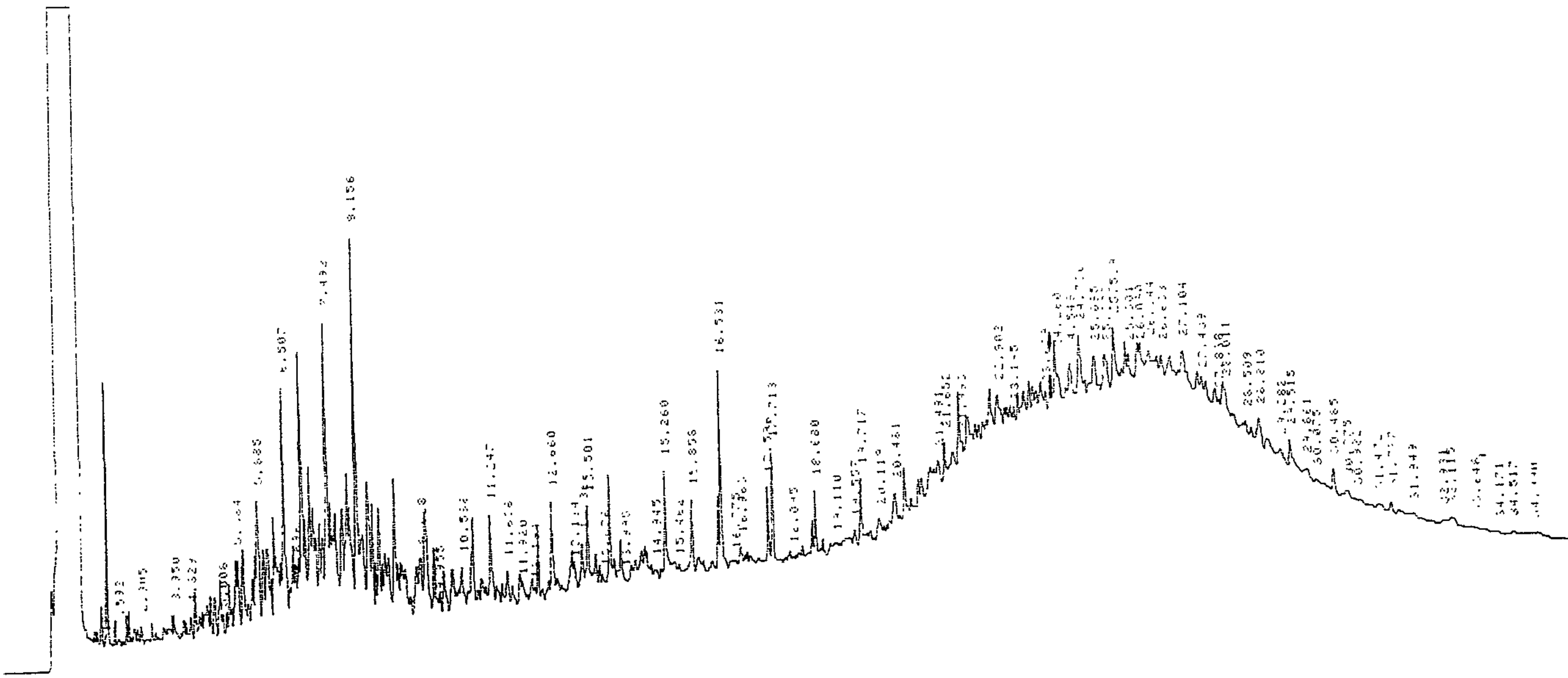
TPH by modified EPA 418.1
* Inorganic Nutrient addition plus tilling and moisture control
** Inorganic Nutrient addition plus surfactant (1000 ppm), tilling and moisture control
*** Started 7/19/90



Aqua Resources ("Waste Oil")

Control ~1:5

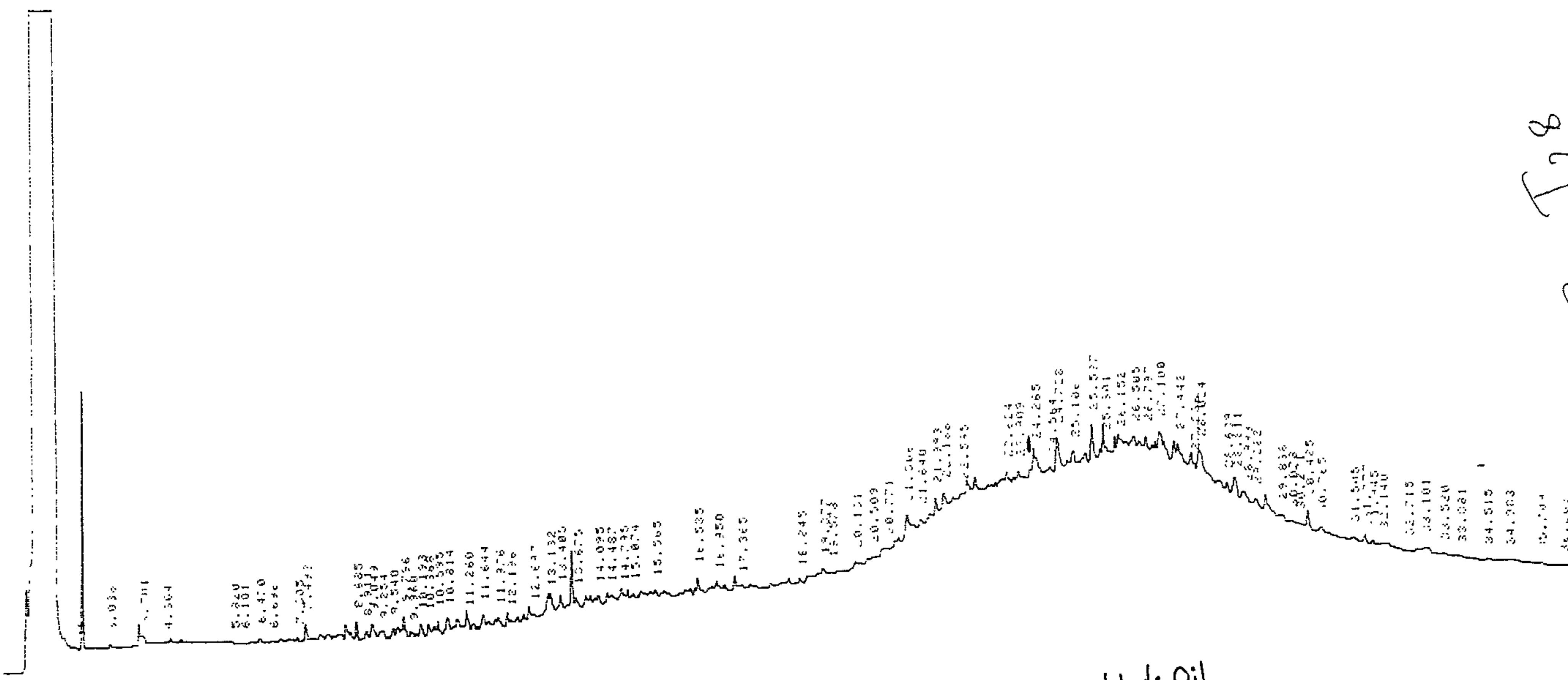
T_7 (7/27)



Aqua Resources Waste Oil

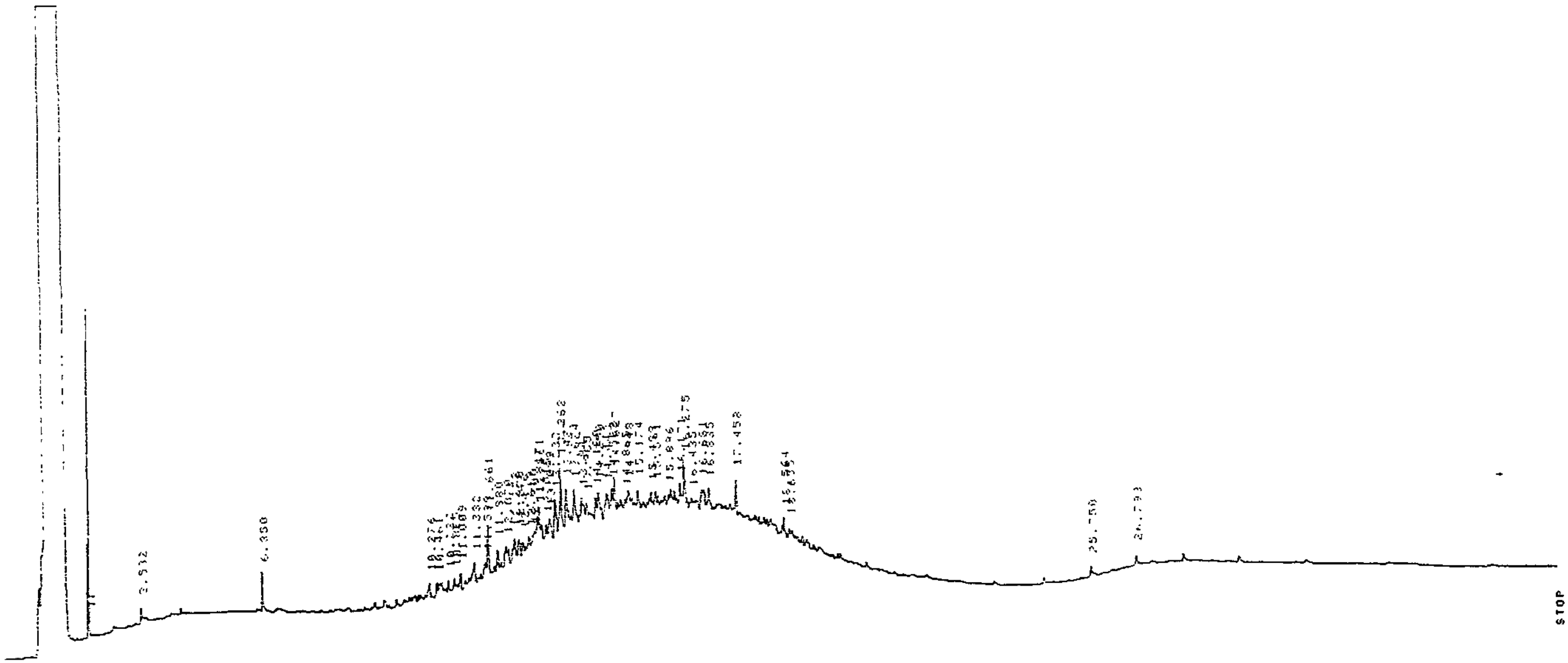
ARc Control T28

1:10

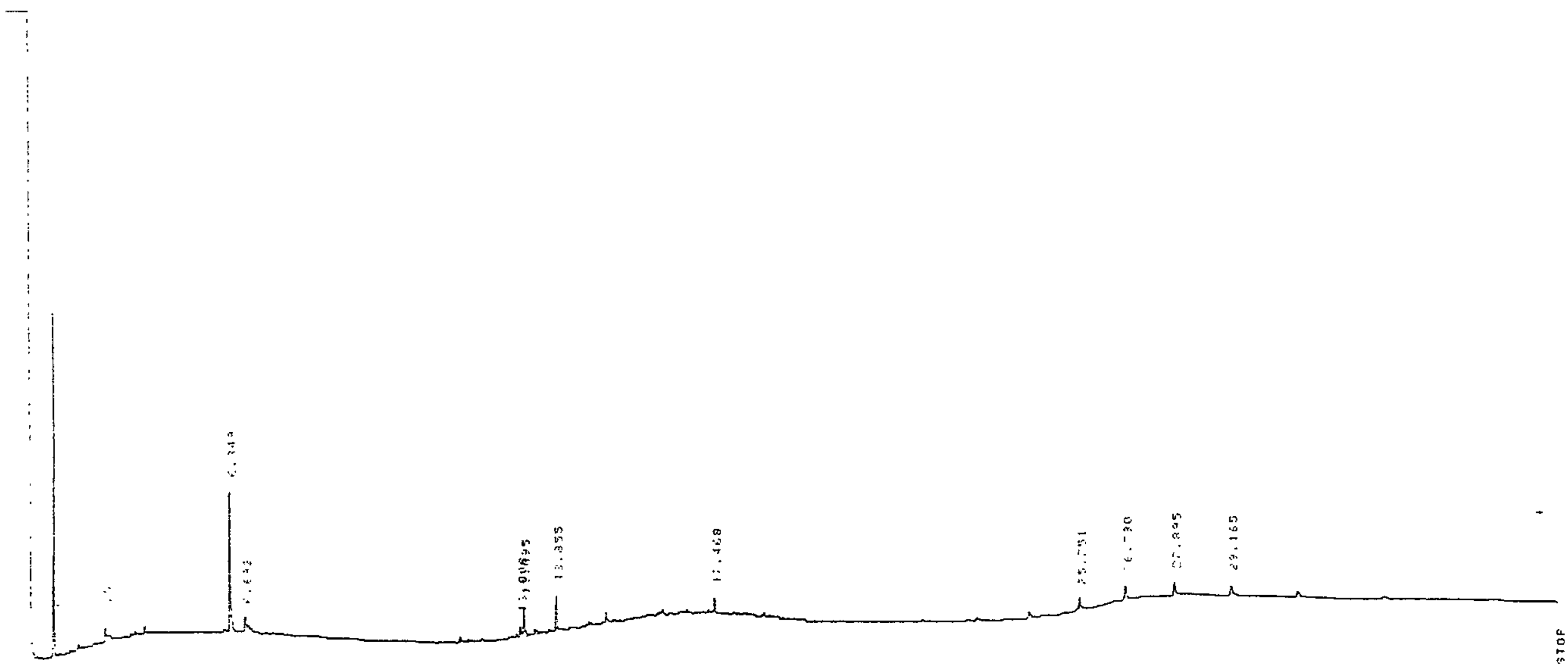


Aqua Resources Waste Oil
AR$_1$ T 28 Treatment #1

1:5

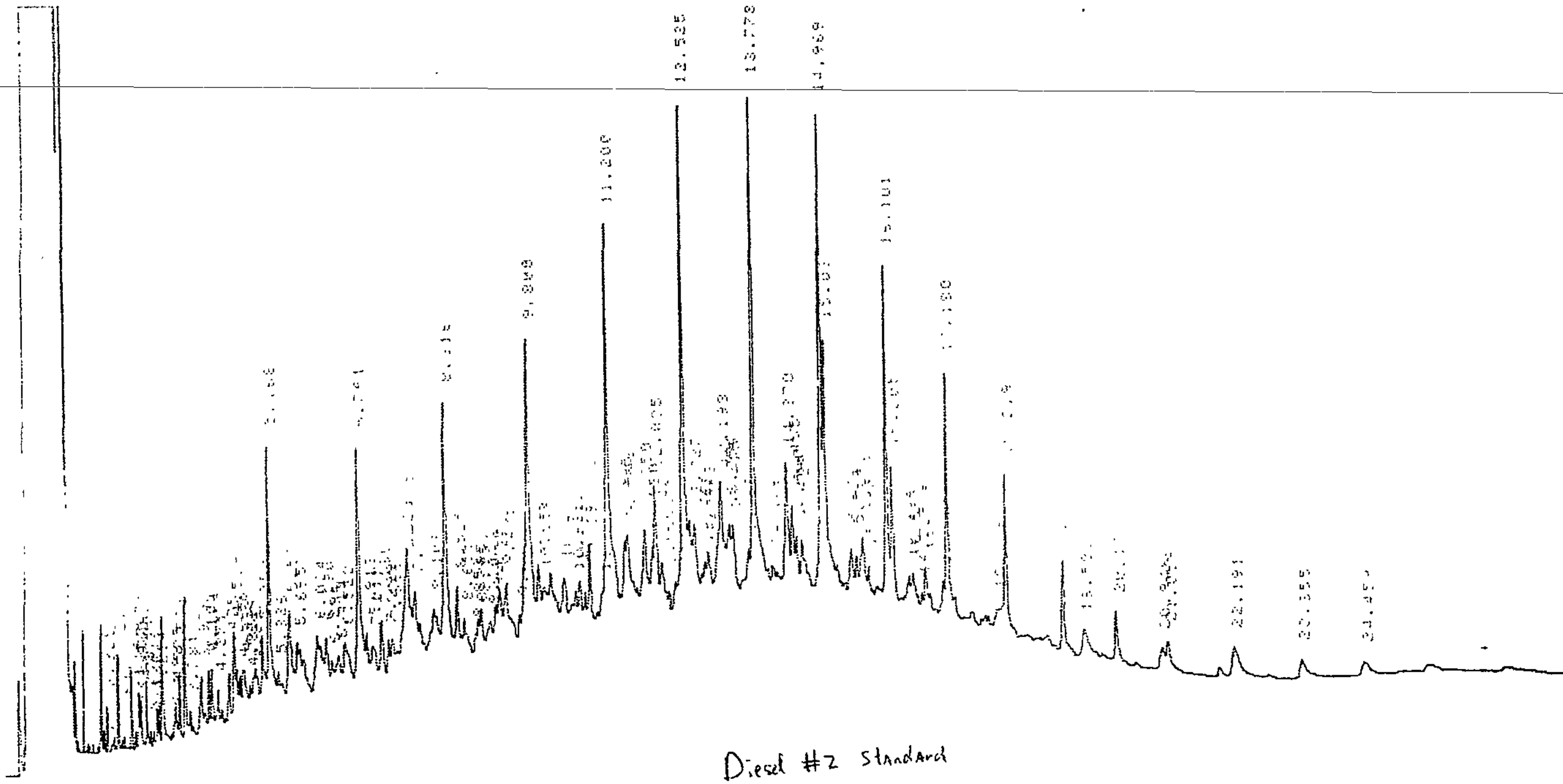


Aqua Resources
Diesel Control T14



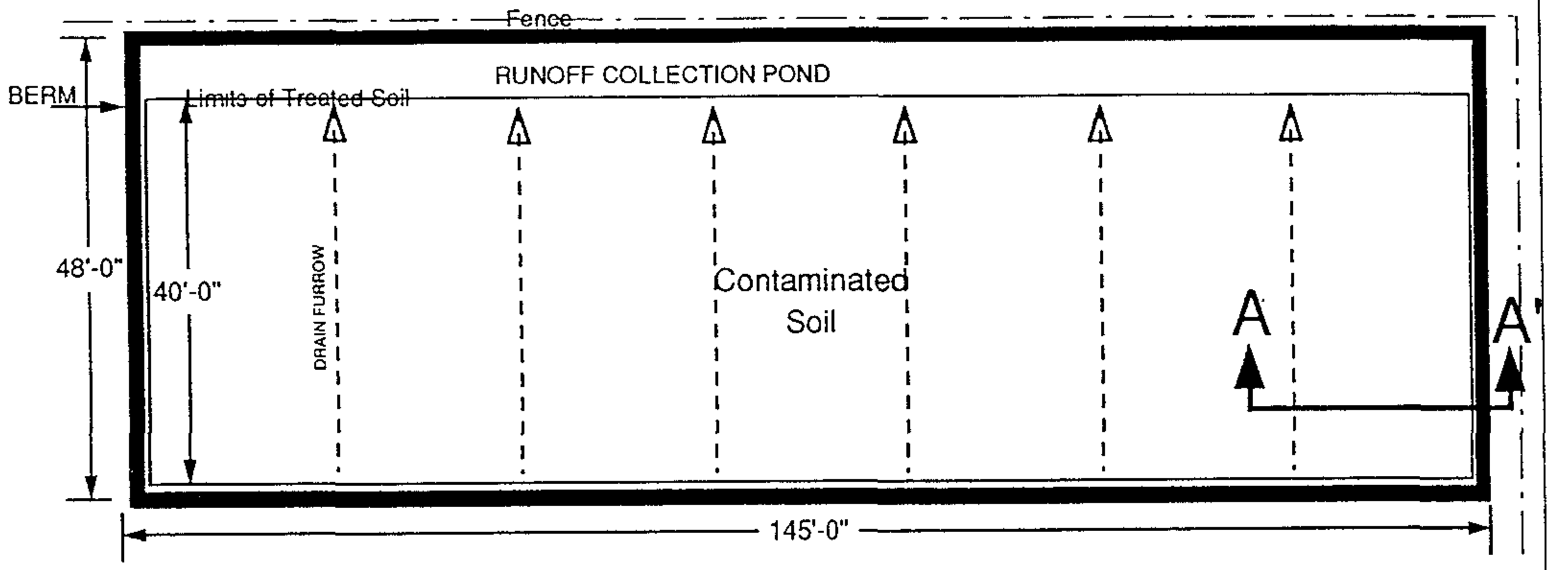
Aqua Resources

Diesel Treatment T14



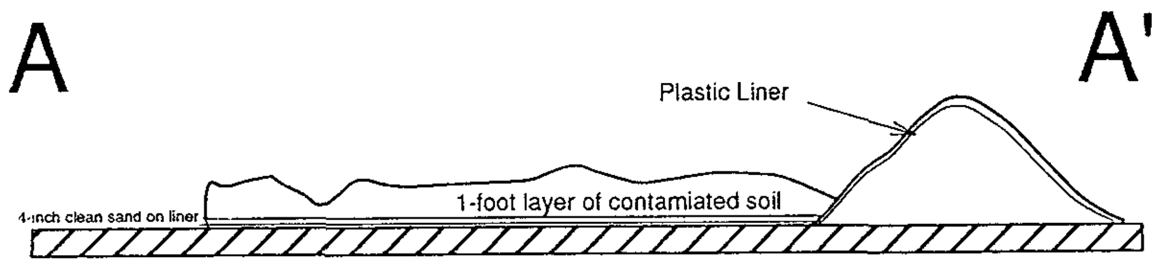
Diesel #2 Standard

102 ppm



Plan View

Scale: 1 inch = 20 feet



Cross Section A-A' Profile

Please contact Mr. Michael Nimmons, Principal Environmental Engineer of Enviros Applied Technologies should questions arise at 820-7575.

Typical Design of Thin - Spread Treatment Area

enviros